2002 Annual Proceedings - Dallas: Volume #1

of
Selected Research and Development Papers
Presented at
The National Convention of the Association for Educational Communications and Technology
Sponsored by the Research and Theory Division
Dallas, TX
2002

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Preface

For the twenty-fifth 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 Dallas, TX. 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. Volume #2 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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Table of Contents

First Online Collaborative Learning Experiences of Freshmen Students in Turkey

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Abstract

In literature, there is very few significant study on the effectiveness of online collaborative learning on students who had no prior experience of collaboration. This presentation describes a case study in which attitudes of students who had no prior experience in online learning and collaborative learning toward online collaborative learning in Turkey were investigated. Data have been collected by using a Likert type questionnaire and interviews. Students mostly expressed positive attitudes toward online learning while they indicated negative attitudes toward collaborative learning. These negative attitudes associated with the preconceptions of learners about collaboration and not enough prior experience to develop interpersonal skills. However, majority of the students pointed out that they would like to take similar courses online and study collaboratively.

Introduction

The field of education has witnessed impressive changes during the last decade with the developments of new communication technologies. These technologies helped faculties provide more interactive learning and apply new pedagogical approaches in their courses.

One of these approaches that the communication technologies, especially Internet enabled is collaborative learning. Literature has revealed that collaborative learning in classroom settings offer many benefits such as active learning and peer interaction for learners. Many of these studies were carefully controlled to test the hypothesis that collaborative learning was more effective then other modes of instructional delivery. The evidence for the effectiveness of peer teaching is well accepted for a wide range of goals, content, and students. This effectiveness has been repeatedly documented for the past 90 years. Klemm (1994) reports that over 575 experimental and 100 correlation studies have been conducted by a wide variety of researchers who tested subjects of differing age, cultures, and geographical areas. Most of these studies have revealed that collaborative learning is more effective than most other approaches. The reasons of this effectiveness summarized by Smith (1993) as: (1) the student who learns best is the one who organizes, summarizes, elaborates, explains, and defends; (2) more learning occurs in an environment of peer support and encouragement because students eagerly work harder and longer; (3) students learn more when they're doing things they enjoy.

Developing body of research on online collaborative learning has also shown that students get benefits from distance and/or online collaboration. The researchers and writers such as Mason and Kaye (1990), Harasim (1990), Henri and Rigault (1996) have described the potential of the Internet as an interactive environment that would enable collaborative group learning and would change the nature of distance education from an autonomous, isolated experience to a potentially social constructivist environment.

In the years that the Internet has come into more widespread use for tertiary learning, online collaborative learning has become more commonly accepted as an effective strategy that is now made possible by the technology. Although literature has shown that online collaborative learning has become a hot topic for researchers and practitioners all over the world, there is almost no or a few significant study on the effectiveness of online collaborative learning on students who had no prior experience of collaboration, especially in Turkey.

Collaborative Learning in Turkey

In Turkey, most of the instruction almost all levels of education except higher education have a very instructive structure. Teachers use textbooks, which are recommended by the Ministry of Education and prepared according to the curriculum, during the instruction. They mostly present the instruction orally and conduct drill and practice sessions. Sometimes enthusiastic teachers provide opportunity for students to do hands on activities, discussions, inquiries. Although the Ministry of Education has recently started to encourage teachers to use collaborative activities in their classes, almost no teachers use this approach due to lack of skills and time. So the Turkish higher education students are not used to work in teams.

In addition, online education is not common in primary and secondary education in Turkey. So that almost all Turkish students come to universities with no online learning experience. Even worst, almost half of them enter universities with a few computer literacy skills.

Purpose and Method of the Study

This paper describes a study in which attitudes of undergraduate students who had had no online learning and collaborative learning experience before having taken "Introduction to Educational Communications" course online in School of Communication Sciences Anadolu University in Turkey are investigated. In other words, the main focus of this study was to explore the attitudes of the students toward online collaborative education.

"Introduction to Educational Communications" is a 14 weeks long compulsory course for the freshmen students in the Educational Communications and Planning Department. After three hours workshop on online learning, collaborative learning and online collaborative learning, the students were asked to participate voluntarily the study and take the course online. Only 19 out of 45 students, who enrolled this course, participated to the study as the subject group.

After two weeks of preliminary preparations, subjects took the course entirely online during the spring 2001 academic semester. WebCT was used as the online learning and management environment. At the end of the course they were asked to fill the questionnaire and attend the interviews. For the data collection, a thirty items Likert type questionnaire was used. First ten items in the questionnaire were developed to learn the students' reaction on online learning and the last ten items were related to the collaborative learning. Also, interviews were conducted with the four of the randomly selected students to get a better in-sight about the students' responses. The participants' final grades are used for measuring their achievements.

Results

The study sought to explore the responses of the learners to online learning environment and collaborating in this environment. The questionnaire at the end of the course asked students to provide their responses to a series of questions on these topics. He questionnaire used a Likert scale responses with five categories arranged so that the 3.41 mean score indicated an expected level of agreement with the item while other responses enables students to show higher or lower levels of agreement. The 3.41 mean average was determined after identifying the critical level: 4 intervals / 5 categories = 0.8. As a result of this the levels of agreement were determined as followings:

1 (Strongly Disagree) = 1+ 0.8 = 1.8
2 (Disagree) = 1.8 + 0.8 = 2.6
3 (Not sure) = 2.6 + 0.8 = 3.4
4 (Agree) = 3.4 + 0.8 = 4.2
5 (Strongly Agree) = 4.2 + 0.8 = 5

In interpreting the results, 3.41 mean average was taken as what would be expected from agreed students and higher scales (agree and strongly agree) and the lower scales (disagree and strongly disagree).

Online learning. Student's responses to questions concerning their impressions of the online learning were generally positive (M=3,768). However, for the 9th item which is "I can remember better what I learn when I study online", average mean of students' responses is lower then critical level of agreement (M_9=3,158>M=3.41). Also, students scored higher on the item #1 (It was interesting to study the topic online), item #3 (I liked working online) and item #4 (I found easier to study online).

Table 1: Frequency of the students' responses to the items related to online learning

Item #	1 (Strongly Disagree)	2 (Disagree)	3 (Not Sure)	4 (Agree)	5 (Strongly Agree)	M
1	0	2	1	11	5	4,000
2	0	1	5	11	2	3,737
3	0	1	5	6	7	4,000
4	0	2	3	7	7	4,000
5	0	3	4	7	5	3,737
6	0	3	6	5	5	3,632

7	0	1	4	9	5	3,947
8	0	2	8	5	4	3,579
9	0	7	4	6	2	3,158
10	0	2	5	5	7	3,895
					means score average	*3,768*

Collaborative learning. The collaborative learning activities tended to be viewed quite negatively by the majority of the students (M=2,868). By looking at students' scores, it can be told that they were having problems with their teammates all the time (M_{25}=2,789) and were feeling discomfort working in the team (M_{26}=2,684). Most of the students also expressed that they would prefer working individually to in teams.

Table 2: Frequency of the students' responses to the items related to collaborative learning

Item #	1 (Strongly Disagree)	2 (Disagree)	3 (Not Sure)	4 (Agree)	5 (Strongly Agree)	M
21	2	4	6	5	2	3,053
22	1	7	7	3	1	2,789
23	1	6	7	4	1	2,895
24	1	6	6	6	0	2,895
25	2	8	4	5	0	2,632
26	1	9	4	5	0	2,684
27	2	5	4	8	0	2,947
28	2	3	9	4	1	2,947
29	1	3	7	7	1	3,211
30	7	3	3	2	4	2,684
					means score average	*2,868*

At the end of the questionnaire, students were asked how they would like to take a similar course in the future and four different instructional delivery formats offered the students. These were (1) online and collaborative, (2) online and individualized, (3) face-to-face and collaborative, (4) face-to-face and individualized. Table 3 shows the results of this question. Most of the students (69.42%) chosen to take similar courses online but interestingly majority of them (36.84%) also favored online collaborative learning. In addition, some of the students who indicated that they would not like to take a course online prefer collaborative learning. With these students total percentage of the students who favored collaborative learning is 52.63. Furthermore, only 31.58 % of the students wanted to take similar courses face-to-face.

Table 3: Students' preferences of delivery formats for the future courses

Delivery Formats	Number of the Students (%)
online and collaborative	7 (36.84)
online and individualized	6 (32.58)
face-to-face and collaborative	3 (15.79)
face-to-face and individualized	3 (15.79)
TOTAL	19 (100)

Interviews. During the interviews, the students (randomly selected four students) expressed several common thoughts about the online learning and collaborative learning. One of these common thoughts was about their distress with the technology. The server was down due to some technical problems during two weeks. So neither instructor not students was able to reach the web site and email messages. This unpleasant situation created a discomfort among students toward online learning. Another thought about online learning is that most of the students took the course online because they heart a lot about online education but did not know anything. So they thought this could be an opportunity for them to learn this new environment. However, after the course, they found that since they were coming to school for other courses it was not worth to take the course online. Students were also indicated that it was hard to find a computer to use especially during the mid-term and finals. So, they believe that online learners should have computers at home to be successful.

On the other hand, students felt that because they did not know classmates well, they did not work together efficiently. They indicated that it took several weeks to understand who in the team was working hard and who needed more encouragement and push. They complained about the students who had chosen to do nothing but using their teammates. Besides, they claimed that if they had chance to work with their close friends in teams, the team work could have been better.

Discussions and Conclusions

The study has revealed several findings, most of which agreed with the literature. Findings related to the students' distress with this online course due to technological problems are similar to the ones that Hara and Kling (2000), for instance, have reported. Online learning is a hot topic in Turkey but there are few attempts to offer online courses and programs. One of the significant reasons of this shortage is the technological problems such as low bandwidth, low home computer ownership, and lack of computer literacy skills of both instructors and learners (Aydin, 2001). Due to these problems happened during the study, the students did not find what they were expecting before the course about online learning. However, they still showed a higher level of positive attitude toward online learning.

If online learning advocates and providers in Turkey do not want to loose their customers, they should offer better examples of online learning. Especially for the learners who are able to come to campus, providers should design the courses in a way that these students can get benefit of them and value the potential of online learning. For example using a blended mode to create constructivist learning environments or online learning communities among on-campus students might be a way of uncovering the benefits of online learning. Providers should not ignore that today's on-campus students might not be able to come to campuses to improve their skills or to get a higher level of education (e.g. masters' degree or PhD) after the school. So it is important to find the right mode of online learning for the learners and train them about online learning before actually start an online course.

On the other hand, it can be claimed that the Turkish education system is highly competitive. That is it forces students work alone and hard to be able to get in good schools in every level, although over the recent years the Ministry of Education tries to encourage the teachers to use collaborative activities in their classes. So that students develop positive attitudes towards individualized and competitive learning rather then collaborative learning. They come to the higher education with this preconception. The students participated with these preconceptions to the study. As it is indicated in literature, students should be trained before a collaborative learning experience. That is why the students were trained about online learning and collaboration during the first two weeks of the study. However, the study shows that those two weeks were not enough for them to acquire social and interpersonal skills to complete a collaborative activity. Therefore, before starting an online collaborative experience, the designers must be sure that their students have developed a satisfied level of interpersonal and social skills that will help students while they are collaborating to learn online.

Besides, online collaborative learning does not require that all the activities must be online for on-campus students. In other words, some parts of collaborative work can be face-to-face if the students have time to come to the school. For instance, discussions among team members can be held in face-to-face meetings and presentation of the results of these discussions can be posted online. There are many ways of designing collaborative activities and it is important to find the right blend for the learners.

Overall, this study shows that although students had problems in collaborating online with their classmates and the course did not fulfill their expectations about online learning, they still would like to have more online learning experiences and favor studying collaboratively.

In the future research studies, effects of computer literacy, group composition, readiness for online learning in terms of computer ownership, online and/or distance learning self-efficacy, learning styles and strategies, prior experiences on students' achievement and attitudes in online collaborative learning can be investigated. Various comparisons such as face-to-face versus online collaboration, undergraduate versus graduate students might also be conducted in the future.

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A Comparative Study of a Project-Based Course: Face to Face and Online

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Abstract

This study was an examination of the differences in group communication patterns between two different sections of a project-based course. One was a face-to-face class while the other was an online learning class. Small group interactions, learner attitudes, and learning achievement are compared. Results show that there was no difference between face to face and online learning achievement; however face to face and online learners differed in types of interactional statements, flexibility in group roles, and degree of learner comfort early in the course.

Introduction

As applications of computer-mediated communication become more and more accepted for teaching, educators will need to understand the strengths and constraints of such educational delivery modes and be able to develop strategies that can support communication and learning in these environments. Computer-mediated communication includes synchronous or asynchronous communication tools such as electronic mail, discussion boards, and computer conferencing. In this type of communication senders encode the messages in text that are relayed from the senders' computers to a website accessed by everyone or to one or more selected receivers' computers (Walther, 1992).

The most common theories of computer mediated communication such as social presence theory and media richness theory note that electronic mails, discussion boards, and virtual chat eliminate nonverbal cues that are generally rich in the face-to-face communication environment. The absence of such codes affects the user's perceptions of communication content and constrains the users' interpretations of messages. Such characteristics raise the very real possibility that computer-mediated communication may be less suitable for certain communication purposes (Rice, 1984, see also Trevino, 1987) or that there may be negative effects on the communication process (Jonassen, & Kwon, 2001; Hiltz, Johnson, & Truroff 1986) and, hence, on the learning process.

In order to understand the effectiveness of the computer mediated system, therefore, it is essential to understand the communication process involved in interactions between instructors and students and among students in such systems. Perhaps one of the most feasible and useful ways to determine the strength and limitations in computer-mediated communication is to examine the similarities and differences of the communication process in computer-mediated learning environments with the face-to-face (F2F) learning environment.

Past Research

The findings to date concerning the effects of computer-mediated communication on the learning process have been mixed. Research has demonstrated that computer-mediated communication in a small group teaching-learning process creates more flexible communication patterns (Berge & Collins, 1996; Heller & Kearsly, 1996; Ruberg, Moore, & Taylor, 1996). Computer mediated communication allows students to interact with their groups members in a time that convenient for them (Berge & Collins, 1996; Heller & Kearsly, 1996; Ruberg, Moore, & Taylor, 1996) and may increase students' sense of responsibility and self discipline (Berge & Collins, 1996; His & Hoadley, 1997).

Computer mediated communication may also affect the social relationships of learners and the process and content of group discussions and individual perspectives. Social relationships may be equalized during interactions by the lack of social cues and cultural differences (Berge & Collins, 1996; His & Hoadley, 1997). Such changes in relationships may also open learners to new meanings and perspectives (Heller & Kersley, 1996; Ruberg, Moore, & Taylor, 1996). The need to articulate one's arguments in computer mediated communication in a small group forces group members to put their thoughts into a writing in a way that others can understand (Valacich et al. 1994).

However, computer mediated communication can also create difficulties for some students, especially in small group learning environments. For those students who are in need of structure and guidance, the increase in responsibility can be problematic (Berge & Collins, 1996). And the lack of the social cues in a small group may actually contribute to students becoming antagonistic toward others. Computer-mediated communication, especially in an asynchronous mode, may disrupt the natural flow of conversation in a small group, removing the discourses from its logical context (Kelly & McGrath, 1990). This can make the communication process in a small group not only inefficient, but can also lead to misinterpretation of meaning and negative learner attitudes toward the learning experience.

The most recent research in computer-mediated group communication is Jonassen and Kwon's (2001) study comparing the communication patterns within the groups that were collaboratively solving problems via computer conferencing. Through the use of cluster analysis of the communication patterns, the study concluded that computer-mediated communication is more task-oriented and more focused in a small group involved in complex problem-solving. This may be the result of the computer mediated communication system giving learners more time for critical thinking and composition of their responses. Another possibility, not mentioned by this study, is that off task comments in asynchronous environments usually may not generate responses from other learners fast enough to get such dialogue going.

Despite the growth of studies in computer-mediated communications involving small groups, there is no research comparing F2F and online learners involved in intensive small group teams throughout a semester in a project-based learning environment. Nor have the perceptions and attitudes of such learners been compared regarding their roles in the group, feelings about the group processes and preferences for communication tools, and their evaluation of their own learning outcomes in such a learning environment. Because of this lack of empirical evidence for small group effectiveness in the online learning environment, an exploratory study was conducted to investigate questions related to patterns of interaction and group work processes in the online learning environment using computer-mediated communication tools.

Research Questions

The purpose of this exploratory study was to compare the similarities and differences in communication patterns and related learner perceptions and attitudes for learners working in small groups in F2F and online learning environments. Specifically, this study examined: 1) project team (small group) interactions to see if the findings of the Jonasseon and Kwon (2001) study would be replicated in terms of more task-related statements for F2F learners; and to determine what types of interaction were most common for each type of learning environment; 2) learner attitudes and perceptions to determine if there were differences between F2F and online learners in regard to their feelings about collaborative group processes and their own roles, communication tools, and their own learning outcomes; and 3) learner achievements to see if quality of products and course grades were different for F2F versus online learners.

The research questions to be answered in the current study were as follows:

1. Are small groups working in online courses more task-focused in their small group communications than F2F learners?
2. What types of interaction are most common in the two learning environments?
3. Are online learners as comfortable in their team roles as learners in the F2F teams?
4. Are online learners as satisfied with the communication processes for group work as F2F learners?
5. Which communication tools are most useful for online learners?
6. Are the learning outcomes (achievement of course goals as measured by team assignment grades) the same for F2F and the online learners?

Method

Independent Variable

In order to compare interaction patterns and learner perceptions and attitudes, the delivery of one course during one semester with two different conditions of delivery was the independent variable. One section of the course was given face-to-face (F2F) with weekly classroom meetings and with a course website used for e-mail posting of information and a few activities (web-assisted). The other section of the course was given completely online through the use of a computer-mediated system. Students from one section did not interact or contact each other, and each viewed and used only the materials presented to their sections or available on their own websites.

Dependent Variables

To measure the results of the two different learning environments, the dependent variables selected were the 1) communication patterns of the small groups working in each type of learning environment; 2) the perceptions and attitudes of the learners concerning team processes, communication tools, and quality of assignments; and 3) the grades for course assignments (products each group had to develop to fulfill assignment requirements).

Two Learning Conditions

An extensive body of literature supports the notion that a well-designed course will be effective in the face-to-face learning environment; (Dick & Carey, 1996; Gagne, Briggs, & Wager, 1988) and some studies have now included web-based learning environments as well (Bichelmeyer et al., 2001; Relan & Gillani, 1997). Using principles of good course design and adaptation for the web, a graduate level education course, The Management of Instructional Development, was designed and developed based on an existing course that is part of the Instructional Systems master's program at Florida State University. The new online version of the course could be used to satisfy a management requirement in both the existing face-to-face graduate program as well as for the relatively recently implemented Master's in Distance Learning also offered through the Instructional Systems Program.

In the F2F version the instructor and students met for 2 3/4 hours once a week for 16 weeks with attendance required. Most of the activities of the F2F version class were conducted in class, but the course did have a website available to these learners. On the website were slides used during class, description of assignments, and directions for two online learning activities resulting in threaded discussions for two of the sixteen weeks In addition, all the communication tools of small group discussion boards, virtual chat, and e-mail were available for F2F learners but the instructor did not specify making use of them, just that they were there.

The course, Management of Instructional Development, is project-based and requires extensive group collaboration throughout the semester. The F2F version has been given many years and has a stable set of skills and a body of knowledge with related class activities and course assignments. This content, using the same textbooks, class lecture slides, course assignments, and grading schema was used in the online course as well as the F2F course. Class activities were adapted for the online environment, but used the same content and the same or very similar types of learner behaviors. However, instructor presentations were replaced by website files of course slides and additional information as required, and synchronous discussions and activities conducted in the classroom were replaced with asynchronous discussions and activities using the course discussion board on the online version website. Small groups were formed as project teams by the fourth week of the sixteen week semester and were used for weekly activities as well as for five major class products. Both courses also had two major assignments done individually as well as weekly individual activities that complemented the group work assignments.

Learners

The subjects of this study were 36 students (24 in the face-to-face course and 12 in the online distance learning course) enrolled in two different sections of EME 6631, Management of Instructional Development. All of the learners were graduate students, with 22 of the F2F learners and all of the online learners majoring in Instructional Systems. The two non-majors in the F2F section were taking the course as electives for graduate programs in other departments or colleges. All but one of the online students had taken at least one online course within the past year. Three of the online learners were geographically located in the same city as the university while the rest were disbursed throughout the southeast, mid-atlantic, and mid-western states.

Instructors

Both sections of the course were taught by the same instructor who had taught the F2F version for the past three years. In the online section, she was assisted by a teaching assistant who managed and monitored the course website on a daily basis and was the first to receive questions on procedures or content. The teaching assistant had taken the F2F version one year before and was completely familiar with the readings, in class activities, and assignments. In addition, he had worked with the instructor to develop the online version. On occasion the teaching assistant referred questions of content to the instructor who would then post her responses directly in the online discussion board or e-mail the appropriate learners. All assignments were graded by the instructor for both versions. The instructor led the F2F version but the teaching assistant attended each class meeting to ensure his own consistency in working with the online learners.

Instruments and Measurements

Gathering and Coding of Interaction Data

Two of the F2F class meetings were observed and interactions coded at the time and two other class meetings were videotaped and interactions coded at a later time. The online section interaction data were obtained from the archived data of the small group discussion boards and small group virtual chats.

Learner communication patterns were coded into twelve categories based on a coding scheme developed from Jeong's model (2002) focusing on online debate and Poole and Holmes' model (1995) focusing on problem solving. Any meaningful statement between group members is regarded as a communication fact and is assigned a category from the communication pattern model. The categorization is made at the sentence level. An additional category of negotiation was added because negotiation is an important part of the group communication process in the course, both within groups and between client and vendor groups. While Poole and Holmes have a solution development category, neither they nor Jeong have a category of interaction that includes sentences moving the group toward consensus and involving statements of give and take. The categories, therefore, had to be modified to include a "negotiation" communication fact. The twelve categories, used in the present study are shown in Table 1.

Table 1: Coding Categories

Code	Category	Explanation	Example
0	*State a proposal*	Initial statements proposed to solve a problem.	i.e. "regarding vendor suggestion- I think we should mention we welcome suggestions to jump-start or kick off the project, as well as suggestions for continued progress, motivational activities through the winding-down period"
1	*Support a proposal*	Support of an initial proposal	i.e. "Audio make sense. If we're aware that people are looking at a simulate screen, their hearing is free to listen to instruction"
2	*Oppose or criticize a proposal*	Oppose, disagree, criticize other's statements	i.e. "… We cannot really accept the scope to be optimized because it do not fit for our initial objectives…"
3	*Elaboration*	Explanation of the proposal without justifying or defending it	i.e. "This allows notes to be taken, etc"
4	*Simple agree or disagree*	Statements of approval or objection related to other statements. It usually only involves very few words and does not involve reasoning process.	i.e. "Good one, A… should be tested as it will be delivered"
5	*Answer questions*	Statements to answer the questions for the clarification	i.e. "User guide is to assist learner in self-directed learning"
6	*Ask questions for clarification*	The statements to clarify the content, the procedure of the discussion	i.e. "Was the CD to run a pilot prior to load it you intranet? (i.e. "Was the CD to run a pilot prior to load it you intranet?"
7	*Negotiation*	Statement for consensus making in group discussion	i.e. "As your told us, scope is important, but what I am thinking is that may be…"
8	*Draw a conclusion*	Statements attempt to make a final decision for a content related topic for the group discussion	i.e. "O.K. So we can adjust our estimates and staffing to reflect this decision."
9	*Orientation*	Statements orient or guide group's process or procedure	i.e. "Can we discuss the pilot now?"
//	*Non-task*	Any off-take statements not	i.e. "Hi, A, I haven't had much luck in

		related to solving the problem such as personal comments	getting us in-state tuition.”
?	*Unknown*	Statements that cannot be clearly transcribed from video tapes or the statements two coders cannot agree with each other after consensus making.	NA

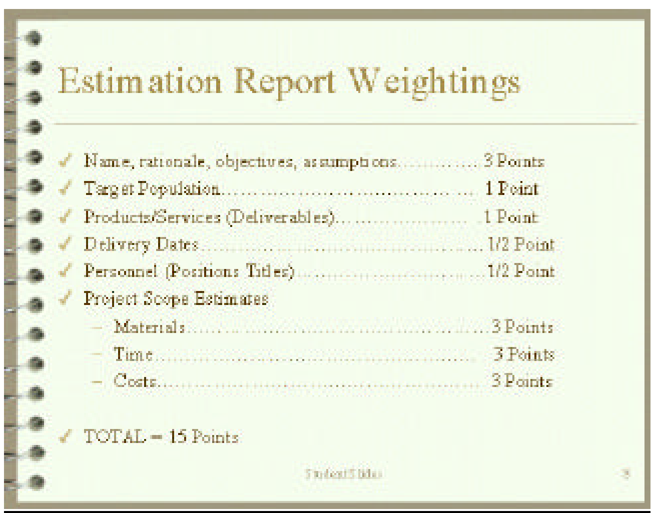
Gathering and Coding of Student Perceptions and Attitudes

Two open-response anonymous surveys were used to measure student perceptions and attitudes with one administered halfway through the semester (week 8) and the other during the last week of the course (week 16). Five categories of the learner perceptions toward the small group team process were measured. These questions asked learners to 1) describe their role in the group process, changes in roles, and their degree of comfort with their roles: 2) evaluate the process of team discussions and methods for communication; 3) evaluate the quality of the team products; 4) evaluate the feedback they received on course activities and products; and 5) describe their preference for course delivery.

Learning Outcomes

Three products developed by the teams were used to evaluate learning outcomes. These three products were the major part of the group work assignments for both courses and all required collaborative group work. These products were the Estimation Report, the Negotiation Report, and the Project Proposal. The grading rubrics developed by the instructor and used for the previous three years were used as the evaluation instrument. See Figure 1 for an example.

FIGURE 1. Sample grading rubric



Analyses and Results

Interaction Analysis and Results

Three activities of both the online and F2F versions were analyzed by two coders. The two coders discussed each statement until they reached agreement. If an agreement could not be reached, the statement was categorized as unknown (?). There were altogether 271 F2F statements and 848 online statements.

Results for Question 1

Are small groups working in online courses more task-focused in their communications than F2F course small groups? Jonassen and Kwon’s (2001) study result on communication pattern is not replicated in one (see Table 2).Overall, there was no apparent difference in non-task statements between the two different learning environments. F2F had 11.8% non-task statements and online had 10.0% non-task statements. (see Table 2 code //, Chi-square =

.84 not significant at .05 level) However, in asynchronous communication (threaded discussion board), non-task statements make up 6.1% (see Table 3 code //), which is much lower than those in face-to-face learning environment 11.8%. But, after a Chi-square test, this difference is not statistically significant. Chi-square = 5.51 not significant at .05 level, but close to the table value 5.99)

Table 2: Comparison of All Statements in Both Learning Environments

Codes	0	1	2	3	4	5	6	7	8	9	//	?	All
Face to face statements	16	13	4	12	39	32	31	69	5	4	32	11	271
% of statements	4.8	5.9	1.5	4.4	14.4	11.8	11.4	25.5	1.8	1.5	11.8	4.1	100
On line class Combined total	179	80	19	44	40	68	109	111	19	92	85	30	848
% of combined total	21.1	9.4	2.2	5.2	4.7	8.0	12.9	13.1	2.2	10.8	10.0	3.5	100

Table 3: Comparison of Types of Statements (F2F and Online Threaded Discussion and Virtual Chat)

Codes	0	1	2	3	4	5	6	7	8	9	//	?	All
Face to face statements	16	13	4	12	39	32	31	69	5	4	32	11	271
% of statements	4.8	5.9	1.5	4.4	14.4	11.8	11.4	25.5	1.8	1.5	11.8	4.1	100
On line class discussion board	67	38	3	6	7	37	18	15	4	22	12	5	196
% of statements	34.2	19.4	1.5	3.1	3.6	18.9	9.2	7.7	2.0	11.2	6.1	2.6	100
On line class discussion virtual chat	112	52	16	38	33	31	91	96	15	70	73	25	652
% of statements	17.2	8.0	2.5	5.8	5.1	4.8	14.0	14.7	2.3	10.7	11.2	3.8	100

Table 4: Legend of codes and categories

Code	Category	Code	Category
0	*State a proposal*	*6*	*Ask questions for clarification*
1	*Support a proposal*	*7*	*Negotiation*
2	*Oppose or criticize a proposal*	*8*	*Draw a conclusion*
3	*Elaboration*	*9*	*Orientation*
4	*Simple agree or disagree*	*//*	*Non-task*
5	*Answer questions*	*?*	*Unknown*

Results for Question 2

What types of learner interactions are most common in small groups in the two learning environments? The online environment had more than four times as many statements in the category of "state a proposal" than did the F2F. (21.1% vs. 4.8%, see table 2 code 0, Chi-square = .32.60, significant at .01 level).There were more "orientation" statements in the online learning environment (10.8% vs. 1.5%, see table 3 code 9, Chi-square=22.56, significant at .01 level). The F2F environment had three times as many statements in the category of "simple agree or disagree". (14.4% vs. 4.7%, see table 2 code 4, Chi-square=29.81, significant at .01 level) and twice as many statements in the category of "negotiation". (25.5% vs. 13.1%, see Table 2 code 7, Chi-square=24.40, significant at .01 level).

Analysis and Results of Learner Perceptions and Attitudes

Comments from the anonymous open response surveys were content-analyzed by grouping common statements into opinion/feelings categories according to the survey questions (Patton, 2001). Then the frequencies were computed for each category and converted to percentages to enable comparisons between the two groups. It is important to remember that there were double the number of learners in the F2F section, thus percentages in the F2F section represent twice the number of students as do the percentages given for the online section. Because of the small sample size, the frequencies were not tested for significance but were reviewed for trends and patterns.

Results for Question 3

Are online learners as comfortable in their team roles as the learners in F2F teams? At the midpoint of the course the first survey revealed that over half the learners in both the online and F2F courses indicated initial comfort with their roles in their teams (online = 58% and F2F = 68%). By the end of the course the results from the second survey showed that both groups increased in comfort with their team roles as the semester progressed, but the online learners increased in comfort more and became comparable to the number of F2F learners feeling comfortable (online = 75% and F2F = 79%). Even though online learners initially felt less comfortable, they finished the semester virtually as comfortable as the F2F class in their group roles.

One interesting unanticipated finding related to the flexibility of roles within the group. While initially about one third of the F2F and online learners indicated they were flexible in their roles in group work, by the end of the course 67% of the F2F learners indicated that they played both leader and supporter roles at various times during the semester, while only 33% of the online learners said they played various roles.

Results for Question 4

Are online learners as satisfied with the communication processes for group work as the F2F learners? Through an oversight, feelings about the team discussion process were gathered only at the midpoint of the course. At that time more than 2/3 of the F2F learners were happy with the team discussion process while only a third of the online learners were satisfied. See Table 5 for the summary of results on learner perceptions and attitudes toward their group roles, team process, and group products.

Table 5: Summary of Learner Perceptions and Attitudes

	Comfort with Roles	Flexibility in Roles	Satisfied with Team Process	Satisfied with Group Products
F2F Midcourse	68%	30%	68%	74%
Online Midcourse	58%	30%	33%	67%
F2F End Course	79%	67%	NA	74%
Online End Course	75%	33%	NA	75%

Results for Question 5

Comparisons of use of the communication tools available to all learners in both versions of the course showed that F2F learners actually made even more use of e-mail than did the online learners (F2F = 94%, online = 83%). Both F2F and online learners made use of the small group discussion boards, with the online learners, not surprisingly, indicated greater use than the F2F learners (online = 50%, F2F = 39%). Virtual chat was used by only

25% of the online learners and none of the F2F learners. And finally, the telephone was used by more than two-thirds of the online learners while only a third of the F2F learners reported using the telephone. It is important to note that all of the online learners reporting use of the telephone mentioned scheduling regular or occasional conference calls with their project teams (small groups), not individual telephone calls between two team members. None of the F2F learners mentioned holding conference calls. The results of learner use of communication tools are summarized in Table 6.

Table 6: Summary of communication tool use

	E-mail	Small Group Discussion Bd.	Virtual Chat	Telephone
F2F End Course	94%	39%	0%	33%
Online End Course	83%	50%	25%	67%

Results for Question 6

Are the learning outcomes the same for F2F and online learners? Evaluation of the three major group assignments (estimation report, negotiation reports and the project proposal) showed that the products from both sections of the course were equally satisfactory. (see Table 7). Regarding learner perceptions of their group products, at the midpoint of the course the online learners were less satisfied with the quality of their group products (67% of online learners were very satisfied while 74% of the F2F learners were very satisfied). By the end of the course, the number of online learners very satisfied with the group products had increased and was comparable to the F2F learners (online was 74%, while F2F was 75%). See Table 5.

Table 7: Learning outcomes measured by three assignments

	F2F Average	*Online Average*
Estimation Report (full score 15 points)	15	14.33
Negotiation Report (full score 5 points)	5	5
Project Proposal (full score 20 points)	18.96	20
Sum	38.96	39.33

Discussion

Question 1

Are small groups working online more task-focused in small group interactions than F2F small groups? The present study found no difference until the threaded discussion interactions were separated from the Virtual Chat interactions. Then the online learners comments were more task focused in the threaded discussion boards. In the Virtual Chat, however, non-task comments were almost as prevalent in the online environment as in the F2F environment. Asynchronous interactions seems to promote more time for learners to reflect and develop indepth questions, comments, or responses. Implications for teaching are that F2F courses may benefit from some required asynchronous threaded discussion activities for small groups. This suggestion must be tempered, however, with the need for the instructor to pose questions or issues requiring reflection.

Question 2

What types of interactions are most common in small group work in the two different learning environments? One interesting finding is that the online environment has about four times as many statements in the category of "state a proposal" than the F2F. (21.1% vs. 4.8%, Chi-square=32.60, significant at .01 level). One possible explanations is that in the online environment, team members have difficulty figuring out what has been said, consequently they do not respond to a proposal which causes the initiator to either restate the proposal or to make a new proposal. One solution may be to provide online learners with access to synchronous modes of audio communication such as Web 4M or telephone conferencing for group organizational and planning meetings to help learners be more efficient and accurate in their group work.

The face to face environment has three times as many statements in the category of "simple agree or disagree" (14.4% vs. 4.7%, Chi-square=29.81, significant at .01 level). One explanation may be that online environment provides students with more time to reflect and thus more time to elaborate on their opinions. We think this finding has implication on practice of course design. Course designer can intestinally put some of F2F activities which requires more time for reflection and high order thinking on the discussion board of the course website to promote learner's reflection process.

The face to face environment has twice as many statements in the category of "negotiation" (25.5% vs. 13.1%, Chi-square=22.40, significant at .01 level). It may be that more cues such as tones, gestures, facial expressions are needed to engage learners in efficient negotiation. There are more "orientation" statements in on-line learning environment. (10.8% vs. 1.5%, Chi-square=22.56, significant at .01 level). One explanation is that on-line learning environment is less structured than F2F and it requires more statements to compensate for lack of social cues and behavioral indicators.

Question 3

Are online learners as comfortable in their team roles as learners in the F2F teams? In this study only half of the online learners felt comfortable in their group roles at the midpoint of the course while over two thirds of the F2F learners felt comfortable at that point. However, by the end of the course the online learners were as comfortable as the F2F learners. This finding may be related to the fact that the online environment has fewer social cues so it takes learners a longer period to get to know each other and feel comfortable working within their teams. Also, online learners had to experiment with the communication tools available in the course, and this required more effort and time for online learners to determine what tools were most effective. In contrast, F2F learners did not have the same barriers, and began to get to know each other more fully and easily during regularly scheduled class meetings. Half of the online learners eventually settled on telephone conferences to provide synchronous team meetings once a week. In such communication, voice contact gave more social cues, as well as help learners resolve issues and make plans with more ease and in a more timely fashion.

Another point to consider is that online learners using virtual chat approximated F2F learners in the amount of non-task statements they made, indicating that this communication tool enabled them to exchange some "social cues" information and build feelings of intimacy more easily. The important element to consider is that synchronous, as opposed to asynchronous, communication seems to foster the exchange of information that helps learners begin to build a sense of community and comfort within a small group.

Finally, the issue of role flexibility indicated that the F2F learners tended to play more roles as the semester progressed, and over three fourths expressed comfort with these roles. While three fourths of the online learners also expressed more comfort at the end of the semester, they also indicated less flexibility in the roles they played. Explanatory comments in the open responses on the survey indicated that online learners tended to feel that it was more expedient to settle into a role (whether leader or supporter) and continue to play that role from week to week. This is probably related to the inefficiencies of communication using the computer-mediated tools and the pressure to get group work completed and assignments submitted.

Questions 4 and 5

Are online learners as satisfied with the communication processes for group work as F2F learners? Which communication tools are most useful for online learners? At the midpoint of the course only one third of the online learners were happy with the communication processes used for small group work while over two thirds of the F2F learners were satisfied. Explanatory comments indicated that crossed messages, lack of timely responses, conflicting personal and work schedules contributed to more online learners being not completely satisfied. However, none of the learners in either section indicated complete dissatisfaction; rather the online learners mentioned problems in coordinating their efforts in a timely fashion and some occasional confusion of who would do what.

In the explanatory comments related to Question 5 on the most useful communication tools for online learners, two-thirds of them mentioned how efficient and satisfying the use of telephone conferencing had been. The audio portion enhanced the sense of team members as individuals and how they were responding to each other, which probably contributed to the sense of satisfaction, too. While 25% of the online learners also used the Virtual Chat, comments indicated that typing skills and problems in knowing who was preparing to respond at any one time made the text-based Virtual Chat less satisfying that the telephone conferences. Here again, communicating in real time (synchronously) allowed learners to more quickly and easily make plans and clear up confusions.

Dissatisfaction with the team communication processes expressed in the F2F class centered more on team members not showing up for meetings, getting work done on time, or participating as fully as expected.

Of the computer-mediated communication tools available to both sections, the most useful tool for both delivery modes was definitely e-mail. However, online learners mentioned that they did not find it as useful for group discussions and team work processes because of the time it took for everyone to respond and the confusion resulting from crossed messages. Instead over two-thirds of them, as mentioned above, discussed the advantages of telephone conferencing. Use of the telephone was certainly not discouraged but neither was it promoted as a tool of the course; and certainly telephone conferencing was beyond the course tools provided. However, two of the online teams had members with access to such conferencing through their work place. The enthusiastic use of telephone conferencing by the online learners in this study indicates that using such tools greatly enhances the communication process for small groups. The key seems to be synchronous exchange of information in a format easily used by all team members. While not all small group communications must be synchronous, comments indicated that conference calls early in the week helped the group develop a plan and timeline and assign tasks for the next product. Group members then worked individually, posting materials on the group discussion board for review or e-mailing documents to specified team members. Text-based virtual chat serve some of the same purposes, but its usefulness was diminished by the lack of typing skills of the participants and confusions that arose in waits for response and crossed text messages.

Question 6

Are learning outcomes the same for F2F and online learners? Evaluation of the work products showed that both online and F2F learners completed assignments on time and with comparable high quality. While over two thirds of both online and F2F learners were very satisfied at the course midpoint with the products of their small group work, by the end of the course both groups had more members now very satisfied with the quality of their products. The increase for both types of learners from mid to end of course probably indicates the greater degree of comfort they had attained by the end of the course based on the feedback they had gotten on earlier products. The greater increase in the online learners (from 67% to 75%) probably reflects the learners' greater comfort in their group roles, more trust in their team mates, and better facility in communicating online.

Conclusion

Small groups can work effectively online and accomplish the same type and quality of learning achievement within one semester. However, online small groups have to spend more time orientating themselves and may tend to stay in one role throughout the semester. Further, asynchronous communication tools impede learner and small group efficiency and feelings of satisfaction. To counter these tendencies, instructors can try to provide access to synchronous tools such as Web 4M or telephone conferencing. However, if such audio tools are not available, encouraging the use of virtual chat will help small groups get to know each other faster and develop organizational frameworks and make plans more efficiently. And F2F small group discussions may be improved by required online threaded discussions. Such discussions can stimulate deeper reflection and responses.

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Relative effectiveness of individual differences and varied instructional strategies: A meta-analytic assessment

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Abstract

This meta-analytic study is unique and significant in that all the 1,341 learners in 11 studies completed the Group Embedded Figures Test (GEFT), interacted with the same instructional module, and completed the same five criterion tests measuring different types of educational objectives. Studies varied in presentation mode and type of independent variables: visualization, rehearsal and feedback strategies. Within each of the independent variables, variations (varied treatments) were examined. Visualization, feedback and rehearsal strategies were embedded into the instructional module as a result of item analyses. Specifically, the purpose of this study was to assess the effect of the variations within each independent variable in terms of their effects in reducing the effect of learning style achievement differences associated with field independent (FI) and field dependent learners (FD). One hundred twenty two effect sizes were generated. Results are not only consistent with prior research related to the instructional effect of visualization, feedback and rehearsal but provide the foundation for significant hypothesis generation related to the instructional use of varied types of visualization, feedback, rehearsal strategies and presentation mode in terms of reducing achievement differences on different types of educational objectives associated with individual learning styles (FI & FD).

Introduction

Individual learning styles are becoming one of the critical dimensions in the design of instruction for learners at all education levels. An individual's learning style generally determines how he or she will proceed to interact with the instructional content presented in a learning environment. In general, the literature on learning style research indicates that learners approach learning objects differently and profit differentially from similar types of instruction (Jonassen & Grabowski, 1983). Implications from this research indicate that differences in learning style, field independence – field dependence, do affect achievement of different types of learning objectives in knowledge acquisition domains: facts, concepts, rules/principles, and procedures (Alemar, 1992; Al-Saai, 1993; Canelos & Taylor, 1981; Couch, 1990; Dwyer & Moore, 1991; Fullerton, 2000; Joseph, 1987; Moore & Dwyer,1991,1994, 2000, 2001a, 2001b, Pollack, 1987).

Information Processing

Upon perception, an event is analyzed from it shallow structural aspects to its deep semantic aspects. A memory trace reflects the analyses performed with the deeper the analyses, the greater the degree of semantic or cognitive coding; hence, the more durable the memory trace (Moscovitch & Craik, 1976). Further analyses occur through elaboration or enrichment resulting in trace persistence. Rehearsal of repeated information at the same level does not increase the recall of information nor the strength of the memory trace; deeper processing results in increased levels of recall (Craik & Lockhart, 1972). Elaborative rehearsal, a function of working memory, involves processes designed to more deeply encode and store information for later retrieval (Craik & Lockhart, 1972; Craik & Tulving, 1975). Thus, elaboration of information facilitates increased retention through greater compatibility between the structure, rules and organization resulting in more compatibility with cueing for the retrieval of the information.

Rehearsal

Consistent with the Information Processing Theory, Dickinson & O'Connell (1990) demonstrated that transformation of material is essential for learning; reading, rereading and skimming are not considered to require as much transformational activity as organizational strategies, the imposition of structure on the material. Embedded questions within the instructional materials have shown that rehearsal, either prompted covertly (thinking about the answer to the embedded questions) or overtly (writing/typing the answer to the embedded questions), does facilitate increased achievement of the learning objectives (Andre, 1990; Denner & Rickards, 1987; Friedman & Rickards, 1981; Glover, 1989; King, 1992; Walker, 1974; Wang & Andre, 1991; Wager & Mory, 1992; Watts & Anderson, 1971; Willoughby & Wood, 1994; Wilson, Koran & Koran, 1974). Conflicting research for overt and covert rehearsal strategies suggest that there may be learning situations that result in covert rehearsal being more effective; these situations may be when the instruction is perceived to be too easy or the overt rehearsal interferes with the already adequate interaction with the content presented (DeKlerk & DeKlerk, 1978).

Feedback

Feedback within instruction has been shown to be more effective than no feedback (Bangert-Drowns, Kulik, Kulik, & Morgan, 1991; Clariana, 1992; Kulhavy, 1977; Kulik & Kulik, 1988). Information processing takes place when a stimulus affects the learner and activates the receptors within the brain to transmit information (Craik & Lockhart, 1972). Feedback by itself does not ensure that additional information processing is taking place (Wager & Mory, 1992). The effect of feedback on achievement of field independent and field dependent learners has not been found to create a significant difference within the individual studies (Al-Saai, 1993; Canelos & Taylor, 1981; Couch, 1990; Pollack, 1987). Comparisons between the studies is needed to further investigate the effect of different types of feedback.

Visualization

Visuals have been shown to be an important variable in facilitating achievement (Baker & Dwyer, 2001; Dwyer, 1978). While visuals have facilitated achievement, visuals placed in positions identified through item analysis, into locations within the instruction where learners have difficulty, have not been enough. Additional instructional strategies have been placed in conjunction with the redundant visuals to assist learners in facilitating additional achievement (Alemar, 1992; Al-Saai, 1993; Canelos & Taylor, 1981; Couch, 1990; Dwyer & Moore, 1991; Fullerton, 2000; Joseph, 1987; Moore & Dwyer,1991,1994, 2000, 2001a, 2001b, Pollack, 1987).

Field Independence – Field Dependence

Field Independence – field dependence is one of the most extensively researched learning styles (Witkin, Moore, Goodenough & Cox, 1962). Field independent learners have been identified to be superior to field dependent learners when thinking operationally and recalling details in a prose passage (Riding & Dyer, 1983). Field independent learners tend to score higher on achievement tests due to processing of text in an analytical manner that imposes order when necessary (Hansen, 1983); field dependent learners tend to interact with the presented information using the structure that is given. Implications from the body of field independence – field dependence research include prescriptive recommendations based on individual studies. Examples of instructional design prescriptions to remediate or compensate for field dependent learners include: (1) provide abundant positive and negative feedback, (2) begin exercises with clear structure, abundant cues, and consistent feedback, and (3) have learners paraphrase the content (Jonassen & Grabowski, 1983). Structure created by the field independent learner will permit the learner to process the information presented to a level that is recalled. The field dependent learner interacts with the material's structure (Hansen, 1983) with the possibility that they may not be organizing the information in a manner that promotes the deeper levels of processing necessary for later retrieval. Additional rehearsal by the field dependent learner may allow for deeper processing of the imposed structure, creating stronger memory traces and higher levels of recall.

Statement of the Problem

The purpose of this study is to examine the instructional effects of different types of instructional strategies in terms of their ability to facilitate achievement of different types of educational objectives in knowledge acquisition domains: facts, concepts, rules/principles and comprehension for field independent and field dependent learners by summarizing the findings of a series of studies that used the same core instructional materials and criterion measures through a meta-analytic analysis. Specifically, the purpose of this meta-analytic assessment is to determine the effects of various types of visuals (black & white, black & white shaded, color coded, none), feedback strategies (independent of response, dependent upon response, no feedback), rehearsal levels (covert, prompted covert, overt), type of instructional presentation (audio only, print based, computer based) and type of knowledge acquisition domain (facts, concepts, rules/principles, procedures).

Methodology

Designed to accumulate experimental results across independent studies that address a related research question, meta-analysis is a set of statistical procedures that uses summary statistics from the individual studies as data points. Each data point is assumed to represent an estimate of the underlying relationship within a population; thus, the combined effect size for a meta-analysis represents the population effect. Effect sizes for this study represent the difference in scores between field independent learners and field dependent learners in an individual study, experiencing identical treatments. Overall effect sizes for various instructional strategies or criterion measures are the representative population effect size for the differences for field independent learners and field dependent learners. Since all data was reported as means and standard deviations within the independent, individual studies, Hedges (1982) and Hunter & Schmidt's (1990) technique for calculating the effect size was employed. Since more than five percent of the individual studies failed to report their unique reliabilities for the criterion measures, the corrections for variance due to the artifacts of measurement error and restriction of range were not calculated (Hedges, 1988). Prior to calculation of effects sizes, the various data points for the means from the individual studies were examined for outliers using the SAMD technique developed by Huffcutt & Arthur (1995). No outliers were found within the data points.

Eleven studies (Appendix A) were identified as utilizing the Group Embedded Figures Test (GEFT) (Witkin, Moore, Goodenough & Cox, 1962) for measuring field independence and field dependence and the instructional materials developed by Dwyer (1965). While many studies employed the GEFT for measuring field independence and field dependence, only the eleven studies (n = 1341) were chosen to ascertain more purely the effect of the various instructional strategies and techniques without the interference of different criterion measures; one of the leading criticisms of meta-analysis (Hunter & Schmidt, 1990; Rosenthal, 1991). One hundred twenty-two effect sizes were calculated from the available data. The means, standard deviations and sample sizes for the field independent learners were assigned to the experimental group and the means, standard deviations and sample sizes for the field independent learners were assigned to the control group when calculating the effect sizes for the individual studies' instructional strategy and knowledge acquisition domains. Analysis of variance was performed to calculate the mean effect size and to determine statistically significant differences of the effects for each category: visual characteristics, feedback strategy, rehearsal level, presentation medium, and knowledge acquisition type.

Instructional Unit and Criterion Measures

The core instructional unit developed by Dwyer (1965) contains approximately 2000 words about the anatomy and functions of the human heart with five criterion measures: comprehension, drawing, identification, terminology, and total. The criterion measures correspond to the different knowledge acquisition domains: facts, concepts, rules/principles and procedures. The instructional strategies include four levels of visuals (black & white, black & white shaded, color coded, none), three levels of feedback strategies (independent of response, dependent upon response, no feedback), three levels of rehearsal (covert, prompted covert, overt), and three types of instructional presentation (audio only, print based, computer based).

Reliability information reports the average Kuder-Richardson Formula 20 Reliability coefficients from a random sampling of studies (Dwyer, 1978) are 0.77 Comprehension Test, 0.83 Drawing Test, 0.81 Identification Test, 0.83 Terminology Test, and 0.92 Total Test. The following description of the criterion tests, adapted from Dwyer (1978, pp. 45-47) illustrates the types of instructional objectives assessed in the studies.

Drawing Test

The objective of the drawing test was to evaluate student ability to construct and/or reproduce items in their appropriate context. The drawing test provided the students with a numbered list of terms corresponding to the parts of the heart discussed in the instructional presentation. The students were required to draw a representative diagram of the heart and place the numbers of the listed parts in their respective positions. For this test the emphasis was on the correct positioning of the verbal symbols with respect to one another and in respect to their concrete referents.

Identification Test

The objective of the identification test was to evaluate student ability to identify parts or positions of an object. This multiple-choice test required students to identify the numbered parts on a detailed drawing of a heart. Each part of the heart, which had been discussed in the presentation, was numbered on a drawing. The objective of this test was to measure the ability of the student to use visual cues to discriminate one structure of the heart from another and to associate specific parts of the heart with their proper names.

Terminology Test

This test consisted of items designed to measure knowledge of specific facts, terms, and definitions. The objectives measured by this type of test are appropriate to all content areas which have an understanding of the basic elements as a prerequisite to the learning of concepts, rules, and principles.

Comprehension Test

Given the location of certain parts of the heart at a particular moment of its functioning, the student was asked to determine the position of other specified parts or positions of other specified parts of the heart at the same time. This test required that the students have a thorough understanding of the heart, its parts, its internal functioning, and the simultaneous processes occurring during the systolic and diastolic phases. The comprehension test was designed to measure a type of understanding in which the individual can use the information being received to explain some other phenomenon.

Total Test Score

The items contained in the individual criterion tests were combined into a composite test score. The purpose was to measure total achievement of the objectives presented in the instructional unit.

Results

By averaging the effect sizes and performing ANOVA with Tukey follow-up pairwise comparisons to find the significant differences, expected effect sizes to show that the field independent (FI) learners perform higher than the field dependent (FD) learners. Each value listed is the number of standard deviations higher the field independent learner would score compared to the field dependent learner undergoing the same instructional strategy and/or knowledge acquisition domain.

Visualization Results

Table 1: Effect sizes for field independent participants compared to field dependent participants for various visual types

	Visual Type			
	None	Black & White	Black, White & Gray Shaded	Color
Comprehension	1.175	0.701	0.260	0.656
Drawing	0.551	0.919	1.343	1.239
Identification	1.306	0.793	1.059	1.129
Terminology	0.989	0.824	0.134	0.876
Total	1.236	0.897	1.161	1.380
Global	1.051	0.831	0.792	1.072

In comparing the performance of FI and FD, learners Table 1 illustrated the fact that field independent learners are differentially affected when visualization is used to complement instruction and differentially affected by different types of visualization are sued to facilitate achievement of different types of educational objectives. For example, the effect size on the comprehension test was 1.175 standard deviations was realized in favor of the FI over FD learners when both groups received verbal instruction without visuals. When varied types of visualization were used to complement the verbal instruction, effect sizes on all criterion measures decrease indicating that the use of visualization may be considered an important instructional variable in reducing the effect of learning style differences between FI and FD types learners. It is also interesting to note the differences between the color-coded and the black and white treatments on the various criterion measures. Also worthy of note is the that the black, white and gray shaded treatment was the most effective in reducing achievement differences between FI and FD learners on both the terminology and comprehension criterion measures.

Feedback Results

Feedback strategies were coded as no feedback conditions within the instruction, independent feedback conditions (feedback that occurs regardless how the learner responds to questions or other prompts for a response; e.g., the answer that appears on the next page), and dependent feedback conditions (feedback that is developed dependent upon the response; e.g., response to learner telling them information related to their answer).

Table 2 : Effect sizes for field independent participants compared to field dependent participants for various feedback types

	Feedback Type		
	None	Independent	Dependent
Comprehension	0.650	1.351	0.376
Drawing	1.106	0.876	0.212
Identification	1.040	0.692	0.221
Terminology	0.783	1.001	0.182
Total	1.155	1.116	0.283
Global	0.958	1.007	0.255

Table 2 illustrates the achievement differences between FI and FD learners when they receive no feedback while progressing through their instruction. It also illustrates that the different feedback types differentially effect achievement on the different criterion measures with the dependent feedback type being most instrumental in reducing achievement differences between FI and FD learners. It also dramatically presents the effect size differences realized between the independent and dependent feedback strategies and the potential significance that may be realized in reducing learning differences when these two feedback strategies are employed and verifies the fact that different feedback strategies are not equally effective in reducing achievement differences between FI and FD learners. It is also important to notice that the interactivity instigated between the field dependent learners receiving the dependent feedback and the content was effective across all criterion measures requiring different levels of information processing. Apparently dependent type feedback activities alerting the FD learners to the critical content to be learned enables them to interact and achieve at levels similar to those achieved by the FI learners.

Rehearsal Results

The type of rehearsal has been shown in other studies to facilitate recall of information by deepening the level of encoding through information processing (Craik & Lockhart, 1972, Craik and Tulving, 1975).

Table 3 : Effect sizes for field independent participants compared to field dependent participants for various rehearsal types

	Rehearsal Type		
	Covert	Prompted Covert	Overt
Comprehension	0.675	0.325	0.788
Drawing	1.251	0.403	0.611
Identification**	1.258	0.408	0.359
Terminology	0.871	0.373	0.588
Total	1.316	0.773	0.697
Global*	1.086	0.509	0.609

* $p < 0.05$ Statistically significant difference for covert rehearsal compared to both prompted covert and overt rehearsal strategies.

** $p < 0.05$ Statistically significant difference for covert rehearsal compared to overt rehearsal for the identification test.

In comparing the effect sizes related to rehearsal type (covert, prompted covert, overt), it is apparent that the prompted covert rehearsal strategy offers the most potential in reducing learning differences between FI and FD learners among the three rehearsal types. Results indicate that the information processing instigated by the prompted covert rehearsal strategies were instrumental across all criterion measures in reducing performance differences between the FI and FD learners. Covert rehearsal strategies, in general, were the least effective type of rehearsal in reducing achievement differences among the different criterion measures. It is also apparent that different types of rehearsal strategies are differentially effective in reducing achievement differences between FI and FD learners and are differentially effective in reducing achievement differences on the different criterion measures.

ANOVA results also indicate that across all domains of knowledge acquisition, that any type of prompting for rehearsal facilitates increased processing and increased recall on the criterion measures; both prompted covert rehearsal and overt rehearsal strategies decreased the difference in achievement by field independent learners compared to field dependent learners as compared to the learners rehearsing covertly with no prompt to rehearse the information at a deeper level.

Presentation Mode

Computer based instruction assumes to be more effective due to increased ability to program dependent feedback conditions or additional rehearsal strategies. Table 4 presents the results for the various presentation formats for the instructional unit. Audio only presented slide images on a screen while an audiotape played the narration of the instructional script. Computer based instruction presented screen with the same images and materials as presented in a print base/paper based instructional booklet. Within the computer based instructional units, some treatments used the same independent of response feedback strategy as the paper based version; placing the correct answer on the top of the next slide/page. A common comment within the computer based research situations is the statement that the computer base may be more motivational and lead to higher scores (Fullerton, 2000; Joseph, 1987).

Table 4: Effect sizes for field independent participants compared to field dependent participants for various presentation types

	Presentation Type		
	Audio	Computer Base	Paper Base
Comprehension	0.652	0.712	0.667
Drawing	0.818	1.015	1.230
Identification	0.531	1.509	1.074
Terminology	0.572	1.240	0.748
Total	0.685	1.270	1.240
Global*	0.667	1.157	1.002

* $p < 0.05$ Statistically significant difference for type of presentation. Follow-up Tukey pairwise comparisons failed to find the difference.

Table 4 examines the effect sizes resulting from methods of presentation type (audio, computer, and paper). Results indicate that the audio presentation format possesses the greatest potential for reducing the achievement effect of learning styles between FI and FD learners. This result may have its foundation in the fact that the audio presentation enabled the FD learners to hear the proper pronunciation of the information being presented and were better able to make the proper associations necessary to assimilate the information and move it from short to long term memory. These results are interesting in that the audio presentations were externally paced and should not have theoretically been competitive with the self-paced computer and paper oriented presentations. Also worth noting is the lack of variability within presentation types in terms of reducing differences between learners identified as FI and FD on the varied criterion measures. These results offer implications for justifying the use of streaming audio in the new electronic delivery systems.

Discussion

Analysis of the results within the different studies were consistent with current research indicating that carefully designed and positioned visualization, rehearsal and feedback strategies can significantly improve learner achievement. The purpose of this study was to systematically examine the effects of different types of visualization, rehearsal and feedback strategies and their impact upon FI and FD learners as they interact with instructional content designed to facilitate achievement on five different types of knowledge acquisition domains. In analyzing the effect size related to type of visualization the results indicate that in general visualization can reduce achievement differences attributed to learning style of FI and FD learners. Results also indicate that within the domain of visualization, different types of visualization function differentially in reducing achievement differences and also function differently in reducing differences on the different types of criterion measures. It was also found that different feedback and rehearsal strategies also functioned differently in reducing achievement differences associated with the different learning styles of FI and FD learners. Differences in the variation within treatments were also realized in terms of their ability to reduce achievement differences of the different criterion measures. Method of presentation was also found to be an important variable in reducing achievement differences associated with FI and FD learners on the different criterion measures.

These observations substantiate the fact that in attempting to maximize learning one cannot simply talk in terms of adding visualization, feedback, or rehearsal strategies to an instructional unit in an attempt to facilitate achievement. Variations within the different types of visualization, rehearsal and feedback strategies function differently - some functioning to reduce achievement differences between FI and FD learners and others having very little influence. It is also important to realize that since variations exist within the independent variable types, it is apparent that one cannot simply talk about reducing achievement differences between FI and FD learners in the abstract. Achievement variables (types of educational objectives to be facilitated) need to be identified precisely so that prescriptiveness can begin to evolve as a strategy for designing varied types of learning environments, which might eventually lead to the reduction of achievement differences associated with differences in learning style.

By averaging the effect sizes across all instructional strategies and knowledge acquisition domains, effect sizes indicate that field independent learners do achieve higher scores on achievement tests. These gaps in achievement may be closed by prompting the field dependent for deeper processing of the information through rehearsal as evidenced by statistically significant differences for effects with rehearsal levels on the identification test and across all knowledge acquisition domains. Osman & Hannafin (1994) found that orienting questions of a conceptual nature improved both factual learning and problem solving and activated prior knowledge to promote deeper processing, which, in turn, promoted more meaningful learning. This study found similar findings for prompting rehearsal to facilitate a decrease in the difference between achievement of field independent and field dependent learners. This prompting may be questions as used by Reynolds, Standiford & Anderson (1979) when testing at the factual level: questions used within the instruction resulted in higher achievement since they caused learners to interact with the material.

The implication for instructional designers is that visuals (Dwyer, 1978), feedback (Clariana, 1992), and medium of presentation are not individually effective enough to facilitate closing the gap between achievement of field independent learners and field dependent learners. Prompting the learners for additional rehearsal to deepen the level of processing to facilitate higher levels of retrieval and recall is necessary.

Future research implications for research include a need for additional study of dependent feedback conditions as compared to no feedback strategy or independent feedback strategy since results indicate that the dependent feedback condition is a low as one-tenth of the difference found for the other strategies. A meta-analysis of field independent – field dependent studies using a variety of criterion measures that examine the use of feedback strategies is recommended. The significant difference indicated by ANOVA for the presentation type indicates that the role of the presentation medium may also be a factor in subsequent performance. Additional study of method of presentation is also recommended.

The purpose of this study was to support and determine recommendations for instructional designers to facilitate a more equal performance by learners that are identified as field independent and field dependent. The results do provide support for the need to include prompting techniques for rehearsal within the instructional materials. The findings of this study also provide the foundation for systematically generating a multitude of research hypotheses dealing with the systematic examination of the instructional effectiveness of variations within different variable domains as they relate to different types of educational objectives.

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Appendix A

Author	**Title**	**Year**	**N**	**Criterion measures**	**Independent variables**	**Outcome**
Alemar	The effect of different levels of coding (color vs black/gray/white) in facilitating achievement in learning facts, concepts, and generalizations with students of different learning styles	1992	244	Drawing, Identification, Terminology, Comprehension, Total	bw, bws, cc, fi, fd, fn, covert, paper	Moderate color treatment participants have higher achievement than moderate black, gray and white treatment.
Al-Saai	The effect of different visualized treatments on field independent and field dependent students at the University of Qatar	1993	150	Drawing, Identification, Terminology, Comprehension, Total	bw, fi, fd, fbind covert, pcovert,overt paper	Field independent participants have higher achievement than field dependent participants in treatment with visual and text and treatment with overt rehearsal.
Canelos,Taylor	A networking information processing strategy and the learning of field dependents receiving visual instructional information	1981	81	Drawing	bw, c, fi, fd, covert, pcovert, audio	Field independent participants have higher achievement than field dependent participants on the drawing test and terminology tests.
Couch	The effects of imagery rehearsal strategy and cognitive style on learning of different levels of instructional objectives	1990	113	Drawing, Identification, Terminology, Comprehension, Total	bw, fi, fn, fd, covert, overt, audio	Field independent participants have higher achievement than field dependent participants on the drawing, terminology, comprehension and total tests.

Author	Title	Year	N	Criterion measures	Independent variables	Outcome
Dwyer, Moore	Effect of color-coding on visually and verbally oriented tests with students of different field dependence levels	1991	119	Identification, Terminology, Comprehension	bw, cc, fi, fn, fd, covert, paper	Field independent participants have higher achievement than field dependent participants for black and white and color-coded treatments. Participants exposed to color coded treatments have higher achievement than those exposed to black and white treatments.
Fullerton	The interactive effects of field dependence-independence and internet document manipulation style on student achievement from computer-based instruction	2000	98	Total	bw, fi, fn, fd, covert, cmpt	Field independent and field neutral participants have higher achievement than field dependent participants.
Joseph	Field dependence/ independence and the mathemagenic effects of observable visual imagery rehearsal for learning from computer-presented text	1987	54	Drawing, Identification, Terminology, Comprehension, Total	bw, fi, fd, covert, overt, cmpt	Field independent participants have higher achievement on the total test with visual images that those that had a visual strategy present. Field dependent participants have higher achievement than those that received no strategy.
Moore, Dwyer	The effect of cognitive style on test type (visual or verbal) and color coding	1994	183	Drawing, Identification, Terminology, Comprehension, Total	bw, cc, fi, fn, fd, covert, paper	Field independent participants have higher achievement than other participants on color-coded treatment for the drawing test, and all treatments for the remaining criterion measures.
Moore, Dwyer	The effect of color coded information on students' level of field dependence	1991	119	Identification, Terminology, Comprehension	bw, cc, fi, fn, fd, covert, paper	Field independent participants have higher achievement than field dependent participants for black and white and color-coded treatments. Participants exposed to color coded treatments have higher achievement than those exposed to black and white treatments.

Author	Title	Year	N	Criterion measures	Independent variables	Outcome
Moore, Dwyer	The effect of field dependence and color coding on female student achievement of different educational objectives	2000	126	Total	bw, cc, cfid, covert, paper	Field independent participants have higher achievement than field dependent participants. Participants exposed to color coded visuals have higher achievement than those exposed to black and white.
Moore, Dwyer	The relationship of field dependence and color coding to male student achievement	2001	55	Drawing, Identification, Terminology, Comprehension, Total	bw, c, fi, fn, fd, covert, paper	Field independent participants have higher achievement than field dependent participants.
Pollack	The use of interactive video to examine the interactive effect of cognitive style and structural organizers on learning	1987	118	Drawing, Identification, Terminology, Comprehension, Total	c, fi, fn, fd, covert, pcovert, overt, audio	Field independent participants have higher achievement that field dependent participants for the total, drawing, terminology, and comprehension tests.

Examining Online Interactions in Two Graduate Courses

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Abstract

The categorization of types of discussion is used to examine patterns of online interactions in asynchronous communications in graduate courses delivered at two public universities. Online interaction patterns are reviewed to look at levels of initiation and response. Online communications patterns are identified based on roles exhibited by online participants. The structure of the communication spaces and implications for online discussions will be addressed.

Introduction

The availability of new technologies such as email, listservs, and computer conferencing has begun facilitating new ways of communicating in instructional settings. Several communication tools now exist to support asynchronous discussions that can be incorporated into existing classes. These tools support messaging between individuals and facilitate the ability of participants to read and respond to messages or to add their own new messages to which others can respond. Discussions can take place among individuals in widely dispersed geographic locations or among persons unable to participate in a discussion at a specific time.

In these new instructional environments, technology can be used for content transmission or as a communication support tool, or these two roles can be combined, as they often are in online learning, to support educational activities (Benbunan-Fich & Hiltz, 1999). E-learning tools can create systems that allow students to exchange messages and participate in discussions in an organized way (Hiltz & Wellman, 1997). The challenge is to design pedagogically effective learning environments in the online world in order to enhance the quality of education (Althaus, 1997).

Some researchers have identified advantages and disadvantages in implementing computer-mediated discussions as an instructional tool (Hilt, Johnson, & Turoff, 1986; Straus & McGrath, 1994; Walther, 1996). While computer-mediated group interactions may be more focused on tasks and less on personal interactions, they also may result in greater processing time and create difficulty in consensus building. Studies have found more equal participation and more idea generation in computer-mediated environments as participants have more equal "speaking" time. Lack of structure in the online context and a reduced likelihood of leadership emerging are other disadvantages pointed to in the literature. Hiltz et. al. (1986) indicate that a leadership void may inhibit consensus building and organization of a group in approaching a problem. Farnham, Chesley, McGhee, Kawal, & Landau (2000) found that enhancing structure in an online environment contributed to higher levels of consensus and better decision-making in group activities. Some contend that asynchronous interaction improves in-depth reflection and topic development (Harasim, 1990).

Hammond (1997) looked at the use of online learning for professional development, focusing particularly on the usefulness of the medium for discussion-oriented activities. While concluding that the medium can be used effectively, Hammond also pointed to a number of issues to consider in developing online discussions. Issues such as acquiring sufficient technical skills, constraints on writing skills, reticence, and access to technology were noted, however, the author discussed in more detail the difficulty of maintaining the debate and structuring the discussion so as to provide openness and at the same time control over learning. While the instructor can initiate a discussion, there may be little control over who responds and there may be a sense of being removed from the interactions. The online tools provide convenience for participation when and where the individual likes and thus increases opportunities for contributions. At the same time, adding structure may reduce flexibility and the sense of being "distant" may contribute to delays in participation.

Muscella and DiMauro (1995) discuss maintenance of online debates, suggesting that an assertion followed by personal experience and a statement of belief will trigger a response to a message. They also suggest starting with non-controversial topics as participants learn together in order to reduce contentiousness and build a comfortable learning environment. Use of the online medium for interactive discussions and collaborative learning has been recommended. Such strategies requires student to take a more active role in the learning process (Lindeman, Kent, Kinzie, Larsen, Ashmore, & Becker, 1995).

Some researchers have analyzed online discourse from listservs and web-based discussion groups and looked at interaction patterns (Chase, Macfadyen, Reeder, & Roche, 2002). Chase et. al. identified nine emergent themes from their sample of text discourse from an online class. First, an online culture developed reflecting the values of the developer of the web environment. That culture was maintained by the guidelines created, and by the facilitators and participants. Second, formal and informal participation was affected in the online environment and distinct communication pattern differences were apparent between the two. Third, individuals varied with their level of comfort in online discourse. Fourth, individuals created their own online identity. Fifth, technical issues and formatting influenced communication. Sixth, participant expectations of the course, the instructor, and the medium influenced the environment. Seventh, facilitator expectations also affected the learning environment. Eighth, differences in communication related to the use of academic discourse versus the telling of stories or narratives were observed and created variation in participation in online debate. Ninth, explicit and implicit assumptions about time were evident.

Another way to look at online discourse is to look at the types of communication or levels of communication that occur. Research on questioning and discussion (Dillon, 1990, 1994; Roby, 1988) has some interesting implications for examining online communication.

Categorization of Discussion Behavior

For instructional purposes, it is important not only that students communicate in the online environment, but that we examine their patterns of that communication. Research on questioning and discussion (Roby, 1988; Dillon, 1990, 1994) has provided a system for categorizing types of communication based on five patterns. **Initiating** patterns of communication include such things as stating an opinion or insight to get the conversation started, formulating a question to open a discussion topic, injecting a new insight or new information into an ongoing discussion, restarting a discussion by suggesting a new approach or idea not previously discussed, or asking for an opinion from someone who is not actively participating in the discussion. In a **supporting** communication pattern, the student may share evidence to support a position, provide an example of a concept being discussed, ask for clarification, restate a position in different words, or introduce a nuance that enriches the original information. Examples of **challenging** communication patterns include simple statements of disagreement, offering different opinions, or correcting facts. **Summarizing** patterns occur when a participant states in a concise way the essence of someone else's remarks or condenses a whole series of remarks from different participants into a concise statement. **Monitoring** is defined as statements that keep the group on task and focus the discussion on the topic.

Context

This study investigated students' use of one asynchronous communication tool used as part of a "hybrid" class that included face-to-face meetings as well as web-enhanced instructional activities. The researchers analyzed communication patterns used during asynchronous discussions about case studies and also examined the type of interactions that occurred among the students.

Two graduate courses at two public universities (Midwest and Southeast) were the focus of a study to examine communication patterns in online asynchronous discussions. One course was in curriculum and instruction (Case 1) and the other in counseling (Case 2). Students in the curriculum and instruction course studied concepts in program evaluation and designed evaluation plans for educational programs. Students in the counseling course studied ethical and legal aspects of counseling. Students in both courses worked in teams, used case studies, and had projects and assigned readings. The two courses were traditional courses with web-enhancements, including web pages, chat rooms, and the use of asynchronous communication tools. An electronic bulletin board (e-board) was used to facilitate group discussions. Through review of transcripts from the e-board, the researchers looked at how students used the e-board to support online discussions, what patterns of communication emerged and what types of interactions occurred.

Methods

The researchers used a qualitative content analysis approach. Data were collected from transcripts generated on the e-board that students used during the online discussion component of the courses. The identified categories of communication were used to code the transcripts from four case study discussions. Initiating (I), supporting (SP), challenging (C), summarizing (SM), and monitoring (M) communications were coded using the identified definitions as a way to look at patterns in the discussion. Reponses were also coded as an initial posting

(IP), response to a post (RP), reply to a response (RR), or reply to a reply (RR#) to look at interaction patterns among the students. In an initial posting, a student started a thread in the online discussion by posting a message. In a response to a post, the student responded to the initial message posted in a given thread. A reply to a response occurred when a student replied to the responses on an initial posting. A reply to a reply occurred when the student replied to one of the replies made by another student. In the discussion thread, the patterns might appear as below in Figure 1. The researchers referred to this as the Initiate-Response-Reply Framework (IRR).

Figure 1. Response patterns in a discussion thread: The IRR Framework

Level 1:	Initial Posting (IP)					
Level 2:		Response to the Post (RP)				
		Response to the Post (RP)				
Level 3:			Reply to the Response (RR)			
		Response to the Post (RP)				
			Reply to the Response (RR)			
Level 4:				Reply to the Reply (RR1)		
				Reply to the Reply (RR1)		
					Reply to the Reply (RR2)	
						Reply to the Reply (RR3)

Higher levels of responses and replies (level 4 is high and level 1 is low) mean more interactions among the participants in the online discussion. To summarize, the transcript data from the e-board discussions that occurred during four case-study assignments was categorized in two ways: (1) type of communication (based on identified definitions), and (2) interaction level observed (the IRR framework)

Findings

Three sets of findings are reported below. First the results of examining the comments on the e-board based on the communication patterns as defined are reviewed. Second, a summary of the interaction pattern evident in the postings and responses is presented. Third, additional patterns in the content of the discussions and the use of the e-board space that emerged during the analysis will be reported.

Patterns of Communication

One primary pattern in both cases was that of initiating responses. Case 1 had a high frequency of initiating communication, while initiating behavior ranked third in Case 2. Examples of initiating behavior are noted below.

> Initiating Example 1:
> What seems as such a distinct difference, formative as process and summative as final; I find (as I usually do) gray areas. Principal evaluations of teachers. Formative, right? They go on year after year in attempt to help the teacher become better and better. But, usually the evaluation is done for a specific lesson, which the principal looks at in detail and gives a summative report.
>
> Initiating Example 2:
> Does a key audience have to be one individual group or could it be multiple groups?

Both cases exhibited high supporting patterns of communication. Supporting responses were the most prevalent type of communication overall and in each of the cases. Examples of comments coded as supporting are noted below.

> *Supporting Example 1:*
> I agree with your decision points for the counselor. And of course, this is assuming that John disclosed his condition to his counselor. I think there are more decision points that Mary's counselor has to make. Mary's counselor now has the responsibility to look into John's case to see if John told his counselor about his condition. If he did, then he is obligated to the ethical codes H.2.a., H.2.b., H.2.d., and H.2.e.
>
> *Supporting Example 2:*
> I was working on the revision and I notice something I need clarification on. In my answer, I used the example of consumer-oriented as my Language Arts department and their evaluation of curriculum

materials for an adoption next year. You said this was incorrect. In our notes, it says "evaluation of curriculum packages." How is this different? Please clarify?

Challenging patterns seemed to emerge in both cases when controversial topics were involved. In one case, challenging communication was actually second highest in frequency. Overall, the challenging pattern was lower than initiating or supporting patterns. An example of a comment coded in the challenging category is listed below.

Challenging Example:
Let's say the counselor did know John was in a relationship with Mary, Maria, or whoever. I think Kitchener's principle of Nonmalficence applies. The counselor was to avoid doing harm. He did not harm John but in the long run he did harm to Mary because he had a duty to inform her of the danger she was in. Also, the principal of truthfulness because informed consent is part of that. The counselor should have told John that there were limits and exceptions to confidentiality.

Both cases exhibited low monitoring patterns. An example of a comment coded as monitoring is noted below.

Monitoring Example:
FYI, In case you haven't checked the Q&A section. Dr. C. said we need to make sure that we adapt that checklist on p. 218 to meet the needs of our program evaluation. We still have to do that, right?

Summarizing communications were observed in only one of the cases (Case 2). An example is identified below.

Summarizing Example:
This is a great example of problems of working in rural communities with only one therapist available. I also see some similarity to what ministers and clergy must inevitably deal with: multiple relationships. What I see here that seems most striking is the counselor's discussion on informing the parent and discussing this duality. But she did not make the same attempt with Chris who is the CLIENT. Hence, I believe he was treated in a second-class manner and the mother was given more power in the counseling process than, again, Chris the client. Also, there is the divergence of obligations due to the counselor again putting the parent's needs before the child.

Overall, initiating and supporting communication patterns dominated the online discussions. Challenging and monitoring patterns were exhibited lower overall. However, in one case, these patterns came out higher than initiating. Summarizing occurred in only one of the cases. Table 1 provides data on the patterns of communication coded using the identified criteria.

Table 1. Patterns of Communication Generated by Group/Case Online Discussion

Case One	Activity 1	Activity 2	Activity 3	Activity 4	Total Postings
Initiating	32	22	26	83	163
Supporting	38	25	29	92	194
Challenging	0	0	0	22	22
Monitoring	2	0	0	0	2
Summarizing	0	0	0	0	0

Case Two	Activity 1	Activity 2	Activity 3	Activity 4	Total Postings
Initiating	10	8	5	5	28
Supporting	40	16	15	13	84
Challenging	22	14	10	9	55
Monitoring	0	3	5	2	10
Summarizing	1	3	1	1	6

Interaction Patterns

Response to a posting (RP) patterns of interaction (level 2) were high in both cases. Reply to a response (RR) patterns (level 3) tended to be lower in occurrence compared to RP patterns. Only in Case 2 did students use level 4 replies. Certain topics seemed to generate higher levels of interactivity, perhaps due to members' orientation and motivation. Also, time to complete an activity or discussion affected the interaction patterns with a positive relationship between level of interaction and time. In Case 2, the levels of replies to replies were further developed than in Case 1. Case 2 was the course in which some initial training occurred for students in how to use the online tools. Data are summarized in Table 2.

Table 2. Patterns of Interaction Generated by Group/Case Online Discussion

Case One	Coding	Activity 1	Activity 2	Activity 3	Activity 4	Total Postings
Initial Posting	IP	32	22	26	83	163
Response to a Post	RP	21	15	18	50	104
Reply to a Response	RR	8	8	9	20	45
Reply to a Reply	RR1	7	2	2	12	23
Reply to a Reply	RR2	3	0	0	7	10
Reply to a Reply	RR3	1	0	0	3	4
Reply to a Reply	RR4	--	--	--	--	--
Reply to a Reply	RR5	--	--	--	--	--
Reply to a Reply	RR6	--	--	--	--	--
Reply to a Reply	RR7	--	--	--	--	--
Reply to a Reply	RR8	--	--	--	--	--

Case Two	Coding	Activity 1	Activity 2	Activity 3	Activity 4	Total Postings
Initial Posting	IP	10	8	5	5	28
Response to a Post	RP	24	11	9	4	48
Reply to a Response	RR	20	9	6	3	38
Reply to a Reply	RR1	13	7	5	2	27
Reply to a Reply	RR2	5	3	3	3	14
Reply to a Reply	RR3	2	1	4	3	10
Reply to a Reply	RR4	1	1	1	2	5
Reply to a Reply	RR5	1	2	0	1	4
Reply to a Reply	RR6	0	2	0	1	3
Reply to a Reply	RR7	0	1	0	3	4
Reply to a Reply	RR8	0	0	0	1	1

Topics of Discussion and Use of E-board Space

In addition to looking at the data by communication patterns and interaction levels, other patterns became apparent during the analysis. The data were sorted into five categories related to the topic or thread of the discussion (administrative, project, feedback, technology, and personal). The topic categories were developed as the analysis was done and different topic areas emerged.

Administrative threads occurred related to postings that students needed to do for the course (requirements or instructions). In Case 1 there were many administrative postings (154) compared to almost none in Case 2 (3). Project topics related to project tasks and their completion. In both cases, the number of postings related to projects was high. Feedback was related to responses made by the instructor or other students on how students were doing with completing their projects or with administration of the e-board. Only students in Case 1 posted feedback comments. Technology comments related to issues with the e-board technology itself. Fourteen such comments appeared in Case 1 and none in Case 2. This might be attributed to initial student training in Case 2. Personal coding occurred with topics not related to the course. While these postings were minimal, the content of the messages seemed important to the community building aspects of the courses. Table 3 summarizes the common threads in the online discussions.

Four common patterns of use of space were observed in both cases: social space, communication space, discussion space, and information sharing space. Social space was used when students used the e-board to share personal messages that contributed to a sense of community. This occurred in both cases, but was minimal. Communication uses included using the space for assignment related interactions, but not content related, for example, students discussing appropriate roles for team members or progress on individual components of the assignment, setting up meetings, and answering questions in order to complete the assignment on time. These uses occurred in both cases. Discussion use was coded when content appropriate interactions occurred directly related to the course assignment, for examp le, students discussing the merits of various points in the case. These interactions facilitated collaboration and assignment completion. These were the primary interactions in the e-board space. Information sharing use included providing facts and data for team members and sharing written products for assembly into a team product. This was the second most prevalent use of the e-board space.

Table 3. Common Thread Across Online Discussions

Case One	Discussion 1	Discussion 2	Discussion 3	Discussion 4
Administrative	21	8	45	80
Project	19	27	9	46
Feedback	26	4	1	26
Technology	6	5	--	14
Personal	--	3	--	9
Total Postings	72	47	55	175

Case 2	Discussion 1	Discussion 2	Discussion 3	Discussion 4
Administrative	--	3	--	--
Project	76	43	33	29
Feedback	--	--	--	--
Technology	--	--	--	--
Personal	--	--	--	1
Total Postings	76	46	33	30

Summary of Findings

It seems that the lower levels of communication patterns (initiating, supporting) were most evident in the online discussions. Students may need to learn new roles and new communication patterns in the online environment to stimulate the higher-level communication patterns (challenging, summarizing, monitoring). Structuring online activities and following sound instructional design principles may lead to more synthesizing (summarizing) and challenging communication patterns.

Initial levels of response or interaction patterns were also more evident in the cases. Students were most likely to respond to an initial posting (level 2), and much less likely to reply to a response (level 3) and not likely at all to reply to a reply (level 4). Thus the interactions appear much less like a discussion, where conversation builds upon previous responses, and more like a question and answer scenario. This was particularly true in Case 1. Perhaps orienting and training students in how to respond in the asynchronous e-board may lead to more complex reply and response patterns.

Administrative and technology comments appeared primarily in the course where no initial student orientation to the technology occurred. The primary topics evident related to the projects, which was appropriate. Communicating about the project guidelines and organizing group activities, discussing content, and sharing information were all achieved in the online environment. Social comments appeared to contribute to the sense of community online.

Suggestions

The following suggestions may lead to enhanced communication patterns in online instructional environments. An increased emphasis on orientation and training of students to operate in the online environment seems warranted. Students should be provided with examples of "good" discussions. Roles might be explicitly defined. Ensuring that students understand the technical aspects of how to post responses may increase the higher levels of responding. Students may also need time to practice using the technology.

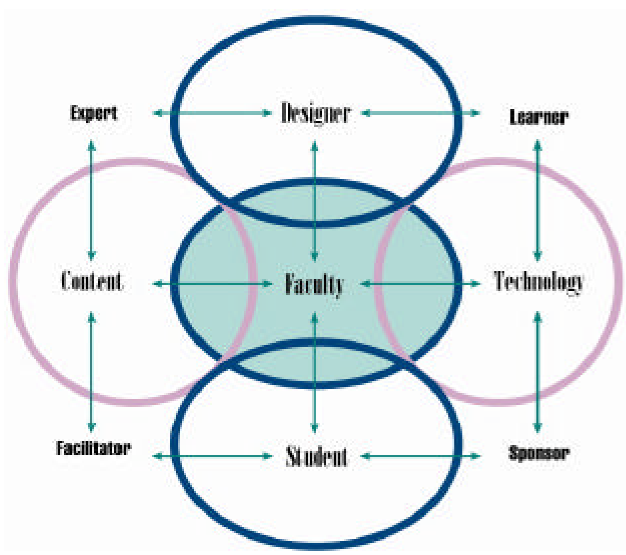
Providing structure seems to enhance the communication patterns. First, instructors should select topics that lend themselves to a discussion format. Students need specific guidelines of engagement that will help them understand the expectations for the discussion. Students should be provided opportunities for both group interactions as well as one-on-one interactions. Students should be encouraged to become reflective practitioners by asking them to include lessons learned from their experiences.

Attending to instructional design principles should enhance the learning environment. Learners should be able to focus on key components of what they are learning. They must be able to connect what they know to what they are learning. They must be active participants in the learning process. And they need feedback on their learning attempts. Use of the asynchronous discussion areas seems particularly appropriate for enhancing active participation in the learning environment.

Insights for Faculty Members

As faculty members integrate technologies such as asynchronous discussion tools into their courses, they may need to adapt to new roles. They must serve as sponsors, experts, learners, and facilitators (SELF). They must become sponsors of the technologies they attempt to integrate into their courses. Sponsors express positive enthusiasm for the tools used to support student learning and provide opportunities for the students to become oriented to the technology. Faculty must create online learning spaces to provide the content expertise. Working with instructional designers and technical support staff, the faculty expert can design an effective learning environment. Third, the faculty member must be open to learning new ways to use technology to support the teaching and learning process. And finally, in this new learning environment, the faculty member must become a facilitator, guiding the discussions and assisting students in acquiring new knowledge. Teaching in an online environment requires a faculty member to engage with the technology, the students, the content, and the instructional design components. This engagement interacts with the faculty roles of sponsor, expert, learner, and facilitator and creates a complex teaching model that might be represented as in Figure 2. How one manages communication so that it enhances learning in this complex model is a task that will challenge faculty to rethink the instructional process.

Figure 2. The SELF Model



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What Effects do Beliefs About Teaching and Learning, and Attitudes About Technology Use have on Level of Technology Implementation for Elementary Teachers in K-5 School Settings?

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Abstract

The purpose of this study was to find if there was a predictive relationship between a classroom teacher's comfort and proficiency with using technology (referred to as attitude) and level of technology implementation; and if there was a predictive relationship between teachers' beliefs and level of technology implementation. The instrument used in this study was the Level of Technology Implementation (Moersch, 2001). The findings show that there was a moderately positive correlation between attitudes and technology implementation and between beliefs and level of technology implementation. A multiple regression of age, years of teaching experience, attitudes and beliefs resulted in attitudes and beliefs being the strongest predictors of higher levels of technology implementation.

Introduction

Researchers have illustrated how computer technologies can be powerful tools that can greatly impact how and what students learn (David, 1994; Dwyer et al., 1991; Dwyer, 1994; Milken Exchange, 1999). Despite the increase of availability of computers, researchers and educators still report that integrating technology into classroom practices is not easily accomplished (Ertmer, 1999; Ertmer et al, 1999; Hadley & Sheingold, 1993; Jones, 2001; Schrum, 1999). Researchers have identified many barriers including teachers' preferred instructional methods and their corresponding beliefs about teaching and learning (Hannafin & Savenye, 1993; Niederhauser & Stoddaart, 2001; Pierson, 2001; OTA, 1995). It is important, therefore, to examine teachers' belief systems and institutionalized instructional routines that support or impede technology use, in order to overcome barriers to successful technology integration. Technology is prevalent in our schools, however, the pressing issue currently centers on how technology is being used or not being used in the teaching and learning process realizing that student achievement may be compromised by poor technology integration practices.

There is little doubt that technology plays an important role in our schools, considering the wide range of computer applications in today's world. Consequently, teachers must be prepared to use computers in their instructional practices and to do so effectively. Research has shown that many elementary teachers still feel uncomfortable using computers (Guha, 2000; Marcinkiewicz, 1993; McDermott & Murray, 2000 Rosen & Weil, 1995; Scheffler & Logan, 1999). Rosen & Weil (1995) investigated technophobia (computer anxiety) and discovered that between one-third and two-thirds of teachers in their study were not using computers at home or with their students because of a lack of confidence. Similar findings were reported by McDermott & Murray (2000), and Guha (2000). In both studies a positive correlation was found between low computer use and low levels of comfort. Schechter (2000) found a strong predictive relationship between higher levels of technology use and comfort, confidence and proficiency with using computers. Attitudes about the value of technology use in education have also been shown to affect levels of technology implementation, for example studies have shown that beliefs and attitudes about the advantages of teaching with technology are significantly correlated with higher levels of technology implementation (Becker, 1994; Lebrutto, 2001). Access is becoming less of a concern (Becker, 1999). It is more important to look at how teachers are learning to implement computers and how they feel about technology use because the teacher is key in the eventual success or lack of success of any computer-in-education initiative (Collis, 1996

The purpose of this study is to examine barriers that affect teachers' effective technology integration in their instructional practices. Two barriers are the primary focus: teachers' beliefs about teaching and learning, and teachers' attitudes towards technology use. Practical implications of the results of this study may provide valuable insight to be considered when planning teacher training (inservice and preservice) and sustaining technology use in meaningful ways that enhance the teaching and learning process.

Literature Review

Beliefs About Teaching and Learning

Any innovation whether in education or in the workplace creates some personal dissonance. It is important, therefore, to examine how teachers' beliefs support or inhibit an innovation (i.e. technology integration) before expecting acceptance and change to occur. Personal belief systems exert a powerful influence on teachers' decision-making and on the instructional practices they use in their classrooms (Niederhauser, D. & Stoddart, T., 2001; Pajares, M.F., 1992). Instructional changes involving innovations (computers) will be filtered through teachers' structure of knowledge and beliefs about teaching and learning. Ertmer (1999) talks about teachers' belief systems in terms of what she calls second-order barriers that interfere with change in teaching practices. She states that teachers may not be aware of their own underlying beliefs about teaching and learning. Thus, it is important to bring about an awareness of what these beliefs are and the underlying values and assumptions that are the foundations of these beliefs. These second order barriers could cause more difficulties because they are less tangible than first order barriers. First order barriers, according to Ertmer (1999), involve a lack of access to hardware and software, as well as a lack of training, time, and support for technology integration. Ertmer suggests that both first-order and second-order barriers be addressed simultaneously and recursively as both types of barriers surface throughout the technology integration process.

Teachers' beliefs are conditioned by how they were taught, and early in the education process, teachers have formed a philosophy of teaching and learning that becomes quite ingrained and resistant to change (Dwyer, D., Ringstaff, C., and Sandholtz J., 1991; McKinney, M., Sexton, T., and Meyerson, M., 1999; Norum, K., Grabinger R.S., and Duffield, J., 1999). Teachers must question these beliefs as they attempt to change teaching practices. For example, technology integration precipitates changes in the learning environment that impacts on teachers' and students' roles in the classroom. It might take some adjusting to the idea that teachers can learn from students who may know more about technology than they do. This new learning environment may cause teachers' a sense of loss of control since the one-way transmission of knowledge model (teacher ? student) may be incompatible with allowing students to be resources in the classroom (Ertmer, P., et al., 1999). Teachers must be ready to reexamine their teacher roles. Resistance to this new role may clearly be connected to teachers' preference and adherence to old patterns of instructional methods (Hannafin, R.D. & Savenye, W.C., 1993; Johnson, 1997), and their belief that responsibility for learning rests with them. If teachers believe that they are to be in charge at all times and the sole dispensers of knowledge, then relinquishing that role will require some shifts in deeply held beliefs.

Niederhauser & Stoddart (2001) found that teachers who hold more traditional beliefs about teaching and learning tend to use more didactic instructional methods (i.e. lecturing) and more teacher-centered practices, while teachers who hold more constructivist beliefs about learning tend to use more student-centered, inquiry based methods. Teachers' beliefs about how learners learn are expressed through their instructional practices. The implication would be that technology integration, then, might be affected by teachers' current instructional practices.

Furthermore, Niederhauser & Stoddart (2001) examined the relationship between teachers' instructional perspectives and beliefs about learning, and their corresponding use of educational software. They classified instructional software into two categories based on the design and purpose of the software: skilled-based software, which embodied a traditional transmission approach to instruction, and open-ended software that embodied a constructivist learner-centered approach. The authors found a consistent relationship between teachers' perspectives about the instructional uses of computers and types of software they used with their students. Teachers who only used open-ended software had a strong learner-centered orientation and weak computer-directed orientation, while teachers who used only skill-based software had the strongest computer-directed and lowest learner-centered orientations. When the authors looked at K-2 teachers and compared them to grades 3-6 teachers, results indicated that K-2 teachers favored the use of skill-based software over open-ended software to a greater degree than the 3-6 grade teachers. Understandably, this could be due to the fact that teachers at the primary grade levels need to emphasize foundational skills in the early grades and the fact that there is wide availability of skill-based software designed for young children.

Honey & Moeller (1990) found that there were certain discernible patterns between teachers' pedagogical beliefs, their instructional practices and the integration of technology into their classroom practices. High-tech teachers employed more progressive educational practices, such as use of inquiry and discovery skills, project-oriented work, group-based activities and hands-on activities. Dirksen and Tharp (2000) evaluated a Goals 2000 project carried out in a rural western school district where participants were being trained to develop skills with a variety of software applications and the integration of technology within the curriculum. They observed that teachers who had their students create presentation products using the internet as a research tool, viewed computers as generative learning tools to be used to help students develop higher-order thinking skills. These teachers were more skilled in using the internet and presentation software from which, the researchers concluded, the students benefited. Those teachers who used computers as a word processing tool, primarily had students type their final products such as reports, stories, and poems. With teachers possessing less skill in computer use and less knowledge of a variety of software applications, students were using the computer as a workbook and using drill and practice computer programs designed to reinforce knowledge and skills introduced by these teachers.

In technology rich environments, the process of learning is transformed to permit more student participation and a focus on students' individual learning styles, according to a study done by McDermott & Murray (2000), conducted in a K-2 building in a Midwest middle class suburban city. These authors felt that teachers' philosophies about how learners learn must be re-evaluated in order to embrace the idea that learners are constructors of knowledge and meaning. In a technology-rich environment, the role of teacher must shift to focus more on the students' active role in learning. For example, the Apple Classroom of Tomorrow (ACOT) project exemplified how teachers' beliefs and practices were changed as teachers realized the benefits of the role shifts not only with students, but also with other teachers with whom they collaborated. The teachers in this project were given access to multiple computers in their classrooms and laptops for personal use. Technology, in other words, was infused into their teaching and learning environment. Teachers in the ACOT project helped one another across content areas and team taught in the context of project-based instruction (Dwyer, D., Ringstaff, C., and Sandholtz J., 1991; Dwyer, 1994). The project seems to hold some promise in changing teachers' beliefs that, in turn, might result in a change in teaching practices to include higher levels of technology integration.

Teachers' beliefs about the efficacy of the role of technology in education also may have an influence on how computers are used in the classroom. Becker (1994) differentiated exemplary computer-using teachers from other teachers and found that exemplary teachers used technology differently and that their goals for computer use were different. Students used computers in "consequential" activities such as creating newsletters, producing a school newspaper or writing for the school yearbook (i.e. authentic tasks). There was a greater use of software for higher order thinking activities such as interpreting data, reasoning, writing, solving real-world problems, and conducting scientific investigations. Less time was spent on recreational activities such as game playing.

In a study conducted by Ertmer et al (1999), there appeared to be a connection between teachers' uses of technology and their beliefs about the role of technology. How teachers used technology was related to what role they believed technology should play in the curriculum. When they interviewed teachers, they found that those teachers who did not value technology as a tool for enhancing learning, used computers as an optional activity. Students were permitted to use computers as a reward after completing "regular" classroom work. These teachers did not see the relevancy of computer use as integral to the curriculum. They felt that once they taught new skills, students could use the computers for drill and practice work to reinforce what was already taught. In this study, however, one teacher did come to change her beliefs about using computers in a way that "drove" her curriculum. She began using computers not only as a support to what she taught, but as an integral part of her teaching.

Teachers' Self-Beliefs (Efficacy) and Attitudes about Technology Use

Teachers beliefs in their ability to positively affect student learning impacts on their willingness to embrace innovative teaching approaches according to McKinney et al. (1999). Teachers must believe that an innovation will enhance student learning before they will be receptive to change and there is evidence that most teachers do see the advantages of technology integration into the curriculum in terms of enhanced student learning and increased motivation (Ertmer, P., 1999; Ertmer, P. et al., 1999). But, teachers have to believe that they are capable of teaching effectively with technology. Honey and Moeller (1990) have shown that teachers who successfully integrated computers into their teaching regarded themselves as learners along with their students and were highly motivated because they expended their own time and effort in learning to use computers. These teachers exhibited confidence in their ability to learn new technology skills. Similar findings were noted in studies conducted by Sheingold and Hadley (1990), Marcinkiewicz (1994), Lumpe and Chambers (2001) and Beaudin (1999). Lumpe & Chambers (2001) found that self-efficacy beliefs (confidence) were a significant predictor of teachers' self-reported use of technology-related engaged learning practices. Similarly, Schechter (200) found a significant correlation between a teacher's comfort and proficiency with using computers and the degree to which he/she employed computers a a process, product and tool to solve authentic curriculum-related problems. In other words, teachers with higher levels of comfort and proficiency tended to implement technology at higher levels of integration. Lack of confidence and/or comfort can be powerful de-motivators to technology implementation and integration. Some teachers may be positively predisposed to using technology, but still exhibit a great deal of technophobia due to bad prior experiences with technology, or, they may simply have a great fear of failure (Rosen, L. and Weil, M., 1995).

It is important that teachers have the opportunity to rethink and analyze their beliefs and values in relationship to technology integration then confront their fear of technology. They must examine their current teaching practices and be prepared to adapt to the changes that technology brings to the classroom.

Clearly changing beliefs takes time and as some researchers have found, it seems to follow a developmental pattern (Johnson, 1997; Pajares, 1992). Pajares (1992) talks about conceptual/belief change in terms of Piaget's two processes of assimilation and accommodation. Assimilation is the process whereby new information is incorporated into existing beliefs and accommodation takes place when new information cannot be assimilated and existing beliefs must be replaced or reorganized. In light of innovations and technology use, for teachers to become adopters of technology use instead of resisters, fundamental changes to their belief system may be required before new ideas become incorporated into a transformed belief system. McKinney et al. (1999) talked about the change process, which they believed occurred in a sequential manner. They believed that there were three stages of innovation: initiation, implementation, and refinement. The authors' theoretical model suggests that participants involved in an innovation move through these stages expressing different sets of concerns. The stages of concern coincide with the stages of innovation ranging from little concern or involvement with the innovation at the outset. With more involvement, concerns seem to be centered on desires to know more about the innovation along with the availability of training or support for the innovation. This, in turn, leads to concerns about practices involved with implementation, then finally, to refinement that involves finding better ways to incorporate the innovation. Throughout these stages, self-efficacy is affected. In the beginning of an innovation, certain sets of concerns tend to be expressed by participants with lower efficacy beliefs while those with higher efficacy have concerns characteristic of the later stages of change, that is, those of impact. Findings from a study conducted by Mills (1999) support the position that teachers' concerns and perceptions of an innovation influence the way in which they implement technology. Teachers' concerns and perceptions must be considered if schools are to experience significant change or reform with respect to integration of computer technology.

Understanding the process of change and feelings (e.g. comfort and confidence) about change in educational settings can help educational reformers, policymakers, and administrators design better training programs to bring about positive change in teacher practices.

Research Questions

1. Is there a predictive relationship between a classroom teacher's comfort and proficiency with using computers and the level of technology implementation?
2. Is there a predictive relationship between teachers' beliefs as reflected in their current instructional practices and level of technology implementation?

Hypotheses

Hypothesis 1: There is a positive correlation between a classroom teacher's comfort and proficiency with using computers (PCU) and the level of technology implementation.

Hypothesis 2: There is a positive correlation between the degree to which a classroom teacher employs student-centered, authentic, problem-solving strategies (CIP) and level of technology implementation.

Definitions

1. Beliefs about teaching and learning refer to teachers' pedagogical beliefs about how children learn. These beliefs have an epistemological component in that teachers' beliefs about the nature of reality form the basis of their orientation to an objectivist or constructivist perspective. Depending on this orientation, knowledge is viewed either as something constructed by learners or transferred intact. This has implications for the learning process, which can be viewed as an active, creative and socially interactive one, or a passive process where learners receive knowledge into supposedly "empty vessels".
2. Attitudes are defined as teachers' feelings of comfort, confidence and proficiency in using technology.
3. Teachers' beliefs about teaching and learning are measured by the Current Instructional Practices (CIP) measure. The CIP profile shows an inclination toward instructional practices consistent with learner-centered approaches and indicators of engaged learning (Means, 1994). These indicators are demonstrated in the following ways:
    a. Children are engaged in authentic, real-world, problem-solving tasks
    b. Children are actively involved in learning activities
    c. Children work collaboratively
    d. Teacher is a facilitator in learning
    e. Children learn through exploration

4. Teachers' attitudes are measured by the Personal Computer Use Profile (PCU), which indicates a classroom teacher's comfort and proficiency levels with using computers.
5. Level of Technology Implementation (LoTi) is a measure of computer use and implementation by a classroom teacher. It consists of eight discrete implementation levels ranging from Non-Use (Level (0) to Refinement (Level 6). As a teacher progresses from one level to the next, a series of changes to the instructional curriculum is observed. The instructional focus shifts to more student-centered practices. Technology implementation is used interchangeably with technology integration.
6. Level of Technology Implementation (LoTi) questionnaire contains 50 items developed by Moersch (1994) that measure three constructs: level of technology implementation, level of computer use, and level of current instructional practice.

Limitations of Study

This study is looking at primarily two variables affecting level of technology implementation, attitudes and beliefs. There are other variables that affect technology implementation besides beliefs and attitudes or several of the demographic variables selected in this study. However, this researcher, in examining the literature on factors influencing computer use, has concluded that teachers' beliefs and attitudes (i.e. internal barriers) seem to be the best predictors of technology implementation.

In addition, this study is examining one school district in Central Pennsylvania and elementary teachers in K-5. Broad generalizations beyond this population cannot be made.

Methodology

Participants

Questionnaires were sent to 84 elementary teachers (K-5) in four elementary schools in a Central Pennsylvania School District. All elementary schools were in a suburban area, which was culturally homogeneous. Forty questionnaires were returned representing a response rate of 48%. 85% were female and 15% were male. A majority (57.5%) of the teachers had more than 20 years of teaching experience and the majority (68%) of the teachers were in the 40-59 age group.

Instrumentation

Instrumentation consists of the Level of Technology Implementation (LoTi) questionnaire. The LoTi questionnaire was developed by Christopher Moersch and Learning Quest, Inc. It measures teachers' levels of technology use at the instructional curriculum level, not their proficiency levels in technology skills. This questionnaire was selected because not only does it measure level of technology implementation, it also builds into the instrument the Personal Computer Use (PCU) subscale which measures teachers' comfort and proficiency using computers referred in this study as attitude. LoTi consists of a beliefs subscale (CIP), which measures teachers' beliefs about teaching and learning as evidenced by their current instructional practices. The purpose of the instrument is to be used to plan and implement staff development. The LoTi questionnaire consists of 50 questions (Moersch, 2001).

Internal reliability of the questionnaire was studied by Schechter (2000) using Cronbach's alpha. The investigator separated the instrument into its three component parts (LoTi, PCU, and CIP), and found fairly high reliabilities ($r = .7427$, $.8148$, and $.7353$, respectively). In addition, individual reliability estimates of individual levels of the LoTi demonstrated high levels of internal consistency on levels 3 ($r = +.7037$), 4B ($r = +.7882$), 6 ($r = +.8235$), PCU ($r = +.8148$), and CIP ($r = +.7535$). The instrument, thus, seems to possess a measure of internal consistency across it parts.

Validity has not been addressed by Moersch, nor has the instrument been validated in research to date. However, the instrument seems to possess face validity and content validity based on an examination of the questionnaire items. For example, test items measuring attitude contained words such as comfort, confidence or referred to the respondents' proficiency in using technology:

"I have the background and confidence to show others how to merge technology with relevant and challenging learning experiences that emphasize higher-order thinking skills and student relevancy to the real world.

Items having to do with beliefs referred to teachers' practices evidencing learner-centeredness:

"I use my students' interests, experiences, and desire to solve authentic and relevant problems when planning a variety of computer-related activities in my classroom."

An addendum to the questionnaire asked for demographic information such as age, gender, years of teaching experience, and grade level taught.

Construct Validity

Construct validity was assessed by having three peers evaluate the instrument by determining which items measured beliefs, attitudes, and technology implementation. This researcher identified 6 items that measured attitudes, 5 that measured beliefs and the other 39 items of the total 50 measured technology implementation. There was little agreement on the items for beliefs and attitudes subscales. Therefore, validity was not established.

Data Analysis

Pearson Product Moment correlations were computed to address the relationships between level of technology implementation and, comfort and proficiency of technology use (PCU), and beliefs about teaching and learning as measured by Current Instructional Practices (CIP). Pearson Product Moment correlations were also computed for two of the demographic variables, age and years of teaching experience. An independent t-test was performed to check for gender differences on level of technology implementation. A one-way ANOVA was conducted to analyze differences among teachers who taught at different grade levels and level of technology integration. Finally, a multiple regression analyzed attitude, beliefs, age and years of teaching experience in relation to level of technology implementation to establish the strongest predictor variables for higher levels of technology implementation.

Results

Research Question 1: Is there a predictive relationship between a classroom teacher's comfort and proficiency (attitude) with using computers and the level of technology implementation?

There was a moderate positive correlation (r=.540) between attitude and level of technology implementation which was significant at the .01 level of significance indicating that the more teachers felt comfortable using technology and the more confidence they expressed in using technology as evidenced by their self-reported proficiency, the higher the level of technology implementation. Teachers' attitudes are a good predictor of higher levels of technology implementation.

Research Question 2: Is there a predictive relationship between teachers' beliefs as reflected in their current instructional practices (CIP) and level of technology implementation?

A moderate positive correlation (r=.524) was found between beliefs and the level of technology implementation, significant at the .01 level of significance indicating that the more teachers were inclined toward learner-centered practices and constructivist principles, the higher the level of technology implementation. Teachers' beliefs are a good predictor of higher levels of technology implementation.

No correlations was found between beliefs and attitudes (r=.276) as expected since both variables measure different constructs.

Age and level of technology implementation showed a slight negative correlation (r=-.017) indicating that older teachers tended to be at lower levels of implementation. When years of teaching experience was correlated with technology implementation, a slight negative correlation (r=-.053) was found indicating that teachers with more years of experience tended to be at lower levels of technology implementation.

No significant difference was found between male female teachers (t=.124, p=.902) with respect to level of technology implementation. With respect to grade level, the analysis of variance revealed significant differences among the grade levels (f=5.927), significant at the .01 level of significance (Table 1). These results show that teachers in various grade level categories (i.e. K-2; 3-5; K-5) differed significantly on levels of technology implementation.

Table 1. Comparison of Levels of Implementation Scores for 3 grade Level Categories

Grade Level Group	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	6.118.242	2	3059.121	5.927	.006**
Within Groups	19098.158	37	516.166		
Total	25216.400	39			

** Significant for between groups at <.001 level of significance

A post hoc test, Scheffe, was conducted in order to determine where the significant differences occurred. Table 2 shows significant differences between group 2 (Grades 3-5) and group 3 (K-5), and group 1 (K-2) and group 3 (K-5), significant at the .05 level of significance.

Table 2. Scheffe Post Hoc Test on ANOVA for Level of Technology Implementation

(I) GRLEVEL	(J) GRLEVEL	Mean Diff. (I-J)	Std. Error	Sig.
1.0	2.00	-23.9722*	7.84923	.016
	3.00	1.5833	10.93603	.990
2.0	1.00	23.9722*	7.84923	.016
	3.00	25.5556	10.76906	.073
3.0	1.00	-1.5833	10.93603	.990
	2.00	-25.556	10.76906	.073

*The mean difference is significant at the .05 level.

Table 3. Means of Grade Level Groups on Levels of Technology Implementation

GRLEVEL	Mean	N	Std. Deviation
1.00	86.7500	16	19.09450
2.00	110.7222	18	25.84298
3.00	85.1667	6	22.30172
Total	97.3000	40	25.42783

Table 3 compares the means of each group and shows that the grade level category 2 (3-5) had a much higher mean than the other two groups indicating that the teachers at this grade category tended to implement technology to a greater extent than the other two groups.

Table 4 displays the results of the stepwise multiple regression for beliefs, attitudes, age, and years of teaching experience on levels of technology implementation. Only the significant ($p<.05$) predictors of higher levels of technology implementation is displayed. Attitude was the best predictor variable ($f=15.642$, $p=<.000$) accounting for approximately 30% of the variance. When the variable of beliefs was added to the equation, almost 45% of the variance was explained. Both variables, in combination, seem to be good predictors of teachers implementing technology at higher levels.

Table 4. Regression Results: Significant predictors of levels of technology implementation

Model	R	R Square	Adj. R Square	Std. Error of The Estimate
1. Attitudes	.540	.292	.273	21.68153
2. Beliefs	.666	.444	.414	19.46916

Discussion

This study adds to the research on factors influencing technology use. It shows that beliefs and attitudes as defined in this study are good predictors of increased technology implementation. Teachers that are comfortable and confident and more proficient in using technology tended to implement technology in their instructional practices to a higher degree than those who were less comfortable, confident and proficient. It also indicated that teachers who believe that learners are active constructors of knowledge, who are more student-centered in their instructional practices and view themselves as facilitators in the learning process, tended to implement technology to a greater extent. Demographic factors such as age, gender and years of teaching experience did not have a significant influence on technology implementation. However with respect to grade level categories, teachers teaching grades 3-5 showed a significantly higher level of implementation than the other two groups (i.e. K-2, K-5). This result indicates that teachers at the higher elementary grades tended to use technology to a greater extent with their students than the others. Further investigation of the K-5 group might reveal that most of these teachers deal with K-3 students and fewer students at the grades 4-5 level, thus making this group more similar in composition to the level 1 group. Most of these teachers taught special education or ESL. It may be reasonable to assume that these teachers are concerned with basic skills much like the K-2 teachers. More analysis would be required to support such assumptions.

This study was limited by the sample size, therefore, these findings cannot be generalized beyond the scope of this particular school district. Further research comparing school districts of similar characteristics might yield interesting corroborative data. Comparisons of dissimilar characteristics would also point to different variables having more power to predict given different contexts and composition of demographics.

Moreover, additional research conducted on teachers' attitudes could explore other factors within attitudes that might prove to be a stronger predictor of technology implementation. For exa mple, the definition of attitudes could include how teachers feel about the importance of technology as a tool in real-world tasks, and how teachers feel about the positive (or negative) effects of technology use on student achievement. Factors within the attitude construct could be explored to find an optimum composition for predicting technology implementation.

If attitudes are important factors in influencing technology use, then finding factors that influence attitudes could also be useful for the purposes of creating the optimum environment to promote attitudes conducive to higher levels of technology implementation. Influencing factors such as prior learning experiences (how teachers were taught), or external factors such as school climate, adminis trative leadership, availability of resources, etc. should be investigated to gauge their influence on attitudes and beliefs. For example, Ross, Hogaboam-Gray and Hannay (1999) found that confidence to implement computer-based instruction was influenced by increased access to technology (resulting in teachers using technology more), administrative support, and stronger beliefs about the value of technology in the classroom. Marcinkiewicz (1994) found that teachers' innovativeness, defined as one's willingness to change, was an important predictor of level of computer use.

In this study beliefs referred to pedagogical beliefs. Beliefs comprise a broader constellation of constructs than that defined in this study. Beliefs can include other factors missing from the predictive model presented here, such as beliefs about one's ability to implement technology (self-efficacy). Self-efficacy influences how people feel, think, and motivate themselves to behave, and refers to beliefs in one's capabilities to execute actions necessary to manage particular situations (Bandura, 1993). Moreover, teachers may have beliefs about the ability of external factors or people to enable a person to reach a goal (e.g. use technology successfully), which may influence whether or not a goal is attained. Also, the belief that the likelihood that a goal can be attained, given a teacher's environment/teaching context, may influence achievement of that goal (Lumpe & Chambers, 2001).

Therefore, a more detailed predictive model can be created taking into consideration the multiple aspects of beliefs and attitudes and the influences that affect these aspects of beliefs and attitudes. Considering many aspects of attitudes and beliefs and the influences affecting these variables can inform better professional development models which is the impetus of this type of research.

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The Development of the Web-Based Training Evaluation Questionnaire

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Abstract

The Web-Based Training Evaluation Questionnaire was developed in order to evaluate a new Web-based instructional product. Currently, few instruments are available for the evaluation of distance learning modules that have established psychometric properties. This paper describes the study that resulted in the successful development of the instrument.

Introduction

The number of courses, certifications, and training opportunities offered on the Internet has increased dramatically over the last few years. Distance education on the World Wide Web is being increasingly implemented in the workplace (Lau, 2000). The number of companies "using the Internet for training purposes grew from 3% in 1996 to 38% in 1999" (American Society for Training and Development, 2001, p. 10). The International Data Corporation estimates the market will reach $11.5 billion in 2003 (Cohen, 2001).

Even though many online courses are offered for education or training purposes, few instruments are currently in use which have the proper established psychometric properties to evaluate modules in the Web-based environment. The Web-Based Training Evaluation Questionnaire (WBTEQ) was developed to assist in the evaluation of a new instructional product that was designed for training future school administrators in the online environment. The researcher hypothesized the instrument would yield a high internal consistency coefficient.

Method

Sample

A pilot study was conducted to establish the validity of the instrument. Five graduate students, who were instructional technology or communication majors and who were enrolled in an advanced instructional technology course in the spring semester of 2002, volunteered to participate in this pilot study. These students were instructed to review the initial version of the instrument and examine each question for its clarity and validity. The instrument was administered to 53 graduate students enrolled in three instructional technology courses taught in the classroom environment in order to establish the instrument's reliability. Then, a follow-up study was conducted by administering the questionnaire to 25 individuals enrolled in a Web-based module pertaining to human resources procedures and employment contracts.

Procedures

For the pilot study, the researcher selected students in the advanced instructional technology course because these individuals had expertise in the online distance education environment. Four of the five students were instructional technology majors. The fifth student majored in communication and was an experienced online course designer.

The researcher chose to administer the survey to 53 graduate students in face-to-face instructional technology courses. After the first data collection phase, the internal consistency reliability was determined using the Cronbach alpha coefficient for the questionnaire and its eight subscales. In the follow-up study, the researcher administered the questionnaire to a sample of 25 teachers and school administrators after they completed a new Web-based training module; 24 participants completed the questionnaire. Once again, the Cronbach alpha coefficient was determined for the total scale and for each of its subscales.

Instrumentation

The WBTEQ has 49 four-point Likert Scale items and 5 open-ended questions. Items on the scale range from 1 to 4: 1, *strongly disagree*; 2, *disagree*; 3, *agree*; and 4, *strongly agree*. The five open-ended questions address trainees' likes and dislikes about the modules, advantages and disadvantages experienced in the online environment, and suggestions or recommendations for improving the module.

Commonly used Likert-type scales have five or seven response sets (Crocker & Algina, 1986; Gall, Borg, & Gall, 1996; Kerlinger & Lee, 2000). Kemp, Morrison, and Ross (1998) advise limiting the number of possible responses on scales to five responses. Others, however, suggest using a 4-point scale in order for participants to avoid selecting neutral responses. This practice eliminates bias and increases the instrument's reliability. The 4-point scale forces participants to select a statement which reflects the direction in which they lean and enables researchers to measure the strengths of their opinions and attitudes (Cronbach, 1946; Pearson & Carey, 1995). Some researchers oppose this method; however, Mercer and Durham (2001) found there was no statistically significant difference between the response style of two groups which were given a scale with and without a neutral response option. Issues addressed on the instrument were based on literature in the field pertaining to the evaluation of online distance education courses. These issues related to access (Belanger & Jordan, 2000; Lau, 2000), communication between parties (Bastiaens & Martens, 2000; Mantyla & Gividen, 1997), instructional content (Biner, 1993; Dean & Ripley, 1998; Kemp et al., 1998; Khan, 1997; Mantyla & Gividen, 1997; Schlough & Bhuripanyo, 1998), instructional design (Aggarwal, 2000; Belanger & Jordan, 2000; Berry, 2000; Harrison, 1999; Schlough & Bhuripanyo, 1998), administrative and technical support (Kemp et al.; Khan, 1997; Mantyla & Gividen, 1997), equipment and technology (Kemp et al.; Khan, 1997; Lau, 2000; Mantyla & Gividen, 1997), learning outcomes (Kirkpatrick, 1996; Mantyla & Gividen, 1997), and general issues such as learner satisfaction, reactions, experiences, and so forth (Khan, 1997; Knowles, 1989; Mantyla & Gividen, 1997; White, 1999; Wideman & Owston, 1999). The revised questionnaire had eight subscales: (a) access, (b) communication, (c) content, (d) design, (e) support, (f) technology, (g) outcomes, and (h) overall.

Data Analysis

Eight questions of the 49 Likert-type scale questions on the questionnaire were negative statements and were recoded prior to the analysis. One case was deleted from the data collected during the pilot study because more than one-third of the data was missing. The other missing data were substituted with the series mean. The data were then analyzed. In the follow-up study, missing data were substituted with the mean, and the data were examined for univariate outliers. Statistical assumptions were examined in order to avoid a violation of the assumptions.

Results

Initially, the instrument had 55 items and 5 open-ended questions. After the pilot study, the instrument was revised to adapt the recommendations made by the participants. Five items on the instrument were identified as redundant. For example, the instrument had questions relating to the attractiveness of the screen design; however, participants felt it was unnecessary to ask trainees if the background color and font color was appealing as well. One question pertaining to graphics having text-based descriptions was deleted because we assumed many school administrators had no previous experience with Web design and, most likely, were not familiar with this term. Several other items were rewritten in order to make the questions more specific and valid.

After the revisions to the questionnaire were completed, the instrument was administered to a sample of 53 graduate students. The reliability was analyzed using the Cronbach alpha coefficient. The instrument's total reliability was high (.95). The subscale reliability for access was .65, for communication .65, for content .90, for design .85, for support .75, for technology .66, for outcomes .76, and for general .79.

The second sample, consisting of teachers and administrators, completed the questionnaire during the follow-up study. Once again, the instrument's overall reliability was high (.97). The reliability of the eight subscales was as follows: (a) access, .94, (b) communication, .65, (c) content, .92, (d) design, .94, (e) support, .54, (f) technology, .89, (g) outcomes, .79, and (h) general, .90.

Discussion

The internal reliability coefficient for the subscale *support* on the WBTEQ was low (.54) in the follow-up study, whereas it was .75 in the pilot study, which may be because the subscale only had three questions, two of which were marked not applicable by 62.5% and 69.6% of respondents in the follow-up study. Only nine and seven respondents, respectively, answered these questions. In order to have a valid reliability analysis completed, a researcher needs at least 20 cases. The reader is therefore advised to disregard the low subscale reliability coefficient in the follow-up study.

It is possible Item 42 on the WBTEQ, "I was anxious to change my methods when I completed the module," might have been an invalid item. During the first instrument administration, one graduate student commented on how the word *anxious* had a negative connotation. The researcher did not change the item because it did not cause any difficulties during the pilot study; however, it may be the reason participants in the follow-up study disagreed with the item. Forty-five percent indicated they were not anxious to change their methods after the completion of the module (M = 2.70). The question was revised to read *excited* after the study was completed.

Conclusion

The results of the reliability of the WBTEQ are promising and show the internal consistency reliability for the instrument and its subscales are acceptable. The researcher hopes others will use this instrument in the future to evaluate online modules and courses to validate the findings of this study. Because the evaluation of online courses is an important issue, we should continue evaluating our courses on a continuous basis. At the very least, courses should be evaluated after participants complete the course. If possible, the completion of a formative evaluation is highly desirable.

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The Affects of an Online Course on Turkish Undergraduate Students' Perceived Computer Self-Efficacy and General Self-Efficacy

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Abstract

This paper is primarily concerned with a study on online student's self-efficacy. The study focuses on differences between Turkish undergraduate students' general self-efficacy levels and computer self-efficacy levels as well as determining the effects of an online course on the students' perceived computer self-efficacy and general self-efficacy levels. This online course was their first experience in online learning. The participants were asked to fill out a generalized self-efficacy scale and a computer user self-efficacy scale prior and posterior to the course. The pretest results have revealed that Turkish students' generalized self-efficacy is higher than their computer self-efficacy scores and there is a significant difference between these scores. The posttest results have also shown the same difference. However no significant effect of online course has been identified.

Introduction

Bandura (1986, p.391) defines self-efficacy as belief about one's own capabilities to organize and execute a certain task. In other words, self-efficacy is about beliefs that are related to the consequences of individuals' actions. An individual's self-efficacy highly depends on prior experiences (success or failure), others' experiences (observing others' success or failure), verbal persuasion (of spouse, friend, etc) or emotional states (anxiety, fear, etc) (Cassidy & Eachus, 2001, p.2).

Cassidy and Eachus (2001) indicate that self- efficacy levels have been shown to be related to choice of task, motivational level and effort and perseverance with the task. Because self-efficacy is based on self perceptions regarding particular behaviors, the construct is considered to be situation specific or domain sensitive. In other words, a person may exhibit high levels of self-efficacy within one domain while exhibiting low levels of self-efficacy within another domain (p.2).

In the literature, there are many studies (e.g. Joo, Bong & Choi, 2000; Pajeres, 1996) about measuring individual's levels of self efficacy within different domains including education and their effects on different variables such as achievement, satisfaction, motivation, etc.

However, few studies that explore the relationships between individual's levels of self-efficacies specifics to different domains have been conducted. For example, no study has been found in the literature that looks for the relationship between students' level of general self-efficacy and their level of computer self-efficacy.

The study summarized in this paper investigates this relationship. That is, it looks at the relationship between Turkish undergraduate students' general self-efficacy levels and their computer self-efficacy levels. It also examines the effects of an online course on the students' general self-efficacy and computer self-efficacy. Therefore the research questions of the study were formulated as:

1. Is there a difference between Turkish undergraduate students' levels of self-efficacy and their levels of computer self-efficacy?
2. What are the effects of an online course on Turkish undergraduate students' levels of self-efficacy and computer self-efficacy?
3. Is there a difference in effects of online course on levels of self-efficacy and levels of computer self-efficacy of the Turkish undergraduate female students and male students?

Method

In order to determine the levels of the students' computer self-efficacy and general self-efficacy, two different scales were combined into one instrument. "The Computer User Self-efficacy Scale" developed by Cassidy and Eachus (2001) was used to measure the students' computer self-efficacy levels. The first part of this scale that consisted of questions related to demographic information about the participants was not used. The second part that is a 30-item Likert scale was used as one the instruments of the study. For the general self-efficacy levels of the students, another scale, “General Perceived Self-Efficacy Scale” developed by Jerusalem and Schwarzer in 1981 has been chosen. The Generalized Self-Efficacy Scale is a 10-item psychometric scale that is designed to assess optimistic self-beliefs to cope with a variety of difficult demands in life (Schwarzer, 1992).

The subjects of this study were the students who voluntarily take the “EIP206 Introduction to Educational Media” course online and participate the study in Anadolu University School of Communication Sciences Educational Communications and Planning Department in Spring 2002. This course was their first experience in online learning. Although 35 students accepted and participated the study at the beginning, only 28 of these students were completed the study.

The pretest was administered at the beginning of the semester and the data derived from this test were analyzed for the first question of the study. Same instrument was used as posttest at the end of the semester and the results were compared with the pretest results for the last two questions of the study.

The reliability of computer self-efficacy scale was found as 0.79 and general perceived self-efficacy scale was as 0.82.

Results

A *t*-test analysis was used to see the difference between general and computer self-efficacy scores of Turkish undergraduate students. Table 1 shows the mean scores of subjects’ levels of general self-efficacy and computer self-efficacy in pretest and the results of the t-test analysis. In addition Table 1 includes mean scores and *t*-test analysis in posttest. The data have revealed that students’ perceived general self-efficacy mean (M=4.69) is higher then their computer self efficacy mean (3.87) and there is a statically significant difference among these scores ($p<.0001$). Same results can be seen in posttest, too. In other words, students’ perceived general self-efficacy mean (M=4.77) is also higher than their computer self-efficacy mean (M=3.63) and there is a significant difference among these two scores ($p<0.0001$) after the online course.

Table 1: Mean scores of all students in pretest and posttest

Tests	**Mean**		**N**	***t***
	General Self-Efficacy	**Computer Self-Efficacy**		
Pretest	4.69	3.87	28	.000**
Posttest	4.77	3.63	28	.000**

*p< .05 **p<.01

In order to see whether there is relation between general self-efficacy and computer self-efficacy scores of students in both tests, a Pearson correlation analysis can be used. Table 2 shows the results of this analysis. According to this analysis there is a significant strong relation (r=0.703, N=28, p<0.000) only between pretest general self-efficacy scores and posttest general self-efficacy scores.

Table 2: Correlation coefficients between in both tests and general self-efficacy and computer self-efficacy

		Pretest Computer Self-Efficacy	Pretest General Self-Efficacy	Posttest Computer Self-Efficacy	Posttest General Self-Efficacy
Pretest Computer Self-Efficacy	Pearson Correlation	1,000	,256	,152	,364
	Sig.(2-tailed)		,189	,441	,057
	N	28	28	28	28

Pretest General Self-Efficacy	Pearson Correlation	,256	1,000	,184	,703**
	Sig. (2-tailed)	,189		,350	,000
	N	28	28	28	28
Posttest Computer Self-Efficacy	Pearson Correlation	,152	,184	1,000	,142
	Sig. (2-tailed)	,441	,350		,472
	N	28	28	28	28
Posttest General Self-Efficacy	Pearson Correlation	,364	,703**	,142	1,000
	Sig. (2-tailed)	,057	,000	,472	
	N	28	28	28	28

** Correlation is significant at the 0.01 level (2-tailed)

On the other hand, another *t*-test analysis is used to investigate the effects of online course on students' general self-efficacy and computer self-efficacy levels. The *t*-test results indicated no significant in general self-efficacy and computer self-efficacy scores between pretest and post test. Table 3 presents the means scores and the results of the t-test analysis.

Table 3: Mean scores of all students in both tests and results of the t-test analysis

Self Efficacy	**Tests**	**Mean**	**SD**	**N**	***t***
General Self-Efficacy	Pretest	4,69	.657	28	.478
	Posttest	4,77	.843		
Computer Self-Efficacy	Pretest	3,87	.510	28	.060
	Posttest	3,63	.511		

*p< .05

In addition, Table 4 illustrates the mean scores of female and male students in both tests and the comparison of these scores. The comparison shows that the mean scores of female students were always lower than that of male student in pretest and posttest. Additionally there was no significant difference between pretest and posttest mean scores either general self-efficacy or computer self-efficacy of female students.

However, the mean score of male students in general self-efficacy scale was showed significant change between pretest and posttest (p< .007).

Table 4: Mean scores of female and male students in both tests and results of the t-test analysis

Tests	**Sex**	**Mean**		**N**	***t***
		Pretest	**Posttest**		
General Self-Efficacy	Female	4,48	4,34	17	.379
	Male	5,01	5,43	11	.007*
Computer Self-Efficacy	Female	3,71	3,51	17	.221
	Male	4,12	3,8	11	.172

*p< .05 **p<.01

Discussion

According to results of this study, it can be drawn that there is significant difference between students' general self-efficacy and computer self-efficacy. These results support the literature. In other words, a person may exhibit high levels of general self-efficacy while exhibiting low levels of computer self-efficacy.

Also, the study demonstrated that the online course caused a few increase in students levels of general self efficacy but it is not statistically significant. Interestingly the students' levels of computer self-efficacy decreased at the end of course. However, it is not significant, too. The instructor of the course indicated that a few technical problems happened during the implementation of the course and the students expressed their discomfort about them. So this might be a cause of this decrease. In addition, this course was their first course. So they might not see the potential of the online learning in this course.

This decrease in computer self-efficacy levels of the students is not sex related and not statistically significant. But, the increase in general self-efficacy is sex related. In other words male students' general self-efficacy scores have shown a significant increase while female students' general self efficacy scores have shown a minor decrease which is not statically significant. This result might be interpreted as that male student hesitate before an experience and show greater self-efficacy after an experience.

More research with a large number of subjects should be conducted to investigate the effects of online learning on students' self-efficacy levels. Also, relations between computer experience, computer ownership and effects of online education on self-efficacy should be examined.

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School districts' web sites: How accessible are they?

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Abstract

Many school districts (SDs) use the World Wide Web (WWW) to disseminate a wide variety of information about things such as district events, policies, and a wide variety of student information. On-line barriers limit the accessibility of the WWW for persons and students with disabilities and thus can limit their access to vital information. The purpose of this study was to evaluate the accessibility of SD home pages in the United States and Canada. A total of 120 SD Web sites were located using a popular online school directory and evaluated for accessibility. A software program was used to quantify the number of accessibility errors at each site. The results indicated that most (74.3%) SD home pages had accessibility problems, and the majority of these problems were severe problems that should be given a high priority for correcting. The good news is that the majority of the errors can easily be corrected. The work reflects a need for SDs to examine the accessibility of their home pages. Recommendations for improving accessibility is provided.

School districts' web sites: How accessible are they?

Since the mid 1990's the World Wide Web (WWW) has become an important way to disseminate information about a wide variety of organizations. These organizations include many educational institutions such as Universities, departments of public instruction, and individual schools. All of these institutions' policies concerning equal access are guided by federal laws such as The Americans with Disabilities Act (ADA). The ADA, enacted in 1990, provides the same civil rights protection to individuals with disabilities as other federal laws that prevent discrimination on the basis 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 like providing ramps to elevated areas and providing accessible signage through height adjustments and raised lettering have become commonplace across the country.

A projected $5.67 billion was spent on technology in America's public schools during the 1999-2000 school year. While 63% of those dollars were spent on hardware, it appears that public schools have shifted their budgets toward software and staff development. More than 46% of schools reported that the majority of their teachers are intermediate level users of technology (able to use a wide variety of computer applications). More than 60% of schools reported that the majority of teachers use the WWW for instructional purposes, and 82% of schools provide WWW access in classrooms.

Fifty-two percent of U.S. homes with children ages 2 – 17 have WWW connections at home, up form just 15% just two years ago. In addition, 20% of students ages 8 – 16 have computers in their bedrooms, with more than half hooked up to the WWW. As the percentage of WWW usage continues to increase both at school and at home so does the need for clearer behavioral guidelines for students. The following is a list of practical steps for school administrators that address student usage of the WWW on school premises and at home.

1. When school administrators review a situation, he/she should first determine whether the fact pattern actually falls within the code of student behavior set at each particular school. Often, the school rules may fall short of covering new situations. Stretching rules to fit new situations is dangerous and risky practice.
2. Before school administrators moves forward with discipline for off-site internet conduct, he/she should put down in writing the connection between off-site conduct and the impact that it has or will have at school. School administrators should always investigate to see if the student violated any discipline code, if so, this might provide a stronger basis for disciplinary action.
3. Compare WWW behavior with its non-WWW behavioral counterpart. For example, if the issue is vulgarity, can a student be held accountable under the behavioral policy set by the school?
4. School administrators should make it clear to all students that your staff monitors the WWW on a

regular basis.

5. School administrators should enlist the aid and support of parents. Parents need to be aware of the schools www policy. Having parents sign a “student WWW code of conduct” at the beginning of each school year will help parents to better understand what the school deems as appropriate and inappropriate.
6. School administrators should have a clear set of procedures that staff should follow if they believe a student has violated the WWW code of conduct. Staff should acquire as much evidence as possible.
7. School administrators may consider lodging a complaint to the WWW/internet service provider. Often the WWW/internet service provider will remove offensive material especially when the material is sexually explicit, personally degrading to target specific individuals, or racially or sexually harassing.

Physical barriers are obvious accessibility concerns confronting students with disabilities. Web site developers need to be just as aware that on-line barriers can create significant accessibility problems for some users. The Americans with Disabilities Act requires that all organizations make reasonable accommodations for individuals with disabilities. Section 508 of the Rehabilitation Act requires that all organizations receiving US Federal funds must comply with standards that make electronic equipment and Web sites usable by people with sight, hearing, and other disabilities. Using the WWW as a resource for distributing information is no exception.

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, modification of keyboards, screen enlargement utilities, voice output utilities, and other technologies allow students 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 things that Web site developers can do, with very little effort, that would make their pages more accessible.

The Trace Research and Development Center at the University of Wisconsin at Madison produced the *Unified Web Site Accessibility Guidelines* (1999). These guidelines were 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, but rather explain how to make multimedia content more accessible to a wider audience.

According to the guidelines, measures for improving accessibility falls into the following categories: (a) structure—HTML documents should use markup to convey meaning and less for format and layout pages; (b) navigation—authors should support keyboard-only navigation and methods to facilitate orientation; and (c) alternative content—authors should always provide alternative ways to access information presented with images, sounds, applets, and scripts. These recommendations have been categorized as Priority 1, 2, and 3 errors. Priority 1 errors involve issues that make it impossible for one or more groups to access information about the Web site. These issues must be addressed to consider the Web site minimally accessible. Priority 2 errors make it difficult for users to access Web site content. Priority 3 errors may be addressed by web developers and make it somewhat difficult for readers to access information in the Webpage. Additionally, the WAI provides specific recommendations and strategies on how to produce Web sites that are in agreement with the guidelines. Examples and models of the appropriate use of HTML tags (i.e., page title, text, lists and outlining, tables, links, objects, images, audio, applet, frames, forms, and scripts) and elements are provided.

The *Web Content Accessibility Guidelines 1.0* (Chisholm & Vanderheiden, 1999a) document is organized around two general themes and 14 guidelines or general principles of accessible design (see Table 1). The themes are (a) ensuring graceful transformation and (b) making content understandable and navigable. The document provides the rationale behind the guidelines and describes some of the users who benefit when they are applied to Web sites. 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.

Table 1. Web Content Accessibility Themes and Guidelines

Theme	Item	Guideline
Ensuring Graceful Transformation	1	Provide equivalent alternatives to auditory and visual content.
	2	Don't rely on color alone
	3	Proper use of markup and style sheets.
	4	Clarify natural language usage
	5	Create tables that transform gracefully
	6	Ensure that pages featuring new technologies transform gracefully
	7	Ensure user control of time-sensitive content changes
	8	Ensure direct accessibility of embedded user interfaces.
	9	Design for device-independence.
	10	Use interim solutions.
Making Content Understandable and Navigable	11	Use W3C technologies and guidelines
	12	Provide context and orientation information
	13	Provide clear navigation mechanisms.
	14	Ensure that documents are clear and simple

The guidelines that primarily address the theme of ensuring graceful transformation, Guidelines 1 through 10, assist Web 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 11 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. Of course the information presented here is an overview of these guidelines and the *Web Content Accessibility Guidelines 1.0* (Chisholm & Vanderheiden, 1999a) document should be consulted for more detail in developing content-accessible Web sites.

Building Web sites that comply with standards for accessibility should be a high priority for Web site developers. To date, little research has documented the extent to which accessibility goals have been reached.

Method

This study examined the accessibility of School District home pages. The purpose of the research described in this article was to: (a) evaluate the accessibility of School District home pages, and (b) direct readers to resources that are available to assist in the development of accessible home pages.

Sampling

A list of URLs for School District Home Pages was generated using the Web 66 (2001) website. This online resource provides a detailed list of school district websites in the United States and Canada as well as around the world. A total of 567 school district Web sites in the United States and Canada were randomly selected from this directory.

Evaluation Process

Each School District's home page was evaluated using *Bobby 3.2* (Center for Applied Special Technology, 2001), a software package that analyzes Web sites in accordance with the W3C Web Accessibility Initiative guidelines. Results from *Bobby 3.2* provide a measure of the extent to which a Web site is accessible for people with disabilities. The type of accessibility error (e.g., images without alternative text, links without alternative text, and pages not usable without frame), the severity of the error (e.g., Priority 1, Priority 2, Priority 3), and the ease with which the error can be fixed (e.g., easy, moderate, hard) are provided in a summary report. In this study only the initial School District home page was evaluated and no links within the domain were evaluated. Scores for each home page were tabulated and analyzed.

There are many accessibility issues that *Bobby 3.2* cannot detect. For example, *Bobby* cannot determine programmatically if the Web site is following accessibility principles, and can only draw the users attention to the potential risks of any technology that is used. The potential errors will be reported in the results, but the researchers did not physically examine the Web site to evaluate these potential errors.

Results

Of the 567 web pages evaluated, 74.3% of the Web site home pages had at least one accessibility error. The means and standard deviations for the accessibility and potential accessibility errors sorted by priority are presented in Table 2. There was an average of .91 Priority 1 accessibility errors on the School District home pages. This indicates significant accessibility issues that can hinder the reader's access to information on the Webpage. Priority 2 and Priority 3 errors averaged 2.33 and 1.64. While these errors are not as severe as Priority 1 errors, they can still affect the degree to which a reader can access a Web site. As seen in Table 3 the most common Priority 1 accessibility problems identified in home pages of School Districts were (a) using alternate ways to convey information represented by color (74%), (b) providing extended descriptions of alternate text (71%), and (c) using structural markup to identify their hierarchy and relationship of two or more header rows or columns in a table (66%). Using alternate ways to convey information represented by color means that information represented or emphasized by specific colors, red for example, should be conveyed in ways that can be recognized by software readers that convert text to speech. If images are used and they convey information then extended descriptions should be used to convey this information. Finally, the relationship of multiple rows and or columns used for table headers should be described so that software readers can correctly relay the relationship of the information among these elements. As will be seen later, many of these problems were rated as easy to fix. Priority 2 errors reported included sufficient contrast between foreground and background colors (81%), lack of descriptive titles to links (78%), and use of movement in images (64%). The most frequent Priority 3 errors reported included no identification the language of the text (96%), lack of keyboard shortcuts to frequently used links (80%), and no logical tab order among page elements (80%).

Table 2. Accessibility Errors Categorized by Priority

	Accessibility Errors				
Severity	**N**	**Minimum**	**Maximum**	**M**	*SD*
Priority 1	567	0	4	.91	.67
Priority 2	567	0	6	2.33	1.57
Priority 3	567	0	3	1.64	.57

Table 3. Type Accessibility Error, Percentage of Homepages with Error, and Ease of Fixing Error

Type of Accessibility Error	Percent	Ease ToFix
Priority One Errors		
If you use color to convey information, make sure the information is also represented another way.	74	Moderate
If an image conveys important information beyond what is its alternative text, provide an extended description.	71	Moderate
If a table has two or more rows or columns that serve as headers, use structural markup to identify their hierarchy and relationship.	66	Moderate
Provide alternative text for all images.	62	Easy
For tables not used for layout (for example, a spreadsheet), identify headers for the table rows and columns.	53	Easy
Priority Two Errors		
Check that the foreground and background colors contrast sufficiently with each other.	81	Easy
Add a descriptive title to links when needed.	78	Easy
Avoid use of deprecated language features if possible.	74	Moderate
Avoid using tables to format text documents in columns unless the table can be linearized.	66	Hard
Avoid using movement in images where possible.	64	Easy
Use relative sizing and positioning (% values) rather than absolute (pixels). 63	Moderate	

Priority Three Errors		
Specify a logical tab order among form controls, links and objects.	80	Moderate
Consider adding keyboard shortcuts to frequently used links.	80	Moderate

Table 3 also indicates that the majority of accessibility errors were rated as easy to fix. Examples of these types of errors include alternate text for images, and specifying the relationship among multiple headers in tables. Some suggested ways to fix these errors include the use of the ALT tag and descriptive text with every image to present textual information about images. A similar technique can be employed to provide descriptive information about links.

Discussion

The Americans with Disabilities Act directs that individuals with disabilities including students and parents being served by School Districts are entitled to the same civil rights protections as their neighbors and peers without disabilities. The law has come to be associated with efforts to make public and private facilities and institutions more accessible for individuals with disabilities. The Internet and World Wide Web have revolutionized access to the resources and services of American businesses, public and private institutions, and other organizations. The accessibility of this information to students with disabilities has not been extensively studied.

School Districts use the WWW to disseminate and gather information. On-line barriers limit the accessibility of the WWW for individuals with disabilities. The purpose of this study was to evaluate the accessibility of School Districts' home pages. 567 Web sites were randomly selected for evaluation. *Bobby 3.2*, a software program, was used to quantify the number of accessibility errors at each site. Most School Districts' home pages had accessibility problems (74.9%). Most of the errors were rated as severe and should be given a high priority. The good news is that the majority of the errors can easily be corrected. The need for School Districts to examine the accessibility of their home pages is evident in the outcomes.

School District Web developers 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 that will help make problems easier to correct and assist developers in avoiding accessibility problems. There are two suggested methods of validating a Web site for accessibility (Chisholm & Vanderheiden, 1999a). First, automatic tools are available for scanning the site and providing data. *Bobby 3.2* 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 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 the seveity of accessibility or usability problems.

One global suggestion for the Web site designer is that all Web pages should be encoded for meaning rather than appearance. For example, providing alternative ways of obtaining information is a key to overcoming many accessibility errors. By using ALT="TEXT" tags on all images, approximately one-third of the errors discovered in this study would be fixed.

There are many Web sites that provide information and recommendations for accessible Web pages. Below are a few recommendations for evaluating Web sites for accessibility:

1. Web site designers should follow the accessibility guidelines. There are several sites on the WWW that give recommendations.
2. Each Web page should be tested for accessibility. Several different procedures should be used: (a) view each page on monochrome screen or use high contrast option of control panel; (b) turn off graphics and view page for readability or use Lynx to view the page; (c) select only text, print to clipboard, and view for readability; (d) navigate using only the keyboard; and (e) use Bobby or other Web evaluation software to test the Web pages.
3. Web site designers should provide a "text only" version of the CE's Web site. This can be done using cascading style sheets so that updates can be accomplished more easily. Providing a text only version of a Web site also provides users with slow internet connections with a relatively fast method of accessing an institution's Web site.
4. Web site designers should provide the reader with alternative methods for obtaining information about the CE Program. Providing a phone number, email, or mailing address can do this. This information should be displayed in a prominent place on the CE's Web site.

Page authors should not produce "handicapped products" to make Web sites accessible. Every effort should be made to keep all Web sites in the mainstream and provide elements that allow universal access. Accessibility guidelines are not designed to stifle the creative freedom of Web site designers; however, extra thought and effort is required in designing accessible Web sites.

Currently, several tools and standards are being developed to help Web developers in these efforts. In Microsoft Corporation (2001) has recently announced its plans to help developers using FrontPage, a popular web development tool, to make their websites conform to the latest US federal guidelines. The World Wide Web consortium has also announced guidelines for software tools to help persons with disabilities access a variety of multimedia content (World Wide Web Consortium, 2001a). Finally, at the time of this writing, the World Wide Web consortium is working on the second version of Web Accessibility Standards (World Wide Web Consortium, 2001b). These new standards will not only help authors create accessible Web sites but will also improve accessibility of the web for persons with disabilities.

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An Assessment of Students' Preexisting Computer Skills and Attitudes Toward Internet-Delivered Instruction

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Abstract

Research examining the rapid expansion of Internet-delivered instruction has by and large reflected rather than driven instructional design. Those interested in maximizing student learning and motivation have a limited research foundation upon which to base instructional strategies. This study examined students' computer skills, attitudes toward Internet-delivered instruction, and the instructional components students' considered important in an Internet course as a function of demographics, prior computer skills and Internet-delivered course experience. Results suggest that student attitudes toward Internet-delivered instruction are fairly positive, with students having Internet-based course experience more likely to recommend taking an online course. However, overall student computer skill levels prerequisite to successful participation in online instruction lack depth. Recommendations for the design of Internet courses and future research are discussed.

Introduction

Internet-based information and communication technologies are increasingly being used for delivery or support of university courses (Hanna, 1998; Johnson, 1999; Mitra, 2000; National Center for Education Statistics, 1998; Volery, 2001). Such uses span a wide range from providing online support for traditional, classroom-based courses through the posting of syllabi, lecture notes or readings on the World Wide Web to Internet-based delivery of entire courses incorporating minimal or no face-to-face contact. Much of the research examining this trend has focused on student achievement (Windschitl, 1998; Swan, Shea, Fredericksen, Pickett, Pelz & Maher, 2000), descriptions of technology issues (Windschitl, 1998; McIsaac & Gunawardina, 1996), or potential cost savings (Inglis, 1999). Missing from the published research is significant consideration of learner characteristics on the design of Internet-delivered courses.

As learners' pre-existing skills, characteristics and attitudes relevant to instructional delivery and design can impact their success within an instructional program (Dick & Carey, 1996; Kemp, Morrison & Ross, 1998; Duggan, Hess, Morgan, Kim & Wilson, 1999), learner analysis constitutes a basic component in most instructional design models. Learner analysis components important as a foundation to the design of Internet-delivered instruction include learners' technological skills as well as their attitudes toward, and perceptions of, Internet-delivered instruction. Limited studies have addressed these issues (Duggan et al., 1999; Hara & Kling, 1999; Jiang & Ting, 1998), yet ignoring learner characteristics can reduce the effectiveness of Internet-delivered courses (Wagner, 1993).

Despite limited research examining learner analysis relevant to Internet delivery of instruction, instructional designers may find the extensive body of research investigating computer anxiety and attitudes towards technology applicable. Instruments developed to measure computer anxiety include Loyd and Gressard's Computer Anxiety Scale (CAS) which has been widely used for adults and extensively analyzed by psychometricians for validity and reliability (Loyd & Gressard, 1984) and Delcourt and Kinzie's Attitudes Toward Computer Technologies (ACT) (Delcourt & Kinzie, 1993). Koroghlanian and Brinkerhoff (2000-2001) modified items from the CAS and ATC instruments to gather information regarding learners' attitudes towards and perceptions of Internet-delivered courses as a means for informing the design of successful Internet-delivered courses. The present study extends the previous work of Koroghlanian and Brinkerhoff (2000-2001) by addressing limitations in the earlier survey which included the limited geographic distribution of participants as well as the low number of participants with previous Internet-delivered instructional experience.

This study investigated the following research questions:

1. What is the current state of computer experience and skills of students?
2. Do computer experience and skills differ by region?
3. What components do students deem important for an Internet-delivered course? Do these components differ by computer experience, demographics, computer skills or prior Internet-delivered course experience?
4. What are student attitudes towards and perceptions of Internet-delivered courses? Do theses attitudes and perceptions differ by demographics, computer experience, computer skills or prior Internet-delivered course experience?

Method

Participants

Five hundred twelve students from six universities located throughout the United States were the participants in this investigation. Approximately two thirds were women, 44% were education majors, 15% were business majors, 16% were humanities, language or physical education majors and 19% were educational technology, engineering, math, science or computer science majors. Of the 277 participants for which data were available, 66% were undergraduates.

In terms of computer experience, 91% of the participants had used a computer four or more years and 67% used a computer six or more hours per week. In addition, 73% of the participants had taken some sort of computer course during their college careers. Finally, 22% of the participants had prior Internet-delivered course experience.

Data collection extended from November of 2000 to June of 2001. Three hundred forty-one students enrolled in traditionally delivered classes completed a paper-based version of the survey distributed and collected during normally scheduled class time while an additional 42 students completed an online version. Students enrolled in Internet-delivered classes (129) completed the online version of the survey.

Criterion Measures

The single instrument for this investigation was a survey. The survey included five sections: demographics and computer experience, computer skills related to Internet delivery of instruction, attitudes towards and perceptions of Internet-delivered courses, rating of components in a Internet-delivered course, and prior distance education experience. Two forms of the survey were used, a paper based-version and an electronic version. Both versions included identical items with the exception of the demographics section, which included one additional question in the electronic version asking participants to name their college or university.

The demographic section had eight forced choice items covering general information including sex, age, major, years of computer use, hours per week of computer use, and completion of college computer courses.

The computer skills section incorporated 13 Likert type items rated on a 5-point scale from Completely Confident to Not Confidence at All. Participants rated their perceived computer skills for each item covering three broad categories: telecommunications, technical expertise, and Internet browser basics. The Chronbach Alpha reliability for this section of the survey was 0.92.

The attitudes towards Internet-delivered courses section incorporated 19 Likert-type items on a 5-point scale ranging from Strongly Agree to Strongly Disagree. Many of the items were based on items from the CAS (Loyd & Gressard, 1984) and the ACT measure (Kinzie, Delcourt, & Powers, 1994). The Chronbach Alpha reliability for this section was 0.87.

The survey section for rating of components in an Internet-delivered course incorporated seven Likert-type items on a 5-point scale ranging from Extremely Important to Not at all Important. These items were intended to determine which features participants felt were important components to an Internet-delivered course. The Chronbach Alpha reliability for this section was 0.81.

Only subjects with distance education experience completed the final survey section. This section consisted of 12 forced choice items and six Likert-type items on a 5-point scale ranging from Strongly Agree to Strongly Disagree. The 12 forced choice items elicited details about participant's Internet-delivered course experience and included items about the number of courses taken, the inclusion of face-to-face meetings, the type of media used and the reason for taking an Internet-delivered course. The six Likert-type items solicited participants' feelings toward courses delivered via the Internet. The Chronbach Alpha reliability for this section was 0.70.

Finally, all participants were asked, "Would you be willing to take an Internet-delivered course?"

Results

Reported results for this investigation are separated into four sections.

Computer Skills Related to Internet Delivery of Instruction - Means and standard deviations of the responses for the computer skills section of the survey are reported in Table 1. The numbers represent responses on a 5-point Likert scale ranging from 5 (completely confident) to 1 (not confident at all). Responses are separated into three categories: participants with prior Internet-delivered course experience (N = 116), participants with no prior experience (N = 386) and all participants (N = 512).

Participants in general were confident in their skills with regards to email, following links on web pages, and sending and reading attachments. Participants reported less confidence concerning use of FTP programs, creating web pages, and locating and installing plugins (see Table 1).

There were large differences in responses between participants with and without prior Internet-delivered course experience for several items. The largest differences were for following threaded discussions, installing the latest version of a browser, locating and installing plugins, and using an FTP program.

An ANOVA was performed comparing means for the computer skills section of the survey between participants from a large Southwestern university (N = 235) and a large upper Midwestern university (N = 190). Significant differences in perceived computer skills between participants' responses by geographic region were found for 11 of the13 items, however the small eta^2 values ranging from 0.02 to 0.08 suggest that the differences were related more to sample size than any significant difference in computer skills.

Correlations were calculated between computer skills and the demographic factors of age, sex, hours per week of computer use and years of computer use. Of the significant correlations found, only those at or above 0.25 are reported in Table 2. Age and hours per week of computer use were the only results with correlations greater than 0.25, with the largest correlations between hours per week of computer use and opening and printing files with Acrobat, locating and installing plugins, and installing the latest version of a browser.

Table 1. Computer Skills Responses by Prior Internet-Delivered Course Experience

Computer Skills		Internet Course Experience: Prior Experience (n = 116)	Internet Course Experience: No Prior Experience (n = 386)	All Participants (n = 512)
Reading, sending and deleting email messages	**M**	4.70	4.71	4.70
	SD	0.65	0.70	.69
Sending and reading email attachments	**M**	4.55	4.19	4.27
	SD	0.88	1.12	1.08
Subscribing to a listserv, sending a message to the entire listserv and responding to just the person who posted a message to a listserv	**M**	3.76	3.05	3.21
	SD	1.42	1.45	1.47
Following threaded discussions and posting messages on bulletin boards	**M**	3.99	2.80	3.07
	SD	1.38	1.48	1.53
Participating in chat sessions	**M**	4.18	3.40	3.57
	SD	1.22	1.53	1.50
Installing the latest version of a browser such as Internet Explorer or Netscape	**M**	3.82	2.95	3.13
	SD	1.51	1.57	1.60
Locating and installing plugins such as Shockwave, QuickTime or VRML	**M**	3.44	2.51	2.71
	SD	1.65	1.56	1.63
Following links on web pages and returning to the starting point	**M**	4.41	4.42	4.41
	SD	1.11	0.89	0.94
Recognizing clickable objects on web pages	**M**	4.59	4.52	4.54
	SD	0.92	0.84	0.86
Downloading files embedded on web pages	**M**	4.13	3.55	3.67
	SD	1.23	1.40	1.38
Creating web pages with images, links and text	**M**	3.08	2.45	2.58
	SD	1.63	1.44	1.50
Opening and printing files with Acrobat	**M**	3.78	3.00	3.17
	SD	1.58	1.56	1.60
Using an FTP program to upload or download files	**M**	3.18	2.26	2.47

	SD	1.60	1.41	1.50

Note. Responses ranged from 5 (Completely Confident) to 1 (Not Confident at all). Ten participants did not indicate whether they had previous distance education experience.

Attitudes Towards and Perceptions of Internet-Delivered Courses - Means and standard deviations of the responses for the attitudes section of the survey are reported in Table 3. The numbers represent responses on a 5-point Likert scale ranging from 5 (strongly agree) to 1 (strongly disagree). While statements appear in their original form, results for negatively stated items were reverse coded for the purposes of statistical analysis. Results of attitudes towards Internet-delivered courses by prior experience indicate that participants in general were slightly positive towards most items. Two items had large differences in responses between participants with and without prior Internet-delivered course experience. The largest difference was for the item concerning choosing an Internet section of a course, while the second concerned being upset if a required course were only offered over the Internet.

An ANOVA was performed comparing means for the attitudes section of the survey between participants from the Southwest and upper Midwest. Significant differences between participants' responses by geographic region were found for six of the 19 items. Again, small eta^2 values ranging from 0.02 to 0.03 suggest that the differences were related more to sample size than any significant difference in attitudes.

Table 2. Correlations of Demographic Data with Computer Skills

	Hours Per Week of Computer Use		Age	
Computer Skills	Correlation	p	Correlation	p
Reading, sending and deleting email messages	NA	NS	NA	NS
Sending and reading email attachments	0.313	< 0.001	NA	NS
Subscribing to a listserv	0.314	< 0.001	NA	NS
Following threaded discussions	0.388	< 0.001	0.278	< 0.001
Participating in chat sessions	0.341	< 0.001	NA	NS
Installing the latest version of a browser	0.441	< 0.001	0.280	< 0.001
Locating and installing plugins	0.458	< 0.001	0.286	< 0.001
Following links on web pages	0.249	< 0.001	NA	NS
Recognizing clickable objects	0.235	< 0.001	NA	NS
Downloading files embedded on web pages	0.410	< 0.001	NA	NS
Creating web pages	0.404	< 0.001	0.277	< 0.001
Opening and printing files with Acrobat	0.466	< 0.001	0.245	< 0.001
Using an FTP program	0.412	< 0.001	0.331	< 0.001

Note. NA = Non-applicable, correlation was less than 0.25. NS = Non-significant result.

Correlations between demographic data and attitudes were calculated and revealed numerous significant correlations, with those greater than 0.25 reported in Table 4. Most of these correlations were between hours per week of computer use and attitudes and between age and attitudes. The largest correlations for hours per week of computer use were for: (1) doing well with computers, (2) convenience of taking Internet courses, and (3) having access to Internet courses. The largest correlations for age were for: (1) the impersonal nature of Internet courses, (2) convenience of taking Internet courses, and (3) feeling upset with required Internet courses. Several significant correlations were found between years of computer use and attitudes, however only one was greater than .25: doing well in an Internet course.

Rating of Components in an Internet-Delivered Course - Means and standard deviations of the responses for the rating of components section of the survey are reported in Table 5. The numbers represent responses on a 5-point

Likert scale ranging from 5 (extremely important) to 1 (not at all important). Overall, participants felt that email communication with the instructor, telephone technical support and instructions for installing and configuring software represented the most important components in an Internet-delivered course. Participants felt the least important component was a weekly online chat time. Participants with and without prior experience rated the components quite similarly. The largest differences concerned having a weekly chat time (M = 3.33 for prior experience, M = 3.99 for no prior experience) and having an initial face-to-face meeting at the beginning of the course (M = 3.61 for prior experience, M = 4.17 for no prior experience).
An ANOVA performed on each of the items revealed no significant differences for participants by geographic region.

Correlations between demographic data and components were calculated. These correlations were not numerous and small to moderate in magnitude. The largest correlation was between age and having an initial face-to-face meeting, correlation = 0.259.

Prior Internet-Delivered Course Experience - Of the 512 participants in this survey, 116 (23%) had experienced some sort of Internet-delivered course prior to the time of this survey. Table 6 reports the types of media these participants used in their Internet-delivered

Table 3. Attitudes Towards Internet-Delivered Courses by Prior Internet-Delivered Course Experience

Attitudes		Internet Course Experience		
		Prior Experience (n = 116)	No Prior Experience (n = 386)	All Participants (n = 512)
I could do well in an Internet-delivered course	M	4.44	3.89	4.02
	SD	0.94	1.01	1.02
I don't do well with computers*	M	4.43	4.07	4.16
	SD	0.96	1.06	1.04
Taking an Internet-delivered course would be one way to stay current with new technology	M	4.33	3.91	4.00
	SD	0.80	0.96	0.94
Internet-delivered courses are an efficient way to learn	M	3.86	3.32	3.45
	SD	1.13	1.04	1.08
I would be upset if a required course was only offered over the Internet*	M	3.41	2.49	2.70
	SD	1.47	1.28	1.38
I feel at ease using the web	M	4.51	4.31	4.36
	SD	0.92	0.76	0.80
Problems with using technology get in the way of learning from the Internet*	M	2.87	3.05	3.01
	SD	1.32	1.09	1.15
If I had a choice between taking an Internet section or a classroom section of the same course, I would choose the Internet section	M	3.43	2.41	2.64
	SD	1.41	1.17	1.30
If I took a course delivered over the Internet, I would feel isolated*	M	3.44	2.86	3.00
	SD	1.29	1.19	1.23
Internet-delivered courses provide a greater opportunity for interactivity between students and between students and instructor	M	2.54	2.35	2.39
	SD	1.19	1.01	1.06
I feel the Internet is as informative as a teacher	M	2.77	2.60	2.64
	SD	1.23	1.13	1.16
It would be exciting to take a course delivered over the Internet	M	3.80	3.12	3.28
	SD	1.09	1.10	1.13
If I took Internet-delivered courses, it would be a chance to learn about the Internet	M	3.63	3.48	3.51
	SD	1.14	1.02	1.05

I feel that Internet-delivered courses are impersonal*	**M** SD	2.97 1.15	2.31 1.01	2.47 1.08
I don't have access to equipment that would allow me to take an Internet-delivered course*	**M** SD	4.46 0.94	3.92 1.23	4.05 1.19
I dislike using the Internet for educational purposes*	**M** SD	4.28 1.05	3.84 1.06	3.94 1.07
Taking an Internet-delivered course would be a good way to learn	**M** SD	3.91 0.97	3.27 0.97	3.41 1.01
It would be convenient for me to take an Internet-delivered course	**M** SD	4.14 1.09	3.46 1.14	3.62 1.16
I would be anxious about taking an Internet-delivered course*	**M** SD	3.43 1.37	2.85 1.12	2.98 1.20

Note. Responses ranged from 5 (Strongly Agree) to 1 (Strongly Disagree). Ten participants failed to indicate whether they had previous distance education experience. Asterisked items (*) were reverse coded and responses in the table reflect this reverse coding.

Table 4. Correlations of Demographic Data with Attitudes

	Hours Per Week of Computer Use		Age		Years of Computer Use	
Attitudes	Corr.	p	Corr.	p	Corr.	p
I could do well in an Internet-delivered course	0.268	< 0.001	NA	NS	0.263	< 0.001
I don't do well with computers*	0.380	< 0.001	NA	NS	NA	NS
Taking an Internet-delivered course would be one way to stay current with new technology	NA	NS	NA	NS	NA	NS
Internet-delivered courses are an efficient way to learn	NA	NS	0.262	< 0.001	NA	NS
I would be upset if a required course was only offered over the Internet*	0.278	< 0.001	NA	NS	0.267	< 0.001
I feel at ease using the web	NA	NS	NA	NS	NA	NS
Problems with using technology get in the way of learning from the Internet*	NA	NS	NA	NS	NA	NS
If I had a choice between taking an Internet section or a classroom section of the same course, I would choose the Internet section	0.255	< 0.001	0.261	< 0.001	NA	NS
If I took a course delivered over the Internet, I would feel isolated*	NA	NS	NA	NS	NA	NS
Internet-delivered courses provide a greater opportunity for interactivity between students and between students and instructor	NA	NS	NA	NS	NA	NS
I feel the Internet is as informative as a teacher	NA	NS	NA	NS	NA	NS
It would be exciting to take a course delivered over the Internet	0.270	< 0.001	NA	NS	NA	NS
If I took Internet-delivered courses, it would be a chance to learn about the Internet	NA	NS	NA	NS	NA	NS
I feel that Internet-delivered courses are impersonal*	NA	NS	0.314	< 0.001	NA	NS
I don't have access to equipment that would allow me to take an Internet-delivered course*	0.286	< 0.001	NA	NS	NA	NS
I dislike using the Internet for educational purposes*	0.270	< 0.001	NA	NS	NA	NS

Taking an Internet-delivered course would be a good way to learn	NA	NS	NA	NS	NA	NS
It would be convenient for me to take an Internet-delivered course	0.307	< 0.001	0.289	< 0.001	NA	NS
I would be anxious about taking an Internet-delivered course*	NA	NS	NA	NS	NA	NS

Note. Attitudes marked with an * were reverse coded. NA = Non-applicable, correlation was less than 0.25. NS = Non-significant result.

courses. The most common media used were email, web site and electronic bulletin boards; by far the least used medium was MOO/MUD. Furthermore, 46% of the participants reported that the course(s) they took met face-to-face at least once and 81% reported that sufficient technical assistance was available during the course(s).

In responding to why these participants took an Internet-delivered course, 14% cited curiosity, 60% cited convenience, 22% indicated that no comparable course was available locally, 15% indicated the course was required, 30% indicated they were working on an online degree, and 12% cited other reasons. In addition, 81% of these participants felt they had received sufficient technical support, 90% rated their experience as good to excellent and 90% would recommend taking an Internet-delivered course to a friend.

Table 5. Rating of Components by Prior Internet-Delivered Course Experience

Components		Distance Education Experience: Prior Experience (n = 116)	Distance Education Experience: No Prior Experience (n = 386)	All Participants (n = 502)
Step-by-step instructions and guides for using, installing and configuring software are posted on the web site	**M**	**4.16**	**4.28**	**4.25**
	SD	1.18	0.94	1.00
A face-to-face meeting at the beginning of the course to provide orientation to the software, install, configuration and usage; attendance would be optional	**M**	3.61	4.17	4.04
	SD	1.46	1.00	1.14
Telephone technical support for software and hardware problems	**M**	4.23	4.39	4.35
	SD	1.04	0.82	0.87
A scheduled weekly "chat time" when the entire class and instructor are online for discussions and questions	**M**	3.33	3.99	3.84
	SD	1.52	1.13	1.26
Incorporating a listserv or electronic bulletin board to distribute general announcements, conduct discussions and ask questions	**M**	4.25	4.13	4.16
	SD	1.09	0.98	1.01
Email communication with the instructor	**M**	4.76	4.61	4.65
	SD	0.61	0.75	0.72
Email with individual students in the class	**M**	4.22	4.10	4.13
	SD	1.04	0.97	0.99

Note. Responses ranged from 5 (Extremely Important) to 1 (Not at all Important). Ten participants did not indicate whether they had previous distance education experience.

These participants rated various aspects of their Internet-delivered course experience and the results are reported in Table 7. One item concerning isolation was stated negatively and the results were reverse coded for purposes of analysis. Overall responses were fairly positive. Not having to meet at a specific place and time and enjoying working at their own pace were rated the most positively, while the statement concerning local availability was rated lowest.

Finally, all 512 participants were asked, "Would you be willing to take an Internet-delivered course?" Of the 500 participants responding to this question, 394 (79%) said yes. Looking at participants with prior distance education experience, 89% responded yes to this question. The difference between participants with and without prior Internet-delivered course experience was significant, $\underline{F}$ (1, 499) = 7.538, $\underline{p}$ = .006, $\underline{eta^2}$ = .02.

Table 6. Media Components used in Internet-Delivered Courses

Media Components	Used	Not Used
Print	76.6%	15.9%
Email	92.6%	4.6%
Listserv	47.7%	36.4%
Chat Room	53.3%	38.3%
MOO or MUD	9.5%	61.0%
Web Site	87.0%	10.2%
Electronic Bulletin Boards	82.2%	15.0%
PDF files / Acrobat Reader	52.3%	35.5%

Note. N = 107.

Table 7. Internet-Delivered Course Experience

	Mean	Standard Deviation
I appreciated being able to work at my own pace	4.52	0.76
Not having to meet at a specific place and time was convenient	4.60	0.78
I received instruction I couldn't have gotten locally	3.32	1.32
I felt there was enough interaction between students	3.51	1.16
I felt there was enough interaction between students and instructor	3.56	1.26
I felt I was working in isolation*	3.42	1.41

Note. N = 104. Responses ranged from 5 (Strongly Agree) to 1 (Strongly Disagree). The asterisked (*) statement was reverse coded and the results in the table reflect the reverse coding.

Discussion

The purposes of this study were to (1) survey a widely diverse sample of college students' existing computer skills and attitudes towards and perceptions of Internet-delivered courses and (2) use those results to formulate recommendations for the design of Internet-delivered courses.

Computer Skills Related to Internet Delivery of Instruction

Participants in this survey rate themselves as proficient web surfers and users of email and email attachments. They rate themselves as less capable with more technical skills such as installing browsers and plugins, web page creation or use of an FTP program.

Substantial, broadly-based differences in perceived skills between participants with and without Internet-delivered course experience were revealed. In particular, those with prior experience reported greater familiarity with following threaded discussions, installing browsers and associated plugins, and use of FTP programs. These results suggest that increased skill levels result from increased experience, a supposition supported by the correlational data in Table 2 indicating that more hours per week of computer use translate into higher skill levels. Years of computer use also reflect increased experience, and multiple correlations with skills were found but the correlations were lower than those for hours per week of computer use. Correlations between age and computer skills provide additional evidence for supposing that increased skills result from increased experience, as younger participants generally reported higher levels of computer use.

These results suggest that the increasing use of email and web surfing have provided many users with a baseline level of competence, however, intermediate to advanced skills are lacking. The shallow level of computer skills may result in significant challenges for students enrolled in Internet-delivered courses as well as their designers. For example, designers intent on providing more dynamic or interactive learning environments requiring installation of a browser plugin could be inadvertently placing landmines of potential frustration in the path of students. This is supported by results of a survey of 206 online MBA students (Schramm et al., 2000) which found students quickly became frustrated with technology that failed to work or wasn't user friendly. On a more positive note, these results also suggest that the experience of completing Internet-delivered courses supports the acquisition of increased computer skills.

Results comparing students from the Southwest and upper Midwest imply that levels of computer skill are relatively evenly distributed geographically. While statistically significant differences in reported computer skills were found, the effect sizes ranging from .02 to .08 were small. Similarities in reported patterns of computer use also suggest an even distribution of computer skills. ANOVAs comparing both groups' hours per week of computer use and years of computer use revealed significant differences for both but effect sizes of 0.01 and 0.02 respectively. The small effect sizes suggest that any significant differences were more a result of sample size than any meaningful difference in skill levels. This implies that instructional designers are likely to find consistent patterns of computer skills in different geographic regions.

Additionally, both groups reported similar completion rates for computer literacy courses, with 73 percent of Southwest students and 69 percent of upper Midwest students having taken such a course. The shallow skill levels reported by participants suggests that completion of such courses does little to promote skills relevant to successful participation in Internet-delivered instruction.

Attitudes Towards and Perceptions of Internet-Delivered Courses

Overall, participants were neutral to slightly positive towards Internet-delivered instruction. They felt at ease using the Web and agreed that taking an Internet-delivered course would help them stay current with new technology. In contrast, participants were neutral to slightly negative concerning the interactivity of Internet-delivered courses and felt that such courses were impersonal.

Large differences exist between participants with and without prior Internet-delivered course experience concerning the desirability of such courses. Participants without prior distance education experience are much less enthusiastic about choosing an Internet-delivered section of a course, would more likely be upset if such a course were required, and are less likely to view such courses as a good way to learn. These feelings may be based on their greater perception that Internet-delivered courses are impersonal and not particularly convenient. The large differences in attitudes between those with and without prior Internet course experience suggest that participation in such courses contributes toward reducing these negative perceptions.

Results comparing students from the Southwest and upper Midwest suggest that attitudes toward Internet-delivered instruction are largely consistent geographically. Effect sizes ranged from .02 to .03 for all statistically significant differences again suggesting that these differences were related to sample size.

Correlation results indicated that students spending more hours per week working with computers generally held more positive attitudes, while older students were generally more negative. Designers might consider limiting, at least initially, the technical requirements of courses aimed at older learners while providing greater levels of support.

Rating of Components in an Internet-Delivered Course

This part of the survey investigated what components students value in Internet-delivered courses. These findings clearly indicate students value email communication with the instructor. Also receiving high rankings were telephone technical support and step-by-step instructions for installing and configuring software. Receiving a more neutral rating was a weekly scheduled "chat time" for students and instructor.

Responses for those with and without prior Internet-delivered course experience were quite similar for most components, with the largest differences occurring for a weekly "chat time" and meeting face-to-face at the beginning of the course. Those with prior experience placed less value on both these components.
Limited correlations of small magnitude were found for this section of the survey with the exception of a correlation of 0.259 between age and having an initial face-to-face meeting.

Implementation of several components identified by students as desirable could require expenditures of time and money that might exceed those available for the design and delivery of many courses. Failing to meet students' perceived needs in the implementation of Internet-delivered classes might lead to reduced levels of satisfaction and support. Before committing to Internet-delivered instruction, instructors and institutions might consider whether resources are available to provide Internet courses likely to meet students' expectations.

Prior Internet-Delivered Experience

Participants with prior Internet-delivered course experience comprised 22% of respondents. As a group, they were positive toward their online experience, particularly appreciating the convenience and ability to work at their own pace that Internet-delivered instruction provided. Fully 90% would recommend taking an Internet-delivered course to a friend.

Participants with prior Internet-delivered course experience identified email and web sites as the two most common components used in the Internet courses they had completed. As the results for all participants identified use of email and surfing the web as the two computer skills they felt most self-assured about, many students may possess basic skills required of Internet courses. However, electronic bulletin boards represented the next most commonly used component, and results for all participants identified use of bulletin boards as one of the skills about which they felt least secure.

Suggestions for Course Design and Implementation

1. Create a database of user friendly, instructionally sound, frequently revised scaffolds addressing technical issues relevant to Internet-delivered instruction such as browser and plugin installation, setting printers, editing preferences, using Acrobat files, etc. Such scaffolds could be made available to the entire campus through handouts at computer labs or online through university websites. Standardizing and sharing such scaffolds on an institution-wide bases would reduce individual teacher workloads in trying to support their students.
2. Provide technical support seven days a week for extended hours to assist with general hardware and software problems. Unique problems relevant to an individual course would be handled by the faculty.
3. Design Internet-delivered courses to accommodate a wide range of student computer skills to avoid overwhelming low-skill students.
4. Perform a task analysis for each Internet-delivered course to identify prerequisite technical skills and include this information in course descriptions.
5. Accommodate older students by providing an initial face-to-face meeting, limiting initial use of more demanding technologies, and offering more layers of support.
6. If applicable, examine the curricula of your university's computer literacy course to identify missing skills necessary for supporting Internet-delivered instruction. The curricula of the course could be expanded to cover such skills and the course could then be listed as a prerequisite for enrollment in Internet courses. Conversely, the design of Internet courses could be constrained to align with the covered skills.
7. Conduct interviews and/or surveys by neutral parties to determine overall Internet-delivered course satisfaction. Include any students who dropped out of the course.

Suggestions for Future Research

New technologies continually expand the options for design of instruction, while student's computer skills and attitudes change over time. Student surveys should be performed on an on-going bases to ensure a satisfactory match between learners and course design.

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The Library Media Specialist and the Health Educator: Collaborating to Meet Students' Needs

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Introduction

According to Information Power (1998) collaboration between library media specialists and different members of the learning community is key to building partnerships within the school. Of prime importance are those between the media specialist and various teachers. School health education teachers have a natural, largely untapped, alliance with library media specialists. Until now, there has been little discussion of the interdisciplinary relationships between health teachers and library media specialists. There are great opportunities for these tow groups to work closely in planning, implementing and evaluating health lessons, projects and research. The National Health Education Standards focus on the development in students of health literacy: this notion is operationalized through adolescent development of skills in accessing valid health information and services, analyzing the influence of media, culture and technology on health; and advocating for personal, family and community health, among others. Library media specialists, as emphasized in the "Information Literacy Standards for Student Learning" (Information Power, p. 8) are ideally suited to collaboration with health teachers in providing students with resources, technological expertise, and media critiques, as well as advocacy competencies, etc. This paper will address the library media specialist in collaboration with the health educator in terms of providing information and materials to health education students in the K-12 educational environment.

The Library Media Specialists

Information Power (1998), which includes national guidelines for school library media specialists, is prepared by two prominent professional organizations to which many school library media specialists belong: The American Association of School Librarians (AASL) and the Association for Educational Communications and Technology (AECT). A major theme in these guidelines is that of building partnerships for learning. This includes nine information literacy standards for student learning and focuses on creating a community of lifelong learners. The information literacy standards for student learning are divided into three divisions: information literacy, independent learning, and social responsibility. The following table presents these standards with the main indicators for each standard. Highlighted areas show relationship to health education standards.

Information Literacy Standards for Student Learning

Information Literacy Standards	Independent Learning Standards	Social Responsibility Standards
Standard 1: The student who is information literate accesses information efficiently and effectively • recognizes the need for information • recognizes that accurate and comprehensive information is the basis for intelligent decision making • formulates questions based on information needs	Standard 4: The student who is an independent learner is information literate and pursues information related to personal interests. • seeks information related to various dimensions of personal well-being, such as career interests, community involvement, health matters, and recreational pursuits • designs, develops, and evaluates	Standard 7: The student who contributes positively to the learning community and to society is information literate and recognizes the importance of information to a democratic society. • seeks information from diverse sources, contexts, disciplines, and cultures • respects the principle of equitable access to information

• identifies a variety of potential sources of information • develops and uses successful strategies for locating information	information products and solutions related to personal interests	
Standard 2: The student who is information literate evaluates information critically and competently. • determines accuracy, relevance, and comprehensiveness • distinguishes among fact, point of view, and opinion • identifies inaccurate and misleading information • selects information appropriate to the problem or question at hand.	Standard 5: The student who is an independent learner is information literate and appreciates literature and other creative expressions of information. • is a competent and self-motivated reader • derives meaning from information presented creatively in a variety of formats • develops creative products in a variety of formats	Standard 8: The student who contributes positively to the learning community and to society is information literate and practices ethical behavior in regard to information and information technology. • respects the principles of intellectual freedom • respects intellectual property rights • uses information technology responsibly
Standard 3: The student who is information literate uses information accurately and creatively. • Organizes information for practical application • Integrates new information into one's own knowledge • Applies information in critical thinking and problem solving • Produces and communicates information and ideas in appropriate formats	Standard 6: The student who is an independent learner is information literate and strives for excellence in information seeking and knowledge generation. • assesses the quality of the process and products of personal information seeking • devises strategies for revising, improving, and updating self-generated knowledge	Standard 9: The student who contributes positively to the learning community and to society is information literate and participates effectively in groups to pursue and generate information. • shares knowledge and information with others • respects other's ideas and backgrounds and acknowledges their contributions • and through technologies, to design, develop, and evaluate information products and solutions

(Information Power, p. 8-43)

The Health Educators

Health educators and pre-service health majors have been challenged to conceptualize and develop comprehensive school health education programs by following the National Health Education Standards (NHES) -- a conceptual framework adopted through a coalition of professional health associations -- including the American School Health Association, American Public Health Association, and the American Cancer Society. These P-12 standards describe skills necessary for adolescents to become "health literate." Thus, health educators are challenged to design and learn to coordinate school education and service programs across components (health services, health environment, etc.) that maximize the potential for their adolescent health students to acquire skills in accessing appropriate health information and services; analyzing media, culture and technology for their impact on health; and advocating for personal family and community health, among others. Table Two below includes the relevant standards. Highlighted areas show relationship to school library media standards.

National Health Education Standards (K-12).

Students will… 1. Comprehend concepts of health promotion and disease prevention. 2. Demonstrate the ability to ACCESS valid health information & services 3. Practice health-enhancing & health-reducing behaviors 4. Analyze the influence of culture, media, technology & other factors on health. 5. Demonstrate ability to use interpersonal communication skills 6. Demonstrate ability to use goal-setting & decision-making skills 7. Demonstrate ability to advocate for personal, family, & community health

(National Health Education Standards [K-1])

Library Media Specialists and Health Educators in Collaboration

The tables above illustrate commonalities between the disciplines of the library media specialist and the health educator, and point to the ever-increasing necessity to teach young people how to cultivate habits and skills of research, technology integration, and critical analysis. In addition, according to Information Power (1998), the following content area standards as applied to the "Information Literacy Standards for Student Learning" (see Table Three) support collaboration of the library media specialist with the health educator.

Content Area Comparisons Between the School Library Media Standards and Health and Related Education Standards According to Information Power.

Standard No.	Behavioral Studies	Health	Life Skills
Standard # 1	• Understands that people can learn about others in many different ways. (Grades 3-5)	• Knows local, state, federal, and private agencies that protect and/or inform the consumer. (Grades 9-12)	• Asks "how do you know" in appropriate situations. (Grades K-2)
Standard # 2		• Knows how to determine whether various sources from home, school, and the community present valid health information, products, and services. (Grades 9-12) • Knows how to locate and use community health information, products, and	• Analyzes arguments to determine if they are supported by facts from books, articles, and databases. (Grades 3-5) • Uses tables, charts, and graphs in constructing arguments. (Grades 9-12)

		services that provide valid health information. (Grades 6-8)	
Standard # 3		• Knows how to locate and use community health information, products, and services that provide valid health information. (Grades 6-8)	• Uses tables, charts, and graphs in constructing arguments. (Grades 9-12)
Standard # 4		• Knows techniques for seeking help and support through appropriate resources. (Grades 3-6)	• Compares consumer products on the basis of features, performance, durability, and cost and considers personal tradeoffs. (Grades 6-8)
Standard # 5		• none that fit *directly* with health and related education standards	
Standard # 6		• Knows a variety of consumer influences and how those influences affect decisions regarding health resources, products, and services (e.g., media, information from school and family, peer pressure). (Grades 3-5)	• Reformulates a new hypothesis for study after an old hypothesis has been eliminated. (Grades 6-8)
Standard # 7		• none that fit *directly* with health and related education standards	
Standard # 8		• none that fit *directly* with health and related education standards	
Standard # 9		• Knows how refusal, negotiation, and collaboration skills can be used to avoid potentially harmful situations. (Grades 9-12)	• Adjusts tone and content of information to accommodate the likes of others. (Grades K-12)

(Information Power, p. 8-43)

The following charges to the school library media specialist illustrate how these two groups can work together to better support their students' needs:

Working With Health Educators: The School Library Media Specialists' Charge

Collaboration

- establish a good relationship with teachers
- inform teachers of what the media center can do
- Become aware of health literacy skills
- show the connections between information literacy and the content-related objectives *(see above)*
- solicit health teachers' assistance in library media program development
- be flexible in expectations and timing
- work with the health educator to integrate the SLMC (School Library Media Center) into the curriculum
- provide intellectual and physical access to information and ideas
- provide a climate conducive to learning
- Provide ongoing assessment in its work with health education
- Provide funds for obtaining needed curricular materials and support for health education
- Solicit input from health educators regarding materials' selection, purchase, and evaluation
- Provide ongoing staff development to health educators

Leadership

- demonstrate the variety of media center materials and equipment to the health educator/ students
- instruct the health educator/students in how to access and use these materials and equipment
- promote collaborative planning, curriculum development, and collaborative teaching
- support the diverse learning needs of all students
- promote the SMLC program as an essential link to the health education community
- promote flexible and equitable access to information, ideas, and resources for learning
- support intellectual freedom/ intellectual properties
- reflect legal guidelines and professional ethics of all kinds
- Communicate clearly all goals and objectives of the SLM program

Technology

- focus on technology as a *process* rather than as a product
- use technological processes and resources to enhance learning
- collaborate with the health educator to design and develop student experiences that focus on authentic learning, information literacy, and curricular mastery
- integrate the uses of technology for teaching and learning

Conclusion

Never before has there been such an opportunity and demand for School Library Specialists and Health Teachers to work together to promote health and information literacy skills in students. With the near omnipresence of computers and the rapid proliferation of web sites, students are more than ever required to have skills to critically evaluate what they see, read, and hear. Cultural norms are not only perpetuated through media outlets such as radio, television, film, music, billboards, news and magazine articles and ads, but through the constant intermingling of advertising, information, and visual signs and symbols found on the internet. The student has become, more than ever, a consumer whose challenge is to sort through the constant bombardment of images and messages that have often been placed there under no professional or ethical standards. What is taught in the health classroom through traditional media techniques such as teacher- prepared overhead transparences or even the more visually stimulating Power Point slides, are countered during class breaks, out of school and, now, even during class, with thousands more media messages that are infiltrating students' way of thinking about the world and their place in it. The decreasing cost of palm computers will only increase the opportunities for students to have continual access to unfiltered messages about what is hip, trendy, and cool. These trends--promoted through advertising or unchallenged websites and emails-affect students' mental, emotional, social and physical health. It is now incumbent upon students to have the critical skills to sort through those messages that are in their best interests and those that would exploit them for economic or even political gain.

Lest one question the relationship between media messages and physical health, it is not far fetched to consider at least two patterns: the increasing use by students of computers and other technological devices that their time, motivation, and *need* to physically move; and the proliferation of websites and unsolicited email messages about diets and weight control that promote unrealistic and unhealthy body images and the purchase of dangerous diet products and/or techniques.

Mentally, socially and emotionally, there is no question that media communications give students mixed and often damaging messages about what is appropriate to think, feel and do. Fortunately, many students are capable of dismissing unhealthy or risky images and messages, and a lot of older teens have the skills to delineate between those that are presented for entertainment or shock value and those that have validity. For those who don't have those skills, however, the challenge for the l health educator and library specialist is to design programs-school and community-based-that actively involve young people in critically evaluating the culture, the media, and technology itself.

As university-level preparation specialists in the two fields, we recommend that school health and library/media/technology specialists collaborate to accomplish shared goals, as described below.

1. Determine general information sources and technological innovations that impact the health knowledge and skills of children and adolescents. This will involve analyzing the many ways health content-such as found in mental and emotional health, substance use and abuse, and consumer health units, among others- intersect with media influences and technological innovations. For example, in what ways should the study of illicit drugs include valid research data that can provide a context for how it is that illegal substances travel from drug-producing regions to local communities? How does the media portrayal often suicide impact students' attitudes and behaviors regarding this tragic act? What are the ways that innovations such as technological devices, gadgets, hardware and software diffuse to diverse population groups? Are these innovations necessary or only desired?

2. Design strategies to educate students about media and information literacy. This would include teaching children and adolescents techniques for critically analyzing information sources and media sources for the messages, the connotations, and the denotations. In addition, this would involve teaching students skills in using internet applications, such as evaluating web sites; developing appropriate and ethical web quests; and designing multimedia presentations, such as documentaries or docudramas to educate others about cultural and media norms that impact health and well-being.

3. Addressed these educational strategies in a broad-based fashion. That is, determine the extent to which individuals and groups or classes of students can work in school with the Library/Media/Technology specialist in computer applications, internet and data-base searches, media criticism, and multimedia development, among many other activities. In addition, involve students in designing outreach and advocacy programs that will provide students, staff and administrators, parents, teachers, and community members with information, tools, and skills to become savvy and lifelong learners/investigators, socially responsible citizens, and informed consumers.

While the authors strongly recommend that health teachers and LMS' s work across disciplines and school programs to ensure that school personnel are unified in their approach to media/technological literacy, a discussion of such a multi-pronged approach is beyond the scope of this paper. Suffice it to say that the health and information literacy needs of students can begin to be met through coordinated efforts between the school or district LMS and the district health coordinators. Current professional preparation standards indicate that specialists in each field need to be able to determine the health and/or literacy needs of adolescent populations; design appropriate, ethical, and standards-based programs that address these needs; implement such programs in collaboration with other academic and community personnel/ agencies; and continually evaluate the effectiveness of such programs. It is recommended and it is feasible for professionally prepared school health educators and school LMS's to work together to strengthen students' knowledge of and ability to use media and technology appropriately. This can and will have an immense and positive impact on the intellectual, social, emotional, and physical health of our children today.

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The Effectiveness of Simulation in an On-line Networking Course

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Abstract

Simulations are an important part of many traditional classes in Computer Networking. As web-based learning environments grow in popularity the need for simulations has become pronounced. This paper reports on a study to compare the performance of students enrolled in two web-based learning environments, one with a simulation package and the second with graphics and text only. Analysis shows statistically significant improvements in performance in the simulation group compared to the other group.

Introduction

The Computer networking, as defined as the interconnection of computers and computing equipment using either wires or radio waves over small or large geographic areas (White, 2002), has long been regarded as one of the more difficult technology-related subjects to teach. Historically, this type of course was thought to require much hands-on interaction with the instructor and was not viewed as a good candidate for an online course. Due to recent advances in network simulation technologies, this view is being challenged. Newsimulations make complex networking systems easily modeled on desktop computers. The effectiveness of simulations and the challenges of distance learning environments are described next followed by the research design, methods, and results.

Effectiveness of Simulations

Simulations have been an effective tool in learning environments (Lindström et al. (1993) Williamson & Abraham (1995). Simulation research can be divided into three subsets: cognitive studies, attitudinal studies, and retention studies (Dekkers & Donnatti, 1981). Cognitive studies are concerned with the simulation's effect on the cognitive development of the student. Attitudinal simulation studies are concerned with student attitude formation and retention studies are concerned with information retention. This project touched on all three of these areas of simulation research. Comparisons were made of the cognitive development of the two course sections through different networking labs and team problems. Attitudinal development was accessed through a course survey given at the conclusion of the course. Retention was accessed through tests given at specified points in the course.

While computers afford the design of highly interactive open-ended learning environments, such as simulations, decisions about how to design the instruction used in conjunction with the simulation are often made with little understanding of how the user will perceive, process and interpret the resulting feedback that the simulation provides. Tailoring the simulation to the needs and goals of a particular course requires an understanding of the capabilities of the simulation and the ways it introduces and enforces various networking concepts. Research demonstrates that the way information is represented matters greatly in the learning process (Rieber, 1996). However, these studies on the effectiveness of simulations in learning environments compared simulations with traditional classroom instruction. Web-based distance learning courses offer a unique challenge to teaching traditionally hands-on courses like network simulations.

The Challenge of Web-Based Distance Learning Courses

Lack of motivation and low student satisfaction have been cited as factors relating to the high drop-out rate in online education. There are a number of studies indicating that simulations can create considerable motivation in their participants (Brawer, 1982). Until recently only simple simulations, with a low level of complexity, were possible in an online learning environment. The ability of this new online delivery mode for simulation technology has great promise for many types of online courses. A key factor cited in improving student motivation when using simulations in instruction is the relevancy or realism of the simulated environment (Orbach, 1979). Advances in commercially available network simulations have produced products that emulate real-world network operations.

Research Design

The purpose of this research was to compare students' performance on simulation-based courses and static graphic representational teaching of the same course content in an online learning environment.

Participants & Methods

85 freshman and sophomores enrolled in two sections of a new online introductory networking and telecommunications course were compared. One section utilized a network simulation package, created by NetCracker Technologies, Inc., that allows the student to build and send data through different network configurations. The second section used Microsoft Visio, a static network diagramming software package. The two groups were compared and assessed on a variety of levels.

NetCracker Technologies offers a simulation package that allows students to design local area networks (LANs), metropolitan area networks (MANs), and wide area networks (WANs) utilizing a wide variety of networking components. A wide variety of data types may be used to test the functionality of the network design.

Static network diagramming software packages like Microsoft Visio have been used in networking courses for decades to teach networking concepts and develop visual representations of networks.

Description of the Project

An undergraduate level course on Introduction to Networking and Telecommunications, is taught at a national university. The course comprised of online instructional materials and assignments. Most interactions with the instructor were online. The only face-to-face instructor interactions were in the form of team project meetings and team presentations.

One course section consisting of forty-four students was asked to use the network simulation package for all course assignments and the second course section consisting of forty students was asked to use Microsoft Visio for all course assignments. Basic instruction was given on both packages.

Assessment of learning outcomes was conducted using multiple choice tests, project results, and a survey of students. The students completed four individual networking labs and two team problems using their respective software packages. The labs required students to demonstrate knowledge of networking rules and concepts by devising networking solutions to given scenarios. The team projects required students to synthesize factual, procedural, and conceptual knowledge about computer networks in order to solve a complex problem. Mid-term and final exams, consisting of fifty multiple-choice questions, were given to both course sections. The exams focused primarily on factual knowledge. A qualitative course survey was administered to both course sections at the end of the course.

Results

Standard statistical analysis procedures were used to compare differences among the two conditions. Results from ANOVA showed the network simulation condition outperformed their counterparts in the static simulation condition. The mean on the test performance was significantly ($p < .05$) lower for the static simulation condition.

Table 1 shows the descriptive statistics for each measure used in the analysis. The course section that utilized that network simulation software demonstrated, better understanding of networking concepts and better retention of the course information than did the course section the did not use the simulation. Scores on the individual lab assignments were all significantly ($p = .000$) higher for students who were in the network simulation group. Team projects scores were significantly ($p=.001$) higher for the simulation group. Mid-term and final exam

Group Statistics

	condition	N	Mean	Std. Deviation	Std. Error Mean
EXAM 2	simulation	48	96.7292	5.5033	.7943
	visio	37	84.3243	30.9678	5.0911
EXAM 1	simulation	48	92.2917	7.9679	1.1501
	visio	37	82.1622	27.5051	4.5218
LAB 1	simulation	48	26.3750	3.0848	.4453
	visio	37	18.2432	9.5435	1.5689
LAB 2	simulation	48	26.7917	2.6654	.3847
	visio	37	16.9730	11.2262	1.8456
LAB 3	simulation	48	25.5417	3.6899	.5326
	visio	37	16.5676	10.2998	1.6933
LAB 4	simulation	48	28.3542	2.0158	.2910
	visio	37	18.4865	10.7590	1.7688
Project 2	simulation	48	93.5833	2.1020	.3034
	visio	37	80.8108	24.7115	4.0625
Project 1	simulation	48	90.8125	3.2463	.4686

scores were also significantly (p = .008 for final and p = .017 for mid-term) higher for the students that used the simulation.

No students in the course section that used the simulation withdrew from the course due to failing grades while three students in the course section that did not use the simulation withdrew from the course with failing grades.

Students that used the simulation reported that they spent, more time on course assignments than did the students that used Microsoft Visio (3.5 hours vs. 2 hours) and reported that they spent more time on assignments primarily because the simulation allowed them to experiment with different network configurations and verify the functionality of their network designs. Many students reported that they felt that the simulation helped them to understand complex networking concepts because they could actually build and test the different components of a network and try different network configurations. Many of the students that used Microsoft Visio reported that they had no way to verify that their network designs functioned correctly prior to submitting them to the instructor and, as a result, did not experiment with different network configurations.

Implications for Learning Networking

Online learning environments have long been plagued with student motivational problems that have lead to historically high drop-out rates. This project suggests that the use of interactive learning tools, such as simulations, have the potential to increase student motivation and learning in an online learning environment. Simulations offer immediate feedback and allow the learner to explore different alternatives at will. Simulations enable knowledge application through multidimensional problem solving (de Mesquita, 1992). Simulations have been found to significantly improve knowledge transfer (Kozma, 1992, White, 1994). This type of discovery-based learning using simulations has been shown to increase understanding of abstract concepts (Rieber, 1996) and increase student motivation (Brawer, 1982).

The network simulation utilized in this study can be used for a variety of learning objectives targeted at differing levels of learning. The intellectual skills that contribute to challenging classroom learning, as identified by Gagne (1977, 1985), are discrimination, concept learning, and rule utilization. Simulation affords the instructor the opportunity to develop instructional events for all of these levels of learning.

For example, at the factual level, the simulation can be used to identify the parts of a networking system. The package can also be utilized as a type of procedural simulation, described by Riegeluth and Schwartz (1989), and teach network diagramming and documentation procedures. At the conceptual and rule levels, the deep structures made possible by the diagnostic capabilities of the simulation allow for evolving problems that require sequential and interrelated decisions. Therefore, as in real situations, errors may be compounded on top of errors as nonproductive diagnostic and solution procedures are pursued (Berven & Scorfield, 1980).

Suggestions for Further Inquiry

While the use of simulation in education has been studied for decades, its use in an online learning environment has not been widely explored. Most simulation research compares simulations to regular classroom instruction. The instructional goals for which each can be most effective differ and more research needs to be complied on the use of simulation as a supplement to traditional and online instruction. Traditional face-to-face instruction and online instruction can be effective at transmitting items of information while simulations have the potential to develop students' mental models of complex systems and problem solving strategies. Further research on the effectiveness of differing combinations of these instructional methods is needed.

Another area of simulation research that requires additional study is the use of feedback. Schimmel (1983) has identified three types of feedback; confirmation, corrective, and explanatory. The simulation utilized in this study provided only confirmation feedback. Research on the information content of feedback has been inconsistent and has provided little guidance for designing feedback. More research is needed on the effectiveness of different types of feedback in simulation and in online learning environments.

Conclusion

The results reported here suggest that web-based courses on computer networking can utilize simulations very effectively.

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Students' Learning Styles and Collaboration in Project-based Learning of Web Page Development

Li-Ling Chen

Abstract

Project-based learning theorists advocate that learning is promoted when students pursue individual interests, when they build on prior knowledge, and when they engage in hands-on and authentic activity. Although a great deal of literature exists describing ideals such as these, research examining the implementation of these ideals in classrooms is scarce. The purpose of the study is to investigate the effects of collaboration and students' learning style on field dependency while involving in project-based learning activities in designing and developing Web pages. A group of K-12 teachers who registered a graduate course on Web page development were asked voluntarily to serve as participants. Both quantitative (learning style test and Web page projects analysis) and qualitative data (teacher's log of the activities, students' emails, and interview) were collected.

Introduction

During the past few years, teaching learners to develop Web Pages has proliferated in both education and business. There are tremendous numbers of interdisciplinary learners taking Web page development classes. The learners include K-12 students, college/university students, or any adults who are interested in the World Wide Web (WWW). Although there is a huge difference among individual learners, there is one common instructional strategy that has been shared by all of the instructors. That strategy is project-based learning. In other words, almost all learners who teach Web authoring classes are required or recommended to design and develop Web pages.

Project-based learning is an instructional strategy in which students generate projects as part of their learning process. Students assume the role of active learners as they construct their own knowledge and plan and develop their projects. Project-based learning is supported by the constructivist view of learning. Students are provided with real world contexts and problem-solving situation to make learning experience meaningful.

Project-based learning theorists advocate that learning is promoted when students pursue individual interests, when they build on prior knowledge, and when they engage in hands-on and authentic activity. Although a great deal of literature exists describing ideals such as these, research examining the implementation of these ideals in classrooms is scarce.

"The information technologies increase the versatility and value of project-based learning as a curriculum tool. Technology can help create a rich environment for individuals and teams to carry out in-depth projects that draw on multimedia and information resources from throughout the world" (NFIE, 2002).

Learning Web authoring via a project-based approach, especially with collaboration method, provides learners a social interaction opportunity to organize their thoughts and create their own meaningful learning experiences. Since field dependent students are "socially sensitive and interpersonal in orientation" (Witkin & Goodenough, 1979), will they learn better with such instructional approach? It is also interesting to study the impact of such instructional strategies on field independent learners. It is based on the arguments that the researcher proposes studying the influence and interaction between learners' field dependence/ independence and collaboration on their performance in developing Web pages.

Purpose of the Study

The purpose of the study is to investigate the effects of collaboration, individualization, and students' learning style in field dependency while involving in project-based learning activities in designing and developing Web pages. Specific questions include:

1. What influences do collaboration and individualization have on students' learning of Web page development in a project-based learning environment?
2. How does students' learning style, specifically field dependence/independence, affect their learning of Web page development in a project-based learning environment?
3. What is the relationship between instructional strategies of collaboration and individualization and learners' learning styles in field-dependency and field-independency in a project-based learning environment on Web page development?

Project-based Learning

Definition and Theory - According to the project-based learning (PBL) handbook published by Bulk Institution of Education (2002), the defining features of project-based learning include content, conditions, activities, and results. First, contents focus on compelling ideas. “Project Based Learning is worthwhile because it allows teachers and students to focus in depth on central ideas and salient issues.” With project-based learning, problems presented in their full complexity; content can be presented realistically, holistically, rather than in fragments, and investigated in depth.

Second, “conditions encourage social, personal and collaborative skills. Project Based Learning can give students a richer, more "authentic" learning experience than other learning modes because it occurs in a social context where interdependence and cooperation are crucial for getting things done. This context also allows students to prevent and resolve interpersonal conflicts. In a non-threatening, supportive environment, students gain the confidence to develop their individual abilities.” Conditions also “encourage mastery of technological tools. Projects provide an ideal context for learning to use computer technology and graphic arts tools, thus extending students' capabilities and preparing them for the world beyond school. Using technology: expands students' capabilities to display and manipulate information widens students' interests and career options multiplies the ways that individual students can contribute to project work.”

Third, activities are effective, engaging strategies. In project-based learning, “students tackle difficult questions or problems. Investigations provide students opportunities to: learn complex ideas and skills in realistic settings apply skills to a variety of contexts combine skills, by completing "expert" tasks, professional duties, job performance, or real-life demonstrations solve problems.”

Fourth, results mean real world outcomes. For example, students generate complex intellectual products that demonstrate their learning (e.g., models, reports); students participating in their own assessment; students held accountable for choosing how they will demonstrate their competence; and students exhibit growth in frequently neglected areas important for real-world competence: social skills, life skills, self-management skills, and dispositions to learn on one's own. “Results also include certain skills, dispositions, attitudes, and beliefs associated with productive work. Project Based Learning can effectively accomplish goals that are difficult to achieve with other models of instruction.”

PBL and Internet

A great deal of literature (Bartscher, et al., 1995; Cognitive and Technology Group at Vanderbilt, 1992; Gonella, 2000; Land & Greene, 2000; Nicaise & Crane, 1999; Meyer, et al., 1997) has suggested that project-based learning with hypermedia technology such as WWW has great potential to enhance students’ motivation and learning. Its benefits include: motivating students, increasing students’ mental efforts, involvement, interest, planning, and developing students’ higher order thinking skills. On the other hand, there are also many researchers concluded that the instructional effect of project-based learning with the WWW is questionable (Land & Greene, 1999; Wang, et al., 2000; Laffey, et al., 1998; Ward, 1997).

In addition, project-based learning can be conducted collaboratively or individually. It is interesting to find that research examining the impact of collaboration versus individualization in a project-based learning environment on Web authoring is scarce, and research investigating the relationship between learners’ field dependence and collaboration is even scarcer.

Research (Bulk Institute of Education, 2002) also concluded that project-based learning helps students gain self-confidence from their project work, become motivated, self-directed learners in other contexts. “Additional studies of PBL effectiveness have emerged from the staff of the Cognitive and Technology Group at Vanderbilt University (CTGV, 1992). These studies involve video-based stories that introduce complex problems or project ideas to students. Although these studies have demonstrated gains in students' skills and understanding of project content as a result of PBL experience, their greatest value may be in establishing principles and methods to improve the process of PBL.”

PBL and Students’ Learning Styles -Researchers studied the role of student characteristics in project-based learning believes that there is a differential appropriateness or effectiveness of PBL for different kinds of students. Several PBL practitioners concluded that “PBL, because of its various features, is a more effective means of adapting to students' various learning styles or "multiple intelligences" (Gardner, 1991) than is the traditional instructional model (Diehl, et al., 1999).”

A review of literature concluded that only four studies were found that investigated the role of individual differences in Project-Based Learning. Rosenfeld and Rosenfeld (1998) investigated the learning styles of students who were characterized by their teachers as "pleasant surprises" (students who perform poorly in conventional classrooms, but who do well in PBL activities) and "disappointing surprises" (students who performed well in conventional classrooms, but who turned in poor projects or no projects at all)." Their study concluded that "pleasant surprises" students have a better academic achievement for applied, discovery, technical, and confluent processing in a math lesson test, whereas students who were characterized as "disappointing surprises" scored high on the fact-oriented information.

A second study, conducted by Meyer, Turner, and Spencer (1997) investigated the relationship between students' learning style and PBL. They divided a group of fifth- and sixth-grade students into "challenge seekers" versus "challenge avoiders" based on surveys and interviews, and found that "challenge seekers would approach project-based learning with greater interest and mastery focus than would "challenge avoiders."

The third study, conducted by Horan, Lavaroni, and Beldon (1996), compared the behavior of high ability to low ability PBL students in group problem-solving activities, and concluded that "high-ability students engaged in the criterion social participation behaviors more than two and one-half times as frequently as low-ability students in the four classes observed and engaged in critical thinking behaviors almost 50% more frequently. The interesting finding, however, was that lower ability students demonstrated the greatest gain in critical thinking and social participation behaviors, an increase of 446% between two different observations, compared to an increase of 76% for the high-ability students."

The fourth study, by Boaler (1997), investigated mathematics learning in two contrasting schools and found differences between girls and boys in their preferred mode of learning. They found that girls were "more disaffected by traditional instruction than boys and showed lower achievement than a matched sample of girls taught with project-based methods."

The literature review revealed that none of the research has studied students' cognitive learning styles on field dependency and field independency in a project-based learning approach. This is one of the reasons to support the author's study on the issue.

Use of Cooperative and Individualized Learning Strategies for Project-based Learning

Project-based learning can be carried out individually or cooperatively. In other words, teachers can have their students work on a project individually or in small groups. Literature suggests that projects organized by cooperative groups can increase students' motivation (Bartscher, 1995). There are lots of studies on the use of collaborative learning strategy for project-based learning (Peterson & Myer, 1995); however, none of the study was found to investigate the effect of students' characteristics and cooperative learning strategies in a project-based learning environment.

Field-independent and Field-dependent Learners

The impact of learners' cognitive styles, defined as "characteristics modes of perceiving, remembering, thinking, problem solving, decision making" (Messick, 1993, p.3), in teaching and learning has long gained its attention. According to Riding and Cheema (1991, p. 195), a cognitive style is a "fixed characteristic" of an individual that is developmental, static, and stable.

Learners' characteristics and tendencies have been classified into numerous constructs in the literature as part of the cognitive style. Examples of the cognitive styles include auditory learners, visual learners, kinesthetic learners, and so on. Field independent/dependent construct, began in the 1940s with Herman Witkin's research on human perception of the upright (Witkin & Goodenough, 1979; Witkin, Moore, Goodenough, & Cox, 1977) is one of the classification.

Individuals who were able to orient themselves along the true vertical in a room despite confusing physical and visual cues generated by a tilted floor and moveable chair were described as articulated or field independent. Witkin (1979, 1977) defined field independent learners are "individuals who were able to orient themselves along the true vertical in a room despite confusing physical and visual cues generated by a tilted floor and moveable chair were described as articulated." Field dependent learners are "individuals who aligned themselves along a vertical axis relative to the misleading environment." Witkin and Goodenough, in 1981, further indicated that the field-independent learners are "analytic, self-referent, impersonal in orientation", whereas the field-dependent learners are "global, socially sensitive, and interpersonal in orientation."

"Field dependence/independence is generally considered to describe learners along a testable, value neutral, bipolar continuum such that individuals at one end are measured as field independent. Individuals at the opposite end are considered field dependent, and subjects in the middle of the range are characterized as field mixed or field neutral (Hall, 2000)."

Research indicated that "field dependent learners generally perform less well than field independent individuals in most instructional environments" and are generally disadvantaged (Hall, 2000). Field independent learners are also more efficient information processors with better short term memory encoding, better long term recall, and more accurate performance on visual search tasks than field dependent individuals (Davis, 1991).

There are numerous studies exploring the importance of learners' cognitive styles and the role of field dependence/independence in teaching and learning across academic disciplines and at all levels of schooling (Burton, Moore, & Holmes, 1995; Hall, 2000). However, the consequences of cognitive style differences have not been thoroughly pursued by educators in project-based learning environment for Web authoring.

Educational theorists have demonstrated that some instructional strategies are more or less effective for particular individuals depending upon their specific characteristics. Dyer and Osborne's (1996) study offers another example. They concluded that field independent learners learn significantly better with a problem-solving approach than a subject-matter approach.

It is suggested that technology may impact learners more in some situations than it does in others because of the interaction between the task, the learners, and the technology (Kozma, 1991). This view is compatible with Cronbach and Snow's (1977) argument that for some instructional strategies are more or less effective for particular individuals depending upon their specific characteristics.

A review of literature suggested that field-dependent learners were slightly more satisfied with ICN ((Interactive Communications Network) instruction overall, but there was not significant difference between the attitude scores of field-dependent and filed-independent learners toward distance learning (Miller, 1997). Although many researchers (Anderson, 2000; Burton, Moore, & Holmes, 1995; Jonassen & Wang, 1993; Luk Suet Ching, 1998; Weller, Repman, Lan, & Rooze, 1995;) argue that field independent students are more likely to benefit from Web-based learning experiences than field dependent students, their researches focus on students' learning by viewing hypermedia programs, instead of authoring.

Web page developing is a learning and designing process to display associative, possibly nonlinear information built around a network of multimedia materials. It heavily depends on a learner's ability to determine and control selection and non-linear sequence of content; it is composed of user-determined (associative) links which add up to an individual navigational trail.

Literature indicated that "field independents are more likely to have an internal locus of control than field dependents, but field dependents are more likely to be successful self-monitors in a social group" (Leventhal & Sisco, 1996). In educational situations, field dependent learners' tendency to be influenced by their peers is critical as they prefer feedback and social sources of information (Jones, 1993). Field independent learners are more individualistic and rule-oriented and less likely to seek peer input (Jones, 1993). Does the literature imply that field dependent learners will learn better in a cooperative learning environment than field independent learners?

Methods and Procedures

This study examined the effect of collaboration and students' learning style in a project-based learning environment on Web page development. Two graduate courses on Web page development was implemented using a project-based approach and offered in the Summer Quarter of 2002 at the California State University at Hayward. Both of the classes were taught by the same instructor, and the instructor introduced the same hypermedia design principles and Web authoring tool, Macromedia Dreamweaver. As to Web projects, students were required to include at least a navigation mechanism by which learners control the order and flow of information, multiple formats of presenting their materials, and some types of interactivity.

Participants were the students who enrolled in the courses and also taught in K-12 educational environments. There were twenty-eight voluntary participants. Participants were allowed to carry out Web projects individually or collaboratively. If choosing to do the Web projects collaboratively, only two members in each group were allowed. Attitudinal and demographic data were collected through face-to-face interviews or email interviews.

Both quantitative and qualitative data were collected. Quantitative data include students' field dependency from learning style test and their Web project scores from analyzing their Web projects. Specifically, learners' preferred cognitive styles on field dependency or field independency were measured with Group Embedded Figure Test (GEFT), developed by Consulting Psychologists Press, Inc., which is a testing instrument to identify whether a learner is field dependent or field independent. Students' Web projects were evaluated with a multimedia project scoring rubrics, designed and developed by the author to meet its special needs (See attachment). In the rubric, the instructor allocated a score for each category. Therefore, a final score will be attained for each Web project.

Qualitative data was also collected in order to increase the reliability of the quantified Web project data. The researchers collected the instructor's observation and log of students' activities, students' email conversation, and interviewing with students on such learning experiences.

T test was used to compare field dependent learners' performance in developing Web pages with field independent learners, and also used compare learners' performance between collaboration and individual strategies. Collected qualitative data was chucked and analyzed to interpret the impact and interaction of learners' learning styles and collaboration in Web authoring.

Finding

After taking the GEFT, ten out of the twenty-eight volunteers were identified as field independent learners, sixteen out of the twenty-eight were field dependent learners, and two participants were field neutral. For the research purpose, the researcher did not analyze the data collected from the field neutral participants.

Students in the Web authoring classes had choices to design and develop their Web projects individually or with a group of two members. Fourteen participants in the study chose to do their Web authoring projects individually, and twelve participants worked on their projects in groups.

Participants were not aware of their cognitive styles in field dependency or field independency before they chose to do the Web authoring project individually or cooperatively. In the study, among the fourteen participants chose to do the project individually, eight of them are field independent learners and six are field dependent learners. On the other hands, ten out of the twelve participants chose to do the project cooperatively were field dependent learners and only two field independent participants chose to do Web projects individually.

Effects of Cooperative/Individual Learning

It was found that participants who designed and developed their Web projects with a partner had a higher mean score than participants who designed and developed their Web projects individually. Participants who completed their Web projects with a partner received a mean score of 33.67 with a maximum score of 35; however, participants who completed their projects individually had a mean score of 29.57 (see Figure1).

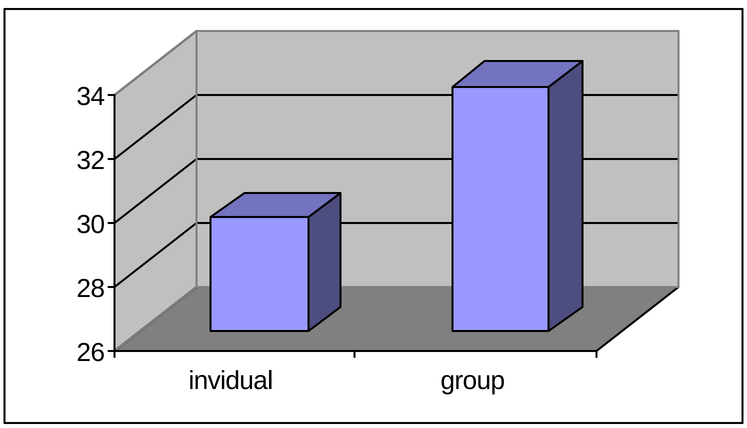

Figure1: Comparison of Mean Scores Between Individual and Group Learning.

Specific group statistics was in Figure 2.

	variable	N	Mean	Std. Deviation	Std. Error Mean
SCORES	Individual	14	29.4286	3.2071	1.2122
	Group	12	33.6667	.5164	.2108

Figure 2: Group Statistics on Individual and Group Learning

The researcher used T-test to analyze the data, and found a significant difference between individual learning and group learning in a project-based learning environment with the alpha at .05 level. Specific data was displayed at Figure 3.

	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
						Lower	Upper
Equal variances assumed	-3.182	11	.009	-4.2381	1.3319	-7.1697	-1.3065
Equal variances not assumed	-3.445	6.361	.013	-4.2381	1.2304	-7.2077	-1.2685

Figure 3: Independent Samples Test on Group/Individual Learning

Effects of Learners' Field Dependence/Independence

The study showed that field dependent learners had a higher mean score than field independent learners when designed and developed Web pages with project-based learning approach. Field dependent learners had a mean score of 32.375 with a maximum score of 35, and field independent learners have a mean score of 30 (see Figure 4).

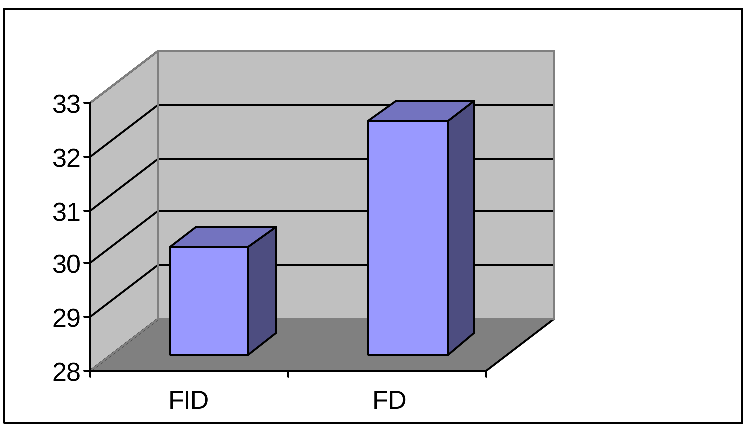

Figure 4: Comparison of Mean Scores Between Field Dependent (FD) and Field Independent (FID) Learners.

Specific group statistical data was in Figure 5.

	Learning Styles	N	Mean	Std. Deviation	Std. Error Mean
Scores	FD	16	32.3750	3.0677	1.0846
	FI	10	29.8000	2.9496	1.3191

Figure 5: Group statistics on FD and FID Learners.

The researcher again applied T-test to investigate whether there was a significant difference between learners' field dependency and field independency in a project-based learning environment on Web authoring. No significant difference was found between group learning and individual learning with the alpha level at .05 (Figure 6).

	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
						Lower	Upper
Equal variances assumed	1.493	11	.164	2.5750	1.7247	-1.2210	6.3710
Equal variances not assumed	1.508	8.910	.166	2.5750	1.7077	-1.2941	6.4441

Figure 6: Independent samples Test on the effects of group learning and individual learning

Interactive Effects of Cooperative Learning and Learners' Learning Styles

To investigate the interaction effects between factors of cooperative learning, individual learning, field dependent learning and field independent learning, the researcher applied Univariate Analysis of Variances. It was found that there was no significant effect between these factors with alpha level at .05. Specific between-subjects effects were in Figure 7.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
LS	1.817	1	1.817	.269	.617
GROUP	34.116	1	34.116	5.050	.051
LS * GROUP	2.243E-02	1	2.243E-02	.003	.955

Figure 7: Tests of Between-Subjects Effects

Discussions

Discussions of the research were based on the three major research questions proposed in the study. First, what influences do collaboration and individualization have on students' learning of Web page development in a project-based learning environment? The study found that learners would have a better academic performance if the collaboration strategy was applied in a project-based learning environment with the learning task on the development of Web pages.

Second, how does students' learning style, specifically field dependence/independence, affect their learning of Web page development in a project-based learning environment? According to the statistical results, there was no significant difference between field dependent learners and field independent learners when learning to design and develop Web pages with a project-based learning approach. However, if comparing the mean scores of both groups of learners, it was found that field dependent learners performed better in developing Web authoring projects than field independent learners. Findings in the study seems contradictory to the literature review which suggested field independent learners are more likely to have an internal locus of control, are more efficient information processors, and usually perform better in academic learning (Davis, 1991; Hall, 2000). In the study, most of the field dependent learners completed their Web authoring projects with a partner. Only two field dependent learners chose to complete their projects individually. However, it is very interesting to find that all of the field independent learners chose to complete their projects individually. Therefore, it was concluded that field dependent learners could learn better with group learning in a project-based learning approach of Web authoring.

Third, what is the relationship between instructional strategies of collaboration and individualization and learners' learning styles in field-dependency and field-independency in a project-based learning environment on Web page development? No relationship was found between these factors; however, it was found that most of the field dependent learners (83%) chose to do the project cooperatively, and only 17% of field-independent participants chose to do the Web project individually. This finding reflected the theoretical assumption suggested by Leventhal and Sisco (1996) that “field dependents are more likely to be successful self-monitors in a social group,” and by Jones (1993) that field dependent learners “prefer feedback and social sources of information.” On the other hand, Jones (1993) also suggested that “field independent learners are more individualistic and rule-oriented and less likely to seek peer input.

Conclusions

Several interesting findings were found in the study. First, field dependent learners tended to choose to do the project cooperatively, and field-independent participants tended to choose to do the Web project individually. Second, field dependent learners performed better in developing Web authoring projects than field independent learners when group learning strategy was used in a project-based learning approach of Web authoring.

In conclusion, the study found that field dependent learners have a better academic performance than field independent learners if they work cooperatively in a project-based learning environment. By understanding the relationship of learners’ field independent/dependent cognitive style, cooperative learning, and project-based learning, teachers can better design an effective instructional environment for their students.

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A Rubric for Evaluating Final Group Multimedia Projects

	Beginning	Developing	**Accomplished**	**Score**
Score	0 - 1 point	2-3 points	4 points	
Content Organization	The contents are not organized, and the reader will get lost.	The contents are partially organized, and the reader sometimes can navigate be themselves; however, sometimes get lost.	The contents are organized, and easy for its readers to go through the project. A site map was provided.	
Interface design	The interface design was not based on any human computer interaction theories. Readers have difficulty understand the information being displayed.	The interface design was based on a few human computer interaction theories. Readers can understand the information being displayed.	The interface design was based on sounded human computer interaction theories. Readers can understand the information being displayed and easy to follow.	
Interactivity	There is no interactivity between users and the project.	There are only low levels of interactivities in the project.	There are high levels of interactivities in the project.	
Resources	Resources provided are not sufficient for students to accomplish the task. OR There are too many resources for learners to look at in a reasonable time.	There is some connection between the resources and the information needed for students to accomplish the task. Some resources don't add anything new.	There is a clear and meaningful connection between all the resources and the information needed for students to accomplish the task. Every resource carries its weight.	
Overall Visual Appeal	There are few or no graphic elements. No variation in layout or typography. Or Color is garish and/or typographic variations are overused and legibility suffers. Background interferes with the readability.	Graphic elements sometimes, but not always, contribute to the understanding of concepts, ideas and relationships. There is some variation in type size, color, and layout.	Appropriate and thematic graphic elements are used to make visual connections that contribute to the understanding of concepts, ideas and relationships. Differences in type size and/or color are used well and consistently.	
Navigation & Flow	Getting through the lesson is confusing and unconventional. Pages can't be found easily and/or the way back isn't clear.	There are a few places where the learner can get lost and not know where to go next.	Navigation is seamless. It is always clear to the learner what all the pieces are and how to get to them.	

Mechanical Aspects	There are more than 5 broken links, misplaced or missing images, badly sized tables, misspellings and/or grammatical errors.	There are some broken links, misplaced or missing images, badly sized tables, misspellings and/or grammatical errors.	No mechanical problems noted.	
Total Score				**/35**

Handheld, Wireless Computers: How They Can Improve Learning and Instruction

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Abstract

This paper explains how handheld, wireless computers were incorporated into the design of an interactive face-to-face classroom instruction and reports the effects of such design (continuous assessment and immediate feedback) on the quality of instruction and student learning in a higher educational institution. The design and development specifications are explained in detail. The evaluation results revealed that providing continuous assessment and immediate feedback using handheld, wireless computers during instruction had a positive effect on students' knowledge of their own learning and attitude toward various forms of assessment and the usage of handheld computers. The result of data analysis also indicated that using handheld computers to continuously assess student learning followed by immediate feedback enhanced the level of class participation and interactions among students and between students and the instructor.

Introduction

Assessment of student learning is a critical component of any instructional system (Bloom, 1984; Gagné, Wager & Briggs, 1992; Gagné, 1985). Research indicates that continuous assessment serves two strongly interrelated purposes: (1) to increase student learning (Crooks, 1988) and meet learning outcomes (Black & Wiliam, 1988; Gibbs 1992; Rowntree 1977; Ramsden 1992), and (2) to increase motivation and interaction (Cornel & Martin, 1997; Crooks, 1988; Moore & Kearsley, 1996). Students learn more in classes that use frequent assessment than in those that do not, and brief, frequent assessments are more effective than infrequent ones (Bangert-Drowns, Kulik, & Kulik, 1988, Dempster, 1991). Knowledge of results is also critical for all learners. As assessment is a vehicle for providing this knowledge, research results also emphasize that frequent and meaningful assessment has a powerful effect on students' overall motivation and learning (e.g., Covington, 1992; Angelo & Cross, 1993; Black & Wiliam, 1998; Mason & Woit, 1999).

Assessment data are also useful in determining and improving the quality of instruction (Pilcher, 2001). A continuous or frequent assessment allows a teacher to confirm students' understanding of the material being introduced, to diagnose learning problems, and to provide remediation before proceeding into the next section. Continuously providing assessments throughout instruction not only offers teachers an opportunity to observe the change and progress of students' performance, but such assessments also help students to consolidate their learning during the process of knowledge construction. Moreover, the feedback that teachers give as a result of continuous assessment provides the scaffolding that allows learners' understanding of how to grow and evolve (Cornel & Martin, 1997; Moore & Kearsley, 1996; Schnorr, & Hazari, 1999).

Electronic technology plays an important role in assessment. Technology can be used for assessment purposes at various levels ranging from managing the assessment information to providing a fully automated assessment system. Researchers who studied the effects of computers on student learning processes claimed that the computer-based assessment system improves the quality of student learning (e.g., Oswald, 1996; Proctor & Donoghue, 1994). It is argued that such an assessment system enables improvements in the quality of learning by ensuring objectives and reproducible assessment of learning outcomes, providing immediate feedback, saving time in monitoring student progress, and freeing up time for teachers to assess the quality of their courses by quantitative analysis of learning outcomes. Until recently, individual students did not have full access to computers during instruction in traditional classroom settings (unless they were in the computer laboratories). Handheld computers, with their low cost and high portability provide great promise for individual student's access to computer technology during instruction and in the traditional classroom settings.

The advancement of handheld computer technology offers various functions and tools, allows students to respond instantly to the instructor's inquiries, permits the instructor to assess students' responses and to offer individualized point-of-need feedback. The handheld computers are also capable of storing and managing assessment data. This capability reduces a great deal of instructors' chores. Through the employment of this technology, an innovative assessment method, such as continuously providing assessments and personalized immediate feedback in order to promote teaching and learning in a traditional classroom, becomes possible.

The purpose of this paper is to explain how handheld, wireless computers were used to design and develop interactive face-to-face instruction and to provide some evidence of the effects of such design (continuous assessment and immediate and delayed feedback) on the quality of instruction and student learning in a higher educational institution. The paper specifically attempts to answer the following questions: How and in what ways can handheld, wireless computers be used to enhance student learning and improve student attitude and motivation?; and How and in what ways the use of handheld, wireless computers influence the design and quality of a face-to-face instruction?

Methodology

A total of 52 students enrolled in one of the three education courses (early childhood, middle school education, special education) participated in this project. All three courses are required courses for undergraduate students seeking a baccalaureate degree in education and teaching licensure. At least one unit from each course was selected to integrate the use of handheld, wireless computers in its design, development, and evaluation. A unit was defined as a minimum of two one-hour and fifteen minutes classes.

Design specifications for each course and unit of instruction

The following common features and design specifications were used for each course and its units of instruction, regardless of contents and targeted learning outcomes:

Continuous assessment strategies - This design feature assumed that assessment, which enhances learning, incorporates activities that are consistent with, and sometimes the same as, the activities used in instruction. Such ongoing assessment, therefore, encourages and supports further learning by documenting development of the knowledge, skills, and dispositions of learners. Continuous assessment of students' thoughts and work not only facilitates their learning but also enhances their confidence in what they understand and can communicate. When done properly, such assessment also helps teachers adjust their instruction. Given the above assumptions, the following design specifications were integrated in each unit.

- Ungraded team activities were built into study materials (e.g., real world problem-solving tasks or cases).
- Short self-assessment quizzes that allow learners to check their own learning at the beginning and/or at the end of the unit were designed. The quizzes were developed using quiz maker software that was available on campus through the WebCT course management system.
- Graded individual assignments that were specific to the content of the unit and assessed students' understanding of the reading materials were also incorporated into the unit. The expectation was that students would submit this assignment using the Internet and handheld computers at the beginning of each unit. Formal and timely feedback was then to be provided by the instructors and peers.

Timely and formative feedback - The second design feature was the use of timely feedback. Research shows that feedback on student performance is a critical part of formative assessment. It is critical to the quality of learning, and can have a very positive effect on the learning process. Feedback for assessment comes in many forms (written/verbal, formal/informal, and group/individual), and various degrees of usefulness. To facilitate learning, it was assumed that feedback should be informative, meaningful and constructive. Students should understand whether or not they have achieved, and to what extent they have achieved, the assessment criteria, and also what further action is required for better performance.

Each unit was then re-designed in a way that students either received automated feedback on their assignments (quizzes, graded individual assignment, ungraded team activities, etc.) or received feedback from the instructors. The WebCT course management system was used to develop interactive tests with a wide array of functions to provide automated feedback. The instructors also provided timely and prompt scaffolding feedback for both individual assignments and team activities.

Immediate feedback and interactive learning environment using Student Response System (SRS) - High levels of interactivity are essential to instructional systems (Moore & Kearsley, 1995; Muirhead, 1999; Zirkin & Sumler, 1995). Meaningful learning occurs only when students actively participate in the learning process. Learner feedback is essential in determining students' needs, in measuring comprehension, in encouraging their interest and participation, and in improving learning. However, even skillful teachers find it difficult to involve all the students in the large group classroom discussion simultaneously. In this study, a Student Response System

(SRS) was used for each unit to allow instructors to ask questions during lectures and large group discussions and to receive immediate responses from all students.

Numina II SRS is a Web-based polling system developed by UNCW Computer Science Department. It uses a combination of wireless networks, handheld computers, and a data projector to allow students to submit their responses to questions posed by the instructor and to immediately display the results of submission using bar graph for quantitative data and text for comments. With this manner, an instructor is able to measure students' comprehension or opinion on a posed question and to provide just-in-time remediation whenever necessary. By using the handheld computers and SRS, students are able to respond to questions without having to raise their hands and risk exposing their lack of understanding, and the instructor can diagnose misconceptions instantly from the submitted responses that are displayed in graphical format for the entire class.

In preparation for the use of this system during the live instruction for each unit, the instructors developed key questions related to the concepts covered in their lecture or large group discussions. The questions then were posed to students during the instructor's lecture or class discussion in order to receive feedback for immediate remediation of instruction and discussion. The nature and the format of the questions differed depending on the content of the unit, expected outcomes, and the instructor's teaching styles.

Implementation Procedure

The instructors and the researchers collaborated in designing and developing the instructional materials for each unit while the instructor for each course was solely responsible for providing the content. The researchers also developed a try-out session in order to train students and familiarize them with the implementation procedure. The try-out session emulated the implementation procedures and trained students in the use of handheld computers for both taking online quizzes and assignments and responding to SRS. All instruction took place in classrooms that had wireless connection to the Internet. A set of handheld PCs (HP Jornada) that came standard with the pocket version of Microsoft Office (Word, Excel, Access, and PowerPoint) and a Web browser and were equipped with wireless network cards was used in both courses. The following procedure summarizes the implementation process.

- Students received notification from the instructor to complete the unit's individual assignment before the class session by logging on to the WebCT course site and completing their individual assignment. The instructor then skimmed over students' responses to the individual assignment before the first class session.
- At the beginning of the first class session, handheld computers were distributed to students. Students then were asked to connect to the Internet and log on to the WebCT site and complete a pretest (quiz) that covered the objectives of the unit. Students were also encouraged to view the results of their test if the items were closed ended. However, no formative feedback was provided during the pretest.
- Upon completion of the pretest (quiz) the first class session proceeded with the instructor's lecture and large group discussion. The instructor used the SRS during his/her lecture to pose questions and receive feedback from students. The results of students' responses were projected as soon as they were submitted, both quantitatively (graphs) and qualitatively (students' narrative memos to support the yes/ no, agree/disagree, true/false or multiple choice questions) and were followed by large group discussion.
- After the first but before the next class session, the instructor reviewed students' responses to the individual assignment more carefully and provided individual and formative feedback to students (through e-mail or WebCT course management system).
- The second class session began by distributing handheld computers to students and asking them to open a word file that contained the team activity, which was saved on the desktop of their handheld computers, and reviewing the content of the team activity. The instructor then provided a brief overview of the previous session's discussions and explained the team activity and its purposes. Students were then grouped into teams to discuss the team activity and to compose a short report. The recorder of each team was expected to send his/her team's report to the instructor via e-mail and beam it (transmitting data wireless via Infrared) to the other members of the group. Respectively, the instructor used the wireless system to receive the teams' responses/reports as they were submitted by each team through e-mail, compile them in a word file, and project them for the large group discussion.
- At the end of the second session, students were given time to log on to the Internet using their handheld computers and complete the posttest. Students were encouraged to view the results and the feedback for both close-ended and open-ended test items. They were also asked to complete a print-based anonymous attitude survey.

Evaluation and data analysis strategies

Data was collected from the following sources: (1) students' performance on quizzes (pre- and posttest consisting of both multiple-choice and short answer items), individual and team activities using records generated and kept in handheld computers; (2) students' responses to an attitude survey (using 5-point scale with 5=strongly agree, and 1=strongly disagree) which measured students' attitude toward different forms of assessment and the usage of handheld computers; (3) instructors' observational notes on the students' level of engagement in class activities and interactions. A combination of quantitative and qualitative data analysis approach was used to make sense of the data.

Results and Discussions

Three independent Paired Samples t-tests were used to analyze the students' performance on quizzes for each class. The analysis results yielded significant differences between pre- and posttest scores across all three groups ($t = 9.95$, $df=19$, $p<.001$; $t=15.8$, $df=19$, $p<.001$; $t=5.3$, $df=8$, $p<.001$). The integration of continuous assessment and immediate feedback into the design of instructional material and activities delivered by handheld, wireless computers may account for the significant improvement of the students' performance on the posttest.

Table 1: The results of t-test analyses of students' performance on quizzes

Courses	N	Mean		T-Test	P
		Pretest	Posttest		
Early Childhood Education	10	27	39	5.30	<.001
Special Education	21	32	57	9.95	<.001
Middle School Education	21	.4	6.5	15.8	<.001

The analysis of the students' attitudes survey toward different forms of assessment and the usage of handheld computers showed that students thought the use of various assessment strategies (M=4.4) followed by immediate feedback (M=4.5) during instruction had a positive effect on their knowledge of their own learning. The analysis further revealed that students found the SRS' bar graph display of the student responses was a useful feedback affecting their performance (M=4.5). The same rating was also indicated in the category of immediate feedback on posttests (M=4.5). Students also reported that the incorporation of the handheld wireless computers enhanced their level of involvement (M=4.1) created more opportunities for interactions both amongst students and between students and the instructor (M=4.1), and made the unit of instruction more interesting. Overall, students felt positive about using handheld computers during classroom instruction. They indicated that they enjoyed having an opportunity to use this new technology and thought that they learned how this technology could enhance student learning in the classroom.

The analysis of instructors' observational notes on the level of student engagement in team activities suggested that students were actively involved in the team discussions and appeared to enjoy the process of sharing files and ideas. The instructors' notes indicated that using handheld computers and the immediate feedback from students helped in aligning instructional objectives with instructional content and evaluation, and in monitoring students' learning and understanding their perceptions and/or misconceptions. The instructor also thought that having access to students' understanding of the concepts during instruction assisted in tailoring the instruction toward students' needs. Overall, it appeared that focusing on designing instruction for continuous assessment of student learning using handheld computers changed the class dynamic from a teacher-directed, lecture driven classroom to a more student-centered and student-controlled learning environment.

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Action Research of Constructivist Approach to Integrate Technology in Support of Standards-based Science Curriculum Development in Teacher Education

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Abstract

This study examines the process of employing technology to support in-service teachers in the development of science curriculum. The action research concludes with four main challenges in the integration of technology into curriculum: computer access, computer experience, technology support and institutional support. This study suggests various ways to strengthen technical support such as electronic portfolio, site visit, tutorials, and computer software. Nevertheless, access to computer remains a critical issue for in-service teachers in rural areas.

Introduction

As technology has become ubiquitous in K-12 environments, the successful integration of technology into curriculum and instruction remains a main challenge in teacher education. The lack of sound pedagogy and instructional support to integrate technology into instruction can account for some of the resistance among teachers to hop on the bandwagon of technology. Many teachers are novice technology users and there are not enough opportunities for professional development. This study aims to evaluate the process of providing technological support to K-12 teachers and examine factors contributing to or impeding the integration of technology into curriculum in a teacher education course at the College of Education. The constructivist approach that emphasizes learner-control and co-construction of knowledge in a real-world context is adapted to facilitate the process of providing technology integration. Action research that investigates the means to instructional improvement within the educational experience is employed for this study.

This research focuses on the process of implementing technological support to a group of science teachers with different levels of technical skills. The objectives of this study are to:

a. Determine how technology can provide support for curriculum development
b. Evaluate the constructivist approach to the integration of technology into curriculum design

Theoretical Framework

Piaget and Vygotsky are two thinkers whose impact on constructivism is profound. Constructivist theorists who draw from Piaget put more emphasis on individual construction of knowledge as a result of interaction with the physical environment. Constructivist theorists who are influenced by Vygotsky posit that knowledge is constructed through the appropriation of culturally relevant activities. In other words, knowledge is co-constructed with peers or experts and through immersion in a social context (Bonk & Cunningham, 1998). Jonassen et al. (1995), long-time advocates of constructivism for distance education, argue:

> 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 in 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). These four attributes also serve as the framework for the implementation of technology in the course for this study.

Course Description

Background

The course for this research is titled "Interdisciplinary Science Curriculum: *Malama I Ka Aina*, Sustainability (subtitle: Environmental Bioremediation: Concepts and Practices in Environmental- and Agriculture-based Science)". This course is part of the Department of Education funded project, Malama I Ka Aina, in support of K-12 science teachers to develop both standards based and culturally relevant science curriculum to Hawaii students as described in the Malama web site (http://www.hawaii.edu/malama). Science teachers registered in this course were expected to achieve the main course objective: incorporating traditional Hawaiian cultural practices and methods of modern environmental technologies into science curriculum and instruction through an immersion program in the field and hands-on practice with community experts. This course began in summer 2001 and was concluded in May 2002.

Twenty two in-service teachers from three different Hawaiian islands registered in the course and eight site teachers provided instructional and content support for all teachers at different campuses. The course was co-taught by two faculty members from the College of Education and College of Tropical Agriculture and Human Resources. The core instructional team consisted of the instructors, a content and curriculum design specialist, and an instructional designer. The instruction was supplemented by guest instructors from Hawaiian community groups. The subject areas that the participating teachers teach included biology, agriculture, chemistry, hydroponic, physics, earth science, life science, marine science, environmental science, and general science. Since the teachers were from different islands and carry their full-load of teaching during regular semesters, meetings were usually scheduled during the weekends or semester breaks in summer. The use of technology played an important role for continuous communication in the year-round course.

Standards-based Curriculum Development

One important aspect of the course is the incorporation of science standards into unit and lesson plans. A standards-based curriculum provides a set of guidelines for teachers to develop the content and devise activities that are appropriate for the various levels of the students. The standards employed in this course are based on the booklet "Hawaii Content and Performance Standards, HCPS II" developed by the Department of Education at the State of Hawaii. HCPS, which provide specific benchmarks and learning outcomes in K-12 systems, can be divided into two domains:

> "(1) Domain I standards are about science as a way of thinking and knowing. It has roots in Scientific Inquiry and meets the first goal of Science Education (which is understand and apply the process, ways of thinking and dispositions that humans have while investigating the Natural World). (2) Domain II standards are about Science as Cumulative Knowledge. Domain II identifies essential understandings that will help students meet the second goal of Science Education (which is to understand and apply the knowledge we know today about the world around us to our curiosities and in our daily lives)" (p. 2-3, Office of Accountability and School Instructional Support/School Renewal Group, 1998).

Examples on unit and lesson plans that address the benchmarks in the standards can be found at the Malama web site.

Technology

The four constructivist attributes, namely, context, construction, collaboration, and conversation provide the foundation for the design of the technological learning environment. The context was the subject area in which the teachers developed the instruction and activities for their own classroom use. This course provided the training opportunities for the teachers to acquire the skills, knowledge and technology for curriculum development. They were to construct the curriculum through either group projects or individual projects based on their own disciplines and background knowledge in a subject area. Through collaboration with other teachers in the same group, they drew on experiences from their own teaching in different grade levels and contributed their knowledge to the project. For teachers in different groups, they engaged in online conversations to comment and receive suggestions from peers on their own projects. Throughout the entire year, online conversation was encouraged to increase the understanding of the course content and information sharing.

The role of technology in the Malama program was to foster a learning environment in which participants collaborated together to develop a database of K-12 standards-based science curriculum for information dissemination. The participants did not meet on a regular basis. The email list and the web tools played a vital role in the communication between instructors and participants. The Malama web site provided the resources and venue for teachers to disseminate information, collaborate on projects, carrying out discussion and co-construct knowledge together.

Specifically, the tools employed in the course included: email, web pages, bulletin board, chat room, and listserv. In order to make sure that every teacher learned how to use the web editor Dreamweaver and publish their curriculum on the web, a two-day technology workshop was planned and conducted by the Malama instructional support group in a computer lab. The workshop description can be found at http://www.hawaii.edu/malama/handouts/DW_workshop.html (there is an underscore between DW and workshop.html). Participants were provided with detailed handouts and online resources for learning about Dreamweaver. Preview of the lesson plan and preparations for the workshop were sent to the teachers in advance. One of the objectives of the workshop was provide teachers with the skills and knowledge necessary to maintain their own web sites. Eventually, they would also be able to integrate the technology into the lesson plans and teach their students the technical skills necessary to develop their own projects.

Research design and data collection

Action research for instructional and technical improvements

Action research is a process that involves all participants (e.g. students, teachers, and other parties) in the educational process to work together for the improvement of instruction and curriculum. Social psychologist Kurt Lewin's work (1946) has contributed greatly to the maturation of Action Research as a method for research. According to Lewin's (1946) definition, "action research is a three-step spiral process of (1) planning which involves reconnaissance; (2) taking action; and (3) fact-finding about the results of the action" (p. 27, cited by Kemmis, 1988). Action research is ideal for generating insightful information for the improvement of school programs. It provides educators the opportunities to evaluate new ideas about teaching, curriculum, and learning so that they can make informative decisions.

The design of action research is described by Kimmis & McTaggart (1988) in the following cycle: plan -> act -> observe -> reflect -> and revise plan -> next cycle in similar sequence. This study is conducted in the following sequence: selecting research areas/focus, taking action, collecting data, organizing and interpreting data, reflecting on action, and revising action plan.

This research focuses on how technology can support teachers in developing curriculum. Two research areas are identified: factors that enhance or impede the support of technology and assessment of the constructivist approach to the implementation of technology. The research is concerned with how technology can provide support for teachers and how teachers can benefit from the constructivist approach. The action plans include needs assessment, technology workshops, and follow-up support. The following data are collected to assess the process and effectiveness of the technological support: surveys, interviews, observation, and project evaluation.

Research areas This study focuses on how technology can support teachers in developing curriculum. Two research areas are identified: (1) factors that enhance or impede the support of technology, and (2) assessment of the constructivist approach to the implementation of technology

For the first area, the following research questions investigate how technology can provide support for curriculum development:

1. Does the use of technology facilitate curriculum development?
2. Does technology provide the kind of support for teachers to develop curriculum?
3. What kind of support can be further provided?
4. How do novice teachers adopt to technology? What are the factors that enhance or impede their adoption of technology?

For the second area, the following questions evaluate the constructivist approach of integrating technology into curriculum design:

1. Context learning: the effectiveness of using real-world context as the backdrop to develop lesson plans

2. Knowledge construction: the effectiveness of knowledge construction through web resources and information sharing

3. Collaboration: the effectiveness of team collaboration

4. Conversation: the effectiveness of peer critiquing and information sharing through the web bulletin board

Action Plans Several actions are taken to provide support of technology to teachers.

1. Needs assessment: a preliminary survey is conducted to assess the technology literacy of each teacher and the type of technical support from their respective schools.
2. Tech workshops: several technical workshops are conducted for individuals and the whole class to advance teachers' knowledge in technology, specifically web page editing tools.
3. Follow-up support: Once the teachers' web sites are uploaded to the Internet, the instructional support team can monitor their progress and keep close watch on problems that the individual teachers may encounter.

Data collection

The following data are collected to assess the process and effectiveness of the technological support:

a. Preliminary survey on demographic background, technical skill levels, and the institutional support available.

b. Post-workshop survey to evaluate the following aspects of the technology workshop: workshop structure, instructor-participants interaction, overall workshop enjoyment/satisfaction, and computer lab learning environment. (http://www.hawaii.edu/malama/surveys/workshop_eval.html). The questionnaire is adapted from the study by Thomerson and Smith (1996).

c. Observations by instructors: the instruction team reports their observation on teacher's adoption of technology (http://www.hawaii.edu/malama/surveys/project_observation.html)

d. Evaluation of final projects (e.g. web site completion, indication of employing technology in classroom activities and student projects)

The data analysis, critical reflection, and revised plan are discussed in the next section.

Analysis and discussion

Preliminary study

There were eleven male and eleven female in-service teachers participating in this course. The preliminary survey revealed four technological challenges in this course: computer access, computer experience, institutional support, and technical support. As concerns computer access, three teachers did not own a computer at home and they did not use a computer at school for instructional purposes. These teachers did not have email accounts at the beginning of the course. This mixture of novice and advanced computer users presented the first technical challenge of this course: keeping the communication flow in a class that did not meet regularly physically or virtually. The instructors usually sent out class-related announcement via email and then notified other teachers who did not have email accounts by phone calls or mail. After the first technology workshop was held in late July, all teachers except for one had e-mail accounts. Nevertheless, the lack of computer access for some teachers in rural areas made it impossible for them to receive email promptly and efficiently.

Regarding computer experience, only two out of twenty-two in-service teachers had their own web pages. The majority had little or no experience in creating web pages. The July technology workshop aimed at advancing their web editing skills to at least beginner level so that they could start planning curriculum with the aid of technology.

In terms of institutional and technical support, although most K-12 schools are already equipped with computers, schools in rural areas are still ill equipped. There is also a lack of institutional support in providing technical support for teachers. One of the Malama project objectives is to empower the teachers with the knowledge to develop web pages. This initiative was contingent upon the technical support and Internet access from each site school. Half of the teachers were not aware of the kind of technical support that their individual schools would have provided.

Technology workshop surveys

The overall ratings of the workshop evaluated by the participants are high. On a one-to-five scale, one as low and five as high, the workshop ratings as indicated in the parentheses include the following categories:

Instructor-participants interaction (4.1), computer lab learning environment (3.1), workshop structure (4.07), and overall enjoyment and satisfaction (4.36) as shown in Table 1. The comments by the participants offered excellent suggestions in the following areas: smaller class size, classes for participants with different levels of computer skills, multiple sessions, longer workshop hours, and more detailed instructional manuals. Twenty-three teachers who shared 19 computers attended the two-day workshop (three hours each day).

Table 1: Post-workshop Survey Results

Instructor-participants interaction			
	Q1	I felt comfortable asking the instructor questions.	4.57
*	Q4	I felt uncomfortable asking for help during workshop	2.36
	Q5	The instructor was responsive to students' needs.	4.36
	Q11	When I ask questions, the instructors give me the answers I need.	4.64
		Average	4.1
Learning environment (computer lab)			
	Q2	The overall workshop design was conducive to learning about writing web pages.	4
	Q7	The screen layout and interface design of portfolio are consistent and easy to use.	4.14
*	Q13	I had a difficult time understanding the instruction.	2.86
*	Q16	I tend to get easily distracted in a computer training environment.	2.79
		Average	3.1
Workshop structure			
	Q3	The instructor used the computer effectively for meeting the objective of the workshop.	4.43
	Q6	Examples and illustrations were effectively used by the instructor.	4.21
	Q8	The amount of material covered was adequate for the length of the workshop.	3.71
	Q10	Workshop content was presented in a well-organized manner.	3.93
		Average	4.07
Overall workshop enjoyment/satisfaction			
	Q9	I have a sense of accomplishment so far.	4.07
	Q12	The method of workshop presentation kept my interest high through the entire workshop.	4.07
	Q14	I would recommend that other teachers take similar courses from the same instructor.	4.36
	Q15	The instructional team was helpful in providing assistance.	4.93
		Average	4.36
		*Q4, Q13, & Q16 have been reversed for tabulation.	

Follow-up support

Based on the preliminary surveys, the following action plans were taken to provide continuing support:

a. Schedule a series of workshops on computer literacy, web page design, image scanning and processing, and power point presentation

b. Provide individual on-site tutoring for teachers who need extra help

c. Communicate with school tech coordinators on the kind of support and resources that the teachers would need in developing their own web sites

d. Site visit with teachers who have the least computer experience to assess the kind of support that was needed for them to utilize the technology for project development at their own schools

e. Provide books and computer software site licenses for all teachers to develop individual projects.

f. Develop electronic portfolio that provides standard-based curriculum template for teachers to download

g. Establish a web-based bulletin board on WebCrossing for information dissemination.

Observations

Two instructors and one curriculum specialist who were also present to observe the workshop and learned about the technology made comments on the following four categories: overall participant satisfaction, course structure, course design, and instructor-participant interaction. The observations are summarized as below:

a. Overall satisfaction: While three observers agreed that the members of the workshop seem to be happy with the fact that they have learned something new, the learners also seemed overwhelmed by the amount of materials rendered in the workshop. Because there was a large variation in the skills initially, each participant moved to a different level, but all make progress in their best capacity. One observer pointed out that those who had minimal exposure to computers would have benefited more from one-to-one tutorial session than a large workshop.
b. Workshop structure: The course was well-organized and the examples used are relevant to teachers' background. While learning about the technology, they also learned to build an electronic portfolio through several templates. The templates consisted of a consistent layout and several web pages that include school introduction, project overview, standards-based unit planning, unit and lesson plans, student works, and photo gallery. Participants can download the electronic portfolio templates and provide content to the templates without investing much time on web design. Through the use of a template, participants were at a place that they could see good quality results and get excited. Nevertheless, observers suggested that handouts with step-by-step instruction (where to go or click from point A to point B) would be more useful. The handout was written for participants in a face-to-face workshop for reviewing purpose, not for self-guided tutorials. In addition, it would be even better if the participants could upload their web pages to the server and see the results. Since the workshop was conducted at the beginning of the course, many participants have yet to received an email account from the University. Web server access was tied to the availability of an active email account. Therefore, many of them could not upload their practice files to the server even though the instructions were included in the handout.
c. Workshop design: The strengths of the workshop were the use of the handouts, computer projection, and a portfolio that the participants can download as a template for their own projects. The weaknesses were the large size of class (19 participants), fast-paced instruction, and a lack of sufficient time for practice. For future workshops, an introductory course for beginners and an intermediate course for participants with basic skills would make it easier to conduct the instruction.
d. Instructor-participant interaction: While the observers all agreed that the instructor was helpful and responsive to questions, the use of tech assistants also contributed greatly to the positive interaction. It was helpful for both the instructor and the assistants traveled frequently to different corners of the room to provide timely assistant to the participants.
e. Additional comments: Instead of compressing the instructional materials into two afternoons, the workshop could have easily stretched into a three-day workshop to allow more time for practice. The participants definitely need follow-up support and practice on their own to retain all the materials covered in the workshop.

Final project evaluation

Fourteen (64%) out of a total of twenty-two teachers posted their projects on the web. Teachers from the same school usually collaborated on the same project together. Half of the projects posted on the web showed a good command of basic web authoring skills. Two projects showed advanced level of web authoring mainly because the two teachers had prior web authoring experience before registering for the course. Two projects showed intermediate level of web authoring skills and the teachers had minimal experience with web authoring. The reasons that the web editor (Macromedia Dreamweaver) was not highly utilized by participants to develop their projects can be summarized as follows: (a) putting projects on the web was not a requirement for this course, teachers also have the option to submit their paper in a format other than web pages; (b) a steep learning curve of the web editor might have discouraged beginners from continuing using the program; (c) busy work schedules kept the participants from spending time in learning more about or effectively using the web authoring program which was an add-on task to project development; (d) a lack of access to good computers might have deterred teachers who had no experience with computers and living in rural areas.

In addition, most projects developed by the participants did not involve students in the use of computer technology in their learning. In spite of the minimal use of web technology in developing curriculum by most of the participants, their projects did employ modern environmental technology and address the science-standards developed by DOE at the State of Hawaii. All the projects showed real-world applications and participants reported successful results with their students. All lesson plans can be viewed at the Malama Web site: http://hawaii.edu/malama/schools.html.

Analysis on technology use

Overall, email and the Malama Web site were the main means of communication. In the Malama listserv, the majority of postings were submitted by the instructors, tech support, and the same two or three participants. The majority were passive users of the communication technology. Technology integration was most successful for projects by teachers who had already had some knowledge in using the web. With all the technological support and effort to make technology available for teachers, most teachers would only use technology for communication purpose, not for project development. The use of technology was a recommendation, not a requirement, in the course syllabus and thus partially explains the lack of incentives by some participants in the incorporation of technology into curriculum.

The constructivist approach to encourage context learning, knowledge construction, collaboration, and conversation would have worked well with in-service teachers whose skill levels are more or less at the same level in well-equipped K-12 teaching environments. For the course in this study, the participants were geographically dispersed throughout the Hawaiian islands with different skill levels and unequal access to computers, it would take more than one technical staff to provide the kinds of support that the teachers would have needed. Furthermore, more structured tasks in motivating teachers to use technology should be an integral part of the course design, not an add-on task.

Conclusion

In the process of employing technology to support curriculum development, the following four challenges in most rural schools need to be addressed first: lack of computer access, computer experience, institutional support, and technical support. There is a need to provide more access to computers and technology support for in-service teachers before any technology projects can be implemented. This study presents a typical scenario in teacher education and ways to provide the best support with limited resources. It is not a surprise to find out that those teachers who are successful in utilizing technology are those who have access to the resources in this study. Providing computer access to all K-12 teachers and continuing professional development should provide the foundation toward a successful integration of technology into curriculum.

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A Qualitative Inquiry of Pedagogical Symbiosis: Reconciliation of Mixed Cultures

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Abstract

Over the past three years or more, the authors have been examining the impact of technology interventions on students and teachers – from cultures where English is a second language. It is their hypothesis that students and teachers from non-English speaking nations suffer severe disadvantages when technological interventions are superimposed on existing traditional" pedagogical models. This paper is one in a series that examines extent pedagogies, primarily in Asia, and the pressures of having to re-conceptualize what has been tradition for centuries. It traces significant educational origins to their cultural roots and examines contemporary initiatives that may be disruptive. It offers possible solutions that, if approached with reconciliation as its focus, might offset catastrophic results and achieve pedagogical symbiosis.

Introduction

Learn as if you were following someone you could not catch up to, as though it were someone you were frightened of losing (N.D., Confucius, quoted by Beck, 2002).

Thirteen years ago, the last author climbed a mountain named Alishan on a cold December morning, to see the sunrise over Central Taiwan. This mountain holds special significance for all who make the journey and experience the sunrise, for it is both a physical and a spiritual renewal of one's inner self.

In Islamic lore, Mohammad went to his mountain; natives and international tourists alike wait for the clouds to part over Mount Kenya to see its rugged peak; and innumerable adventurers aim their sights on the Matterhorn (Mount Cervin). In each case, there are those like we, who sought renewal and understanding.

The mountains we describe are, barring any major cataclysmic event, not likely to move, much. From this we draw our own parable to other events that, while not as ancient as the mountains, merit connection to our analogy. *We refer to the plight of an international student coming from his or her country to another for study, and finding that nothing is as it should be.*

The background Asian students bring to the West reflects an educational culture that saw its birth thousands of years ago, well before European and American scholars developed their educational theories. Plato (428-348 B.C.) and Socrates (470-399 B.C.) come closest as peers to Confucius (551-479 B.C) (Beck, 2002) for it is he, and his contemporaries who shaped the way education is currently practiced by well over one billion people. Or put another way, over a third of the world's total population. There are myriads of lessons to be learned from a system that has continued and flourished for thousands of years. What's so good about it?

This article is about the impact of Confucian pedagogy on thousands of Asian students; primarily students from China, Hong Kong, Japan, Korea, Singapore, and Taiwan. Despite having learned most of their lessons in another language, English has now become the "lingua franca" for students from across **all** Asia. It traces the pedagogical roots of a specific group of international students (most of whom are from either China or Taiwan) who have come to *one university*, the University of Central Florida in Orlando, and have enrolled in *one graduate program*, the Master's degree in Instructional Systems (http://pegasus.cc.ucf.edu/~instsys/,2002).

Its premise is that 1). Culture does make a difference, especially when two cultures have the possibility of engagement and that 2). These cultures are generally 180 degrees opposite to one another, sometimes while on a near-collision course.

The Problem

Instructional Systems graduates are expected to develop competencies that allow them to communicate to a variety of audiences, both verbally and in writing. They must be able to deliver presentations using a wide array of technologies. They must write papers that reflect both eloquence and conviction. They must work well as a member of a multi-cultural working team and they must develop positive assertiveness. The competencies expected of them are listed in the introductory Instructional Systems course, Survey of the Application of Instructional Systems (Cornell, 2001) and reiterated in Piskurich & Sanders (1998).

Many Western students, particularly those in North America, are generally adept at using these skills, given their innate tendency toward achievement (judged on what one has accomplished and one's past record), both professionally and socially. Other cultures function more on ascription (status attributed to one by birth, kinship, gender, age, one's connections, and educational record), a phenomena often seen in Southern Europe, Latin America, and Asia (Tropenaars & Hampden-Turner, 1998, p. 9). *For Asian students, acting on many of the competencies found within the Instructional Systems program is, to say the least, unnatural, uncomfortable, and often induces considerable stress. The result – silence, both orally and in written documentation.* The problems resulting from this silence are in two categories, Western and Asian:

For purposes of this research, when we use the word "Asian," we refer to students who came to UCF from either China or Taiwan. Thus far we have no students from either Macao or Hong Kong but recruitment efforts in those areas continue. We use the same term when referring to teachers' ethnicity. The overarching descriptor that guides our approach, we take from two works of Trompenaars & Hampden-Turner (1997, 1998), *"reconciliation!"* It implies neither being dominated by others nor acquiescing but rather, "…through an integrative process, a universalism that learns its limitations from particular instances, for example, and by the individual voluntarily addressing the needs of the larger group (p. 53, 1998)."

In this instance, the "larger group" consists of the Asian students' Western peers, who number a little over half. It is conceivable that, in the coming years, this ratio of Asian-to-Western students may well change, with the numerical balance favoring Asian students! Then what? The larger group's needs were not immediately apparent as infusion of Asian students into the Instructional Systems master's program was not a one-shot event but gradual. We recruited one student at a time, until the critical mass gradually increased to where it is now at almost half the number of new students in the program. A similar trend is already apparent in the doctoral program in Instructional Technology where the critical mass of Asian students exceeds 50%!

So…here we have all these students from Asia (as well as those from Cyprus, India, Mexico, Russia, and Turkey) and each, regardless of from where they have come, brings with them their own idiosyncratic view of life. It is a pedagogical life that, heretofore, has been mostly unknown, by both the students *and* their Western professors (2002, International Institute). Many professors know little about the basics involved in coming to the United States as an international student; they know even less as to the specific logistics; and even less than less in-depth knowledge about the countries from which their international students have arrived!

Add to this scenario an even less enlightened American student population, both undergraduate and graduate. Our North American students are mystified by the silence of their Asian peers. They look to professors to encourage their Asian peers to communicate because they, the students, have little success, at least initially. Many professors remain perplexed for they also find their Asian students to be mute. How to evaluate muteness – that poses their immediate challenge!

The professors, and often the students, silently ask themselves, "How did these students ever get accepted to UCF? They can barely speak English!" A disablement? Yes, for awhile, but not a permanent wound so…the task is to release the sounds from within our Asian students, to hear them speak, to read their written words, and ultimately to sense their discovery of new ideas, just as these same professors are accustomed to doing with their North American students. But how to do this…how to understand the pedagogical culture that they bring with them and the degree of symbiosis between that culture and the one found at UCF – that's the challenge as well! Yet, we insist that these students learn and study "our way."

Our research is an attempt to understand what is happening with our Asian students so we can reduce the time lag between the time a student arrives at UCF and the time they begin to truly feel comfortable in their Western classroom environments – a task that is formidable and complex. Our approach is to seek understanding of what these students bring with them and, to do so, we are "going to the experts," mainly professors from both Taiwan and China, asking them about their formative education years. We asked them to describe how learning was for them when they were students, in grades anywhere from within their earliest memory of schooling to the time they completed their last degree. In this way, we have first-hand descriptions that may or may not validate what appears in the literature.

We do not reject what the literature says about Asian education, but we wanted to add richness and provide increased depth to what was experienced, thus our approach was and is to conduct live video interviews where possible. In this way we hope to validate major premises found in the literature and provide a qualitative database that clearly presents imagery that communicates the contrasts in pedagogical styles, East and West. Note, we did not say East *vs.* West; at least not yet.

Review of the literature

Even a cursory review of the literature suggests images that stereotype our students, be they from China, Taiwan or North America. It is tempting to label our Asian students as being passive, quiet, silent, submissive, respectful, intelligent, hard working, introspective, disciplined, and many other descriptors and, for some, these are accurate in their assessment (Tu, 2001). Hampden-Turner and Trompenaars (1997, op cit., p. 10) identify values differences between the West and East-Asia in the business sense as having differing historical roots.

West	East
Supernatural religion	Secular humanism and enlightenment
Belief and faith	Paradigmatic assumptions
Cartesian dualism	The Way of Complimentarity
Values as things	Values as wave-forms
Cultures and Values – Yin	Cultures and Values – Yang
Pioneer capitalism	Catch-up capitalism
Finite Games	Infinite Games

We include these values sets because there is a continuing relationship between instructional systems designer competencies expected in the West by business and industry and the extent conditions the Asian students bring with them. This relationship often reflects the Yin and Yang depicted above. Hampden-Turner and Trompenaars define belief differences, those in the West being anchored in "…the commandments of supernatural beings and their sanctions for good or bad behavior in an after-life". (p. 10-11). In East Asia the authors cite value systems that, while varied across different countries, are based on "their wisdom being secular, practical and of this world." (p. 11). That "they are 'humanistic' in the sense that they aspire to improve the human and social condition, and failure in this leads to criticism and reappraisal. (p. 11).

It is tempting to label our North American students as being Type A, competitive, brash, aggressive, loud, spontaneous, wild, lacking in respect, superficial, ego-centric, lazy, having little discipline or motivation, etc. and for some, these too, are accurate assessments. Let's remove the silk gloves and tell it like it is – there are students from China and Taiwan that could easily pass for what we have described as being stereotypes of North American students and…there are North American students who emulate many of the attributes seen in the literature as being typical reflections of Asian behavior and values.

In the literature we found ample evidence of how things are. *We found little of help as to what to do about it, especially as relates to ways in which we might make the lives of the Chinese students in our program more positive.* We identified a number of categories wherein insight was provided as to what beliefs the students bring with them. As Trompenaars and Hampden-Turner assert, however, "you can never understand other cultures (1998, p.1) and so, while it is our intent to provide clarity as to Asian thinking, understanding might lie beyond our real capabilities. The best we can hope for is to create sensitivity toward the problems raised, and in doing so, perhaps emerge with observations and strategies that may make life for our students far better.

In support of this caveat is a statement read from another source, now disremembered (*Anonymous, N.D.)*, that described the feelings of an American expatriate in China who had worked for 20+ years there. He was asked : "With all your years living in China, how long did it take you to understand the Chinese?" His replied, "I still do not understand them and probably never will." He added: "One cannot understand those from another culture unless they have been born or grown up with it!" So much for really understanding our Chinese students in Orlando.

In terms of what is valued and how it is manifested within the UCF classroom, the literature reinforces our own experiences. An ongoing concern is the silence of Chinese students in our classes, especially during their first or second semesters with us. Is silence always "bad?" This question was posed us at an Orlando conference of the Comparative and International Education Society (CIES) by Dr. Haiyan Hua, Senior Research Associate of Harvard

University's International Education Group. We were quick to respond in the negative, that no, there are many times when silence is, in fact, "golden." From this exchange we learned that we needed to affirm our target population as being Chinese students enrolled in a specific academic graduate program that, while valuing silence in many activities, it also demands vocal and written participation in many others.

We found evidence of why our Chinese students were silent in Brooks (1997) who was quoting Yum (1994): '…the Chinese communication process places the 'emphasis …on the receiver and listening rather than the sender or speech making' "(p.83). Brooks emphasizes Yum's point that Chinese are receivers of messages, listening, rather than being senders. She provides a pedagogical blueprint as to the nature of how Chinese students are educated:

> Confucius believed that…a hierarchal system was essential to the harmonious well being of society. This, in turn, is reflected in the Chinese classroom. Chinese students regard their teacher as all knowing, and the absolute authority on the subject matter. Due to the rigid teacher-student relationship, Chinese teachers are under severe pressures not to make mistakes, not to misguide students, and not to be criticized, in order to maintain their "all knowing" and "ever correct" status. It is the duty of students to give utmost respect to the teacher. To ask questions of the teacher, or to question the words of a teacher is tantamount to questioning the position of the teacher, and therefore is not a feature of Chinese classrooms. Since the teacher is the sole authority in the classroom, rigid order and formality are the main features of the Chinese learning environment (Su, 1995).

Zhang, Sillitoe and Webb (1999), in quoting Ballard & Clanchy (1991) compare Western and Chinese differences in the attitudes toward learning:

> "…in Western culture, tertiary education is oriented towards *extending* knowledge. Therefore, the teaching approach used and learning approach encouraged are designed to develop analytical and speculative abilities of students. By comparison, in more 'traditional' cultures, for example Chinese culture, the education systems are mainly oriented towards *conserving* knowledge, and the learning approach fostered emphasizes the reproductive ability of students.

Tu (1999) reinforces these findings by stating that Chinese teachers have been accustomed to teaching where there was only one-way communication and a quiet environment. This no longer exists. All subjects are discussed, even the teacher's private life. Teachers fear the loss of their authority and the pressure of public opinion (p. 3).

In a later work, (Tu, 2001), he adds that Chinese collect information from non-verbal channels and perceive more exact information than has been delivered (p. 5). Lin and Yi (1997) add more pieces to our puzzle when they describe further issues faced by Chinese students that compliment those already discussed:

> International students from Asian countries are often stereotyped as quiet, reserved and non-assertive. These cultures place an emphasis on harmony and respect for authorities. Therefore, many of them are reluctant to share their feelings or emotions, express their opinions or oppositions to anyone, especially to authority figures. Thus instead of emphasizing personal rights and assertive communication, Asians tend to emphasize the importance of patience, harmony, respect and deference. Asian cultures tend to place a high value on team efforts of collectivity whereas Western culture tends to emphasize individualism. Asians are also modest about their accomplishments. Many Asian international students feel uncomfortable with the individualism and the competitiveness associated with the American culture.

This is not to suggest a caveat, a series of excuses to fall back upon, rather, it is a reflection of reality for many. We cannot stereotype our students so easily, be they from Asia or Central Florida. The common denominator, metaphorical in many respects, seems to be what was termed the "figure-ground" relationship (McLuhan 1964), i.e., that students will perform within parameters that are related to their most comfortable environment, whatever suits them at the time.

In "McLuhanese" this concept is expressed as: 'Figure' refers to something that jumps out at us, something that grabs our attention. 'Ground' refers to something that supports or contextualizes a situation, and is usually an area of *un*attention (Gow, 1998).

Mercurial in many ways, chameleon-like in adaptability – it's just what students do to survive! The literature excerpts provided are but a tip of the pedagogical iceberg. It is our intent to continue surveying the literature continually to better gain understanding of our own Chinese students.

We are in the process of developing methodology that will enable us to better understand the implications implicit in teaching Chinese students at UCF. We think that our findings may also prove useful to other North American institutions wherein Instructional Technology programs are offered. Ultimately, we envision the results as also being of considerable use to multinational corporations, many of whom hire many Asian employees. An initial description of our methodology follows.

Be advised that what we include in this article, as well as in our presentations, may appear offensive to some, to marginalize some, to be found guilty of being patronizing to others…none of which is intended. We are taking observations as we get them, subjecting them to analysis, comparing them to other research found in the literature, and then attempting to devise useful strategies that will enable our Chinese and Taiwanese students to not only succeed, but to prosper! In effect, we are trying to level the academic playing field at the University of Central Florida so that there is equity for most, if not all.

What we were trying to do

The genesis of this study began a few years ago after the lead author, having recruited numerous students from Taiwan and China into the Instructional Systems master's program at UCF, found that, while each student brimmed with enthusiasm, when it came time for communicating ideas in class, most remained silent. The students were always pleasant, respectful beyond belief, and had a work ethic akin to our forefathers. In class, when asked a question directly (as is typical in North American classrooms), they would look down at their notes, mumble soft words, most of which were unintelligible, and squirm uncomfortably in their seats, knowing that multiple eyes were upon them. When asked to post messages on an online discussion forum, the most one could anticipate from our Asian students was a perfunctory few words of acknowledgement, "Yes, I agree with her statement" or similar responses. Not much to go on as an evaluative tool. Then there were the infamous synchronous chat-rooms…where written paralysis was the rule for our Asian students, not the exception. The odds of the professor really knowing what the student knew were getting slimmer by the moment.

Another caveat: The instructor in this instance, was one who evaluated performance based on what the students do, tied to performance objectives and goals that, more often than not, include project-based assignments, rather than conventional paper and pencil objective tests. In addition to individual and group assignments, emphasis is placed on participation, on the development and continuation of positive attitudes, of being self-motivated rather than having to be told what page to read or how many words were necessary in a paper to receive an A. He placed continual emphasis on teamwork, oral and written communication, as opposed to memorization of facts and figures. In short, his pedagogical model was 180 degrees opposite that typically followed by his Asian students!

"Well," one asks, "why is such communication so necessary?" Answer? Because the Instructional Systems master's program (and subsequent lead-in to a Ph.D.) at UCF has both written and verbal communication as foundation skills as well as development of assertiveness, teamwork, and numerous additional competencies. Taken collectively, this skills menu posed a serious threat to the previous learning models brought us by our students from China and Taiwan. Asian culture does not particularly reward self-efficacy, assertiveness, or the typical North American capability of being at ease speaking in front of one's peers. The Western notion of one being a "hale fellow, well met" is an alien concept to the Asian mind…business is not done via bravado or exuberance, rather, by quiet and deliberate analysis of the facts, followed by determined action of benefit to all, not to the individual. With the foregoing as basis, what methodology could we find that might begin to shed light on our questions?

Interviewee Questions

The researchers asked two basic questions of the Chinese and Taiwanese subjects. The subjects in three groups were teachers or professors from China and Taiwan. The fourth group was comprised of UCF students enrolled in the Instructional Systems/Instructional Technology graduate program areas.

The questions were:

1. When you were going to school (meaning any time between your primary school and graduate education), how were you taught and what were the recurring values that your teachers instilled in you?
2. Now that you are a teacher/professor, what strategies do you use when you teach and what values do you feel are important to instill in your students?
3. A fourth group of both Chinese and Taiwanese was composed of current students enrolled at the University of Central Florida. In addition to question 1, above, they were asked, "How are the instruction and the values you are learning here at UCF different than that you received at home?"

Methodology

Interviews are being conducted with four separate and distinct groups of individuals, both composed of either teachers/professors or students from China and Taiwan. By using these individuals as SME's (subject matter experts), we were authentic in our selection of subject class. We then needed to differentiate between the groups to provide focus on differences that might exist between them. We decided to use four groups of ten, an N of 40. The groups consisted of the following:

1. Teachers/professors who had been educated in Taiwan or China and *had not studied abroad*. We anticipated that the demographics of this group might be those who were more experienced and whose teaching would mirror much of the methodology they learned from their own teachers.
2. Teachers/professors educated in Taiwan or China who *had completed additional study in the West*, be it in North America, Europe, Australia, New Zealand, etc. and had since returned to teach in their homeland.
3. *Professors currently teaching at the University of Central Florida* from China or Taiwan.
4. *Students from China or Taiwan studying at the University of Central Florida*, preferably those enrolled in graduate Instructional Technology programs.

Previously we described the questions that would be asked of those in each group. *What we were (and are) trying to do is to get a clear picture of how our Chinese and Taiwanese students learned and what values they bring with them when they come to UCF.*

Each subject is asked the questions while being recorded on video. The sessions are relatively brief, given that there are only two basic questions being asked. The subjects may, if they wish, reply in either Chinese (Mandarin) or English. If Mandarin is selected, the interviewer speaks in Mandarin as well. Transcripts of each interview are produced and analyzed. Where the interviews are in Mandarin, closed-captioned English will be inputted on those taped interviews and an English narration provided. An analysis will then be made of key words across all groups and recorded in terms of similarity, frequency of use, and by category of interviewee. A matrix will then be constructed that depicts the relationships between key words used and group type, thus profiling group differences in a more visible manner. An edited tape of relevant excerpts will be abstracted from the raw footage that highlights the results of the taped interviews.

Once the analysis of Asian (Confucian) pedagogical methods has been validated, efforts will be made to affect a comparison between these methodologies and those regularly employed within Western university classrooms, more specifically, those wherein Instructional Systems design students are enrolled.

Research Questions

Are there elements of the valued Confucian pedagogy that might be compatible with those employed in the West? Are there elements of Western pedagogy that might be in harmony with Confucian pedagogies? Are there implications that this research might have for students from other cultures? Are the findings of value to technology-based commercial organizations who engage in multinational commerce, especially given the current and projected increase in such initiatives in East Asia? Is there symbiosis or asymbiosis – that is the goal we seek to address?

Preliminary Results

Over the past three years a number of efforts have been made (Cornell, Ku, Lee, Pan, Tao & Tsai, 2000; Cornell & Elshennawy, 2001; Cornell & Tao, 2001) to develop pedagogical strategies that would be effective in reaching our students from China and Taiwan. These included:

1. Giving students advance notice of written or oral reports with topics, dues dates, and expectations clearly identified.
2. Encouraging students to prepare and post individual Power Point slides on the class discussion board that introduced them to their North American peers and requiring the North American students to do likewise.
3. Providing a "safe harbor" for the first semester to allow all students increased latitude in terms of spelling, grammar, and punctuation during postings, especially while engaged in synchronous chat sessions and in class, regarding pronunciation, when oral discussion is being encouraged.
4. Encourage (but not initially requiring) Asian students to NOT work together in the same project groups, thus providing the Asian students with direct opportunities and challenges in using English.

5. Inviting students from both Asia and North America to professional meetings, social functions, even to the professor's home, to provide a "mutually safe harbor" for differing cultures.
6. Development and production of a series of video-based modules related to assertiveness (Cornell, Pan, Rendon, Hutton & Sheehy, 2002a).
7. Development of courses related to international issues and the application of instructional technology (Cornell, 2001b, 2002b)

We hope that a matrix of the data collected will reveal the close correlation between what is found in the literature and what was articulated by the subjects during their interviews. A draft of what the matrices may resemble follows.

Confucian pedagogical influences upon Chinese and Taiwanese professors/teachers and their students

Question 1: Think back to when you were a student, to any time between your primary school years and when you obtained your higher education degree. How were you taught? What values did you learn?

	Teacher used blackboard	Teacher is "God" And someone for whom I had great respect	Afraid of my teacher	I had to always be quiet and rarely ever asked a question	I had to listen and take notes of what the teacher said	Little or no interaction, unless it was a science type lab class	Teachers used technology
Group1							
Group 2							
Group 3							
Group 4							

Group 1 – Professors or Teachers with no overseas teaching experience or degrees
Group 2 – Professors or Teachers with overseas teaching experience and one or more degrees received abroad
Group 3 – Chinese or Taiwanese professors teaching at the University of Central Florida
Group 4 – Chinese or Taiwanese Instructional Systems students at the University of Central Florida

Note: Question 1 is modified for Group 4 to read: "Think back to when you were a student, any time between primary school and when you came to UCF. How were you taught and what values did you learn?"

Both the matrices being developed will use key words and/or phrases mentioned during the interviews across the horizontal axis with the different groups aligned along the vertical axis.

Question 2: Now that you are a teacher, how do you teach and what values do you instill in your students?

	I started out being very strict	I continue to be very strict with my students	I am gradually changing my teaching so it includes more interactivity	I have moved away from being teacher centered to being student centered	I use a lot of technology in my classes	While I respect my teacher and his or her knowledge, I know that there are also other sources of information	I continue to teach to the test
Group 1							
Group 2							
Group 3							
Group 4							

Group 1 – Professors or Teachers with no overseas teaching experience or degrees
Group 2 – Professors or Teachers with overseas teaching experience and one or more degrees received abroad
Group 3 – Chinese or Taiwanese professors teaching at the University of Central Florida
Group 4 – Chinese or Taiwanese Instructional Systems students at the University of Central Florida

Note: This question was modified for Group 4 to read: "Now that you are a student at UCF, how are you taught and what values do you get from your instructors?"

Current and Anticipated Results

This is a longitudinal study in that, as time and financial resources permit, the data collection will continue until there is a balance in intra-group findings. Thus far, we have obtained two interviews in China, both of which are from Group 1. It is hoped that in November 2002 an additional six or eight subjects from China will be interviewed, three of whom will be in Group 1 with the remaining five to be in Group 2. We have interviewed 10 from Taiwan in Group 1, and three from Group 2. The remaining two from Taiwan in Group 2 will also be interviewed in November 2000. Groups 3 and 4 will be interviewed during December 2002.

Following is a sampling of some of the interviews conducted thus far. They are summary statements arranged according to categories that will eventually appear in the matrices being developed.

Data Analysis and Results

What it was like when I was a student is included in the first section and five key points were identified. They are educational media, deification of the teacher, one way interaction, transformation in the college, and normative influences.

Educational media

Most of educational media employed included chalk and board, pictures, and tape recorders. A Shanghai interviewee from Group 1 (who has no degree from another country) stated:

> *"In the 50's young people began to learn English, but these teachers were very few. So I was taught by lots of old teachers from a different era...they just teach by the book and prepared lessons by themselves. There were very few tape recorders. We listened to the teacher read and we have very few questions."*

In the past, educational media was not as popular as it is now. A faculty member with an Ed.D. from an American university added:

> *"In my time, they didn't have multimedia, video; the only thing we had was a Studio Classroom...on the air. Students could listen to the radio. Now the students in Taiwan are very lucky in that they have lots of professors and teachers from U.S. with majors in TESL. We had chalk and board."*

There are no major differences found between Group 1 and Group 2 in terms of educational media used, which is not to our surprise. As technology evolves, more educational media are anticipated and expected to be employed in the organizations and institutions.

Deification of the teacher

The role of a teacher was deified and amplified due to its tradition (i.e., Confucius teachings). Teachers were treated as an authority in knowledge, values, and life experiences. A department head with 30 years experience said:

> *"I went to a national normal university in Taiwan. The school was the only institution at that time to prepare any individual for being an effective teacher. During my studies there, I was taught to be disciplined. I was not allowed to be a rascal. I was taught about professionalism. I was not allowed to do what students of other schools did. It was close to being military training...When I was a student, I thought teachers were strict and tough. I felt they were frightening, even more than my parents..."*

Regardless of how sufficient their knowledge and skills may have been, individuals were taught by parents to be obedient and humble before teachers and they were required to look up to their teachers. Mr. Lin, an interviewee who is an education commentator and had resided in the States, recalled what he had experienced as a child:

> *"What I was taught when I was young was of course in the style of Confucius. We were taught all the Confucian values. Like, we should respect our teachers. We should be humble. We should not speak too much. Just listen, don't talk too much. And don't try to raise too many questions; because some time we will think that you are not so humble to your teacher and we will train you in such a way that silence is God. Don't talk too much."*

As a result, teachers were among the top of the social hierarchy. Their teachings were like truth. Maybe that is one of the reasons why Confucian teaching remains one of the classics and must-reads for the educated.

Interaction

One-way interaction between instructors and students was common. The instructors lectured and students listened carefully and bore in mind what was told them. Each of the two parties were held responsible for their own tasks. Dr. Chien, a professor of Social Studies Education at the Taipei Municipal Teachers College in Taipei, who received his doctorate at Northern Arizona State University, mentioned:

> *"To be a Chinese student, all the teachers teach the students directly, just use oral teaching strategy. There is no direct response."*

As one may perceive, lecturing was a common strategy employed by teachers in the classroom. Not only were students asked to be good listeners and note-takers, but it was demanded that they retain the information as much as they possibly could. Although it does not sound interactive, students did not fight against the authorities.

Transformation at the college level

Academic freedom in the college was a backlash against conventional teaching. More interaction was found at this level. Richard Wang commented on his college learning:

> *When I studied in the university, it was a free environment. We needed to get information from the library; we needed to share experiences with others. When I entered graduate school, microcomputers became popular in Taiwan. It influenced the learning method, learning environment, and teaching method.*

Mr. Huang, another interviewee from an elementary school in Taipei echoed Richard Wang and said that he was totally transformed in the college:

> *"The instructors played a role of knowledge facilitator…they spared more time for communication between them and students, which is different from when I was in high school…regardless of their high social-economic status."*

His instructors encouraged him to ask questions without any concern. He was required to do research and present in front of the class. This affected him as a pre-service teacher.

Norm

Not only parents and teachers disciplined students and minors, but also society has an had an impact, effecting students' behavior and cognition. Dr. Tsai of National Chin Hua University in Taiwan addressed this issue:

> *"When we were little children, the meaning of being a good student is to work hard, to behave. That's typically the Asian students' philosophy. After we grow up, we got more responsibility. That means you have to do good in your studies and then you can be a useful person. Useful probably means you have to do good things to not only yourself but others."*

Once environmental factors start to regulate students' behavior and way to learn, the influence is to a great degree on habituation with respect to normative influences. Mr. Lin, an educational reformer, would like to "change" the value systems, so as to improve the way to teach and learn for teachers and students. He suggested:

> *"I tried to modify the value system to my students. Those things, which are very good, very helpful or very inspiring teaching methods, I tried to encourage the students to ask questions. You have read the article in "higher education curriculum". I think something is very well…part of it. Not too much. Students were already molded into a certain kind of style of education."*

A huge task like this demands a leader of strong will and much additional support.

What it is like now I am a teacher follows and another five major ideas were represented: strictness and discipline, attitude shift, educational technology, sources of information, and measurement and evaluation.

Strictness and discipline

Strictness and discipline are major concerns to some teachers, especially those in K-12 classrooms. When technical glitches occurred, they had to resolve the problems and manage the classroom at the same time. Students at K-12 levels are not as self-regulated and self-disciplined as those at higher education. The K-12 classroom teachers tended to shorten their distance to the students; however, in the meantime, they would like to maintain their authoritarian role, lest the students disrespect them. Mr. Lee, an elementary school teacher, claimed that:

> *"I was a harsh teacher when I was a cub teacher. I reflected on my own teaching and leading role over time. I will **not** allow my students to get too close to me, because they are still kids and they can easily jump on your head."*

Conversely, another elementary school teacher stated that she loved her students as her children. She always included her daughter as her target audience when designing teaching plans. For college professors, these sentiments are not necessarily an issue.

Attitude shift (teacher-centered to student-centered)

A teacher's attitude toward teaching changes over time. Number of years spent teaching and environmental factors are major factors in this change. A school principal with 40 years teaching experiences suggested:

> *"Over time the role of teachers has changed. Environmental factors play a critical rule in this issue. Students are affected, too."*

How does it change or evolve? An elementary school teacher:

> *"The way I teach is totally different from what my teachers taught. It has been from teacher-centered to student-centered."*

Paradigm shifts result in teacher attitude shifts. Based on the interviews, most teachers appeared passive in dealing with these paradigm shifts.

Educational technology

New technologies are increasingly and continually being introduced. Thanks to these innovations, students are provided with alternative learning experiences. Even though the relationship of technology to learning has been questioned, technology plays a critical role in determining learning and motivation. Mr. Xie of Beijing asserted:

> *"We now use audio video material for teaching. We use audio tapes video tape VCD, DVD, and other software to teach the students. So students can learn by themselves at home or in the classroom, and we use the platform of computer to provide information or knowledge about the computer. If the students want to learn, they can learn by themselves anytime. Also in the classroom we asked students to ask questions. In this way, we have two-way communications. Before we only have one-way communication."*

Self-paced learning is now receiving more acceptance. Teacher attitudes toward technology use may contribute to its popularity. A caveat is proposed by Richard Wang, a faculty of National Taiwan Normal University:

> *"It is a new technology environment including multimedia and the Internet. I like to teach my students and discuss with my students on the Internet. Teach effectively and learn well and happily. In attaining so, advanced technologies are not really necessary at all times."*

Sources of information

Teachers used to be the only source to knowledge and information. Advanced technology allows learners to discover and construct knowledge by themselves. An elementary school teacher provided insight relative to this issue:*"I found lectures cannot solve my questions completely. That is why I spare more room for students to explore and discover the answers to their own questions."*

To assist learners in discovering and constructing knowledge, Dr. Margaret Chang employs a variety of strategies. She believes:

> *"I taught them how to write a research proposal with an abstract. I ask them to use the methods we have talked during the class. They can pick whatever topic that interests them. They have to discuss their thinking with other senior students and graduate students or their instructors."*

Measurement and evaluation

Affected by the previous key points, measurement and evaluation strategies are being altered. Traditional measurement like paper and pen tests is losing its dominance. Alternative assessment is coming to the surface. Dr. Sofen Chen, commented on this topic:

> *"In my class, I used a lot of group discussion and a lot of team work. I probably only use part of the class time. For the rest of the class time, they discuss and present. I used syllabi from the States and they helped me a lot. Those materials influenced my measurement and evaluation."*

Western influences (i.e., syllabi) become salient in instructional pedagogy of the East in this case. Students are measured at both individual and team levels. Collaboration and coordination were foreign to the culture of long ago, but now the antecedents of that ancient culture have been deeply immersed in the new strategies. We hope that further research in these areas will bring together the values of both cultures, for both must be nurtured.

Summary and Conclusions

It is hypothesized that there will emerge a reflection of Confucian pedagogy across all groups but that its importance will reflect the current environment wherein the subjects are located.

It is hypothesized that a value set will emerge across groups that reflect Confucian pedagogy with a consistent series of key words that identify specific teaching and learning attributes. The words and phrases we have included in the draft matrices are a partial reflection of the data now being analyzed.

The knowledge gained from the interviews will provide a past, present and most likely future portrait of the relationship between Confucian pedagogy and the needs of our UCF Chinese students.

The conclusions reached may have parallel meanings for other students from Africa, Europe and Latin American wherein similar pedagogical hierarchies exist.

The research will then provide the basis for proceeding with Stage II of the research, assisting teachers in China and Taiwan in adapting to Ministry of Education edicts that English as a Second Language and computer competencies be taught in the public schools. This stage and the ramifications of development of a symbiotic pedagogy matrix for Confucian concepts married to technology constructs will be discussed in subsequent presentations Indeed, perhaps Alishan Mountain may just be nudged…a little bit at a time.

We view this research as being in its infant stages, with years of further work ahead of us. We are not unmindful of the sensitivity of our undertaking. We are especially concerned that our actions do not "change these Chinese students to the extent that, upon their return to their home environments, their effectiveness has been culturally emasculated" (N. Ying, personal communication, April 4, 2002). Conversely, Chin-Ning Chu, in his work, *Thick Face, Black Heart* (1992), commenting on how one follows rules of what is right or wrong, states:

> We seek an understanding of ourselves so that we will know what we ought to do in any given situation. You will gradually replace the beliefs you were taught with the truths you discover. It is not whether you turn the other cheek that is important. *Why* you do or do not is most significant (p.37).

These two points might appear diametrically opposed to one another but even here there is symbiosis to the one who looks more deeply into these statements. We are beginning to understand far more about what our Chinese students are thinking and how they process the information we provide them. The degree to which we either proceed toward cultural/intellectual emasculation or redefine what is "right or wrong" remains to be seen; indeed, our research must be conducted with the utmost sensitivity and tact; of this we are very well aware. Our proposed solutions are numerous; some have been tried and proved helpful; a few have failed; others are being tested at this moment.

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Building an Online Instructional Design Community

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Abstract

The field of Instructional Design is changing rapidly, and it is becoming increasingly difficult for designers to stay abreast of the research and evaluation studies describing those changes, not to mention the more informal developments that arise from one designer sharing a new technique or idea with others. A design team at Brigham Young University, in cooperation with AECT, is attempting to make the latest practical knowledge associated with online learning easily available to all designers through the development of an online community. This paper will discuss the origin of the site, its development, its future, and the daunting challenge of designing for designers.

Introduction

One of the challenging aspects of the field of Instructional Design is that it is constantly changing. Many of these changes appear in research articles or evaluation studies while others emerge in less formal ways, e.g., when one designer shares new techniques or ideas with another designer. Either way, it is often extremely difficult for designers to wade through all of the available information to find the practical knowledge they need to complete their projects. The research literature requires too much time to comb through, the cross-institutional collaboration too much time to develop. To stay abreast of the latest knowledge associated with online learning, instructional designers need a central point of contact, a place where they can go for practical solutions to the problems they face every day.

Such a place is currently not available. There are numerous online journals and discussion boards, not to mention countless online course syllabi and instructional design tutorials. However, none of these has organized the information into a complete and usable community of information, nor do they provide the personal connections that are most valuable. Those who have tried have diversified the available information to the point that is no longer practical. Certainly, none has been fully embraced by the international instructional design community. Thus, designers continue to reinvent processes and techniques that others have already mastered.

The Instructional Psychology and Technology Department at Brigham Young University, in conjunction with AECT, is attempting to bridge the knowledge gap by creating an online community of instructional designers, developers, and other educational technology professionals. The resulting site will allow designers to share ideas and techniques with and ask questions of other designers and professionals from academia, the military, government and the corporate world. The site will be a community where designers, developers, academic faculty, students, and others can build relationships with their peers and share valuable knowledge with one another regarding the practical, everyday implementation of instructional design. We have named the site the Instructional Design Exchange Area (IDEA), emphasizing the fact that it is to be a place where ideas and practices are shared as we strive to improve our profession and our field.

Designing for Designers

The true and daunting challenge of building this site is that of designing for designers. What information will be most useful for the practitioner? What tools will facilitate the interaction and relationships that the site hopes to foster? How should the site be structured in order to encourage participation and assist the practitioner in finding the most valuable information? What colors and fonts should we use? The last question may seem funny, but it is a frightening proposition when designing for professional designers, especially those with a particular interest in typography!

Cliff Figallo, a former leader of the WELL in San Francisco, stated that, “It’s my belief that a community should be a practical and useful thing for people to join” (3). We have attempted to make this site as practical and useful as possible, and initial reviews indicate that we are on the right track. We went through several iterations to get where we are now, however. The original idea for the site centered on a discussion board in which designers could ask and answer questions about how to *do* things. The project snowballed, as projects often do, until the site began to look like ERIC with a discussion board on the side. The argument for this structure was that designers need access to research in order to be able to ground their work in sound instructional theory. This was a good argument, but the resources to find that research already existed while this site was supposed to be unique and practical. Etienne Wenger, et al's book, *Cultivating Communities of Practice* dramatically altered the course of the design work. They said, "Community leaders are sometimes tempted to strengthen the community by increasing the amount of material on their Web page, making it a full library. Although populating a database is useful, feeling related and responsible to other community members is a far stronger force for increasing participation and aliveness" (Wenger, 133). We realized that we needed to change the structure of the site in order to make it useful and to encourage the development of a community.

Another design round resulted in a more practical site which was geared mainly toward new designers and students. It contained best practices, some research articles, and guidelines for developing instructional products as well as areas for product reviews and discussion. After a review by Dr. Allison Rossett of San Diego State University, however, the site was once again revised to bring innovation and the more practical features to the forefront. This design and revise cycle has concluded in a site that we feel is very practical and very useful.

A total of 27 individuals have reviewed the prototype of the site that is currently online. Their reviews and comments are encouraging and we have received some excellent suggestions. When asked how useful the site would be to them on a 4-point scale (1-not at all, 4-extremely) the average rating was 3.3. Using the same scale, the site received an average rating of 3 for innovation. While we recognize that there are definite improvements to be made, these results encourage the team to proceed in developing the site. The following quote from one site reviewer identifies both the enthusiasm and the concern of prospective users: "If you stick to your focus of instructional design for the web- emphasizing problems and solutions- you'll definitely be high up on my Favorites list."

Being that IDEA will be a community for Instructional Designers, the design team felt that it was necessary to follow an instructional systems design model. The team developed a protocol that deviates slightly from the standard ADDIE model, calling it the ADEPT model of instructional design. This model includes analysis, design, evaluation of a prototype, production, and testing and implementation. The team felt that the inclusion of a prototype phase was vital not only for IDEA but for many instructional design projects. At the time of writing, the team has worked through the analysis and design phases and is completing the evaluation of the prototype. The development of the site will be cyclical, with further evaluation of a more advanced prototype resulting from the work done thus far.

The team also researched the development of online communities to ensure that accepted methods and tools were considered. The remainder of this paper will follow the definition of community given by Dr. Jenny Preece:

"An online community consists of:

- *People*, who interact socially as they strive to satisfy their own needs or perform special roles, such as leading or moderating.
- A shared *purpose*, such as an interest, need, information exchange, or service that provides a reason for the community.
- *Policies*, in the form of tacit assumptions, rituals, protocols, rules, and laws that guide people's interactions.
- *Computer systems*, to support and mediate social interaction and facilitate a sense of togetherness" (10).

Each of these community components will be discussed in detail below including how they are being cultivated in the IDEA site.

People

While academic faculty, developers, administrators and others are welcome to participate and will find the site useful, IDEA is intended for practicing Instructional Designers. This distinction was made in order to design the site to be as useful and practical as possible. The idea for the site came from a realization that designers are having to reinvent the wheel as they attempt to design the best possible online learning. Lacking a central location to ask questions, discuss ideas and see examples of others' work, designers work independently and, often, parallel to each other in solving instructional and technological issues. IDEA will provide Instructional Designers with a community where they can communicate with each other and assist one another in solving problems and working with new technologies.

The first step after deciding whom the target audience would be was to determine what their needs were and whether or not they were interested in the site concept. As stated by Figallo, "Knowing the needs of your target users is where your design work should begin" (148). A brief online survey was drafted to determine how professionals in the field spend their time, whether or not they were interested in the site, and what types of information they might like to have available.

Instructional design professionals in both academic and corporate settings were invited to participate in this survey. A total of 307 invitations to participate were distributed via email to one representative at each of 145 companies and 33 higher education institutions, along with 65 alumni of Brigham Young University's Instructional Psychology and Technology Department and 64 alumni of Utah State University's Instructional Technology Department. The invitational email message included a description of the project and an invitation to forward the survey to co-workers and others in the field. Hence an exact return rate is difficult to determine. We estimate that 30-40% of those who received the message actually responded.

A total of 142 individuals completed the survey. Respondents represented the full spectrum of experience in the field, from 0 to over 20 years of association. The average length of time spent as an instructional designer was 7 years, with 10 respondents indicating over 20 years of experience in the field.

Across all participants, the most time is spent in original design work (23%). The next largest percent of time (22%) is spent in project management or administrative responsibilities, followed by meetings (14%) and research (12%). Additional time is spent in product reviews, development, teaching and overhead functions. Responsibilities in marketing and consulting were also mentioned. A very small proportion of time (2%) was attributed to "other" responsibilities including analysis, implementation, and evaluation. Of course, the above numbers are an average of the time spent by all participants. The numbers vary slightly when divided by job title. Instructional Designers spend a larger percentage of their time doing original design work, while Faculty spend more time researching and Administrators listed supervisory responsibilities and other associated duties as receiving the majority of their attention.

Next, participants were asked to rate 10 types of information based on their usefulness on a standard Likert scale — 1 being not helpful, 5 being very helpful. Respondents indicated that best practices (mean rating 4.2), research articles (4.1), and web links (4.0) would be the most helpful with online discussion and an online display case also rating quite high (3.9 and 3.8, respectively). Least helpful by far (2.0) were hardware reviews.

When asked which format they would prefer the information to be in on the same 1-5 scale, a website was rated highest (4.6) and a newsletter lowest (3.1). Some participants suggested additional formats, including round table discussions, case studies, and web casts. Most appear to prefer a website backed by a searchable database.

The most encouraging information gleaned from the survey was that referring to interest in the site. Survey participants were asked to indicate their willingness to review and/or test the resulting product as well as their willingness to contribute to that product. A full 85% indicated a willingness to assist in testing, while 75% said they would contribute to the finished site. Considering the broad spectrum of participants and the constant demands on their time, these numbers are very impressive and encouraging. They seem to suggest that such a website is needed in the educational technology community.

Overall, the reaction to the site proposal has been quite positive. One participant responded to the email in the following way: "This is an excellent idea. I have been researching the topic of building a community of practice on the web, and have been wrestling with the issue of how to get people to participate beyond the first few days of excitement. Finding out what is useful for people with a survey is certainly one of the first steps!"

The main problem with building an online community for instructional designers is that designers' time is limited. A central component of a community is participation. "The community element is critical to an effective knowledge structure. A community of practice is not just a Web site, a database, or a collection of best practices. It is a group of people who interact, learn together, build relationships, and in the process develop a sense of belonging and mutual commitment" (Wenger, 34). By populating the site with current and useful information, providing a network of able peers, and allowing practitioners to share their insights and work with others, we believe that designers will embrace the site and make the community successful.

Purpose

The Instructional Design Exchange Area is intended to provide instructional design practitioners with:

- a centralized resource of timely, practical, and foundational information about their field,
- a forum for the ongoing discussion of ideas and solutions to real world situations,
- an opportunity to share the results of their work,
- and access to ongoing, online Instructional Systems Design briefings and instruction.

IDEA will offer a wide array of tools and resources for designers. For those new to the field, the site will offer guidelines and best practices to assist in orienting them to the profession. Current research will also be available so that designers can ground their practice in theory. The site will not, however, become a library of instructional design research. Other sites, such as ERIC, perform that function very well. Instead, IDEA will focus on what's current and how it affects the practice of instructional design.

Most importantly, it will be a "place" where designers can gather to discuss ideas and difficulties and to build relationships with others in the field. While information the developers post on the site will be useful, it is not the lifeblood of the community. "[W]hat energizes the potential community is the discovery that other people face similar problems, share a passion for the same topics, have data, tools, and approaches they can contribute, and have valuable insights they can learn from each other" (Wenger, 71).

The site focuses on three areas: Innovations in Online Learning, Forums & Event, and Tools. These areas will be the center of activity for the community. The first is Innovations in Online Learning. The purpose of this section is to provide a forum where site members can display their work, offer insights about new and different ways to perform instructional design tasks, and discuss the leading edge of the field. It will include a section for "Innovators" where individuals in the field who have demonstrated leadership and creativity will be profiled. Cutting edge research will also be available in this section, and designers will be able to showcase their own innovative projects in the online display case. New design and development tools will also be reviewed and links to other resources will be available.

Forums and Events will be the community message board. In the forums area, designers will be able to ask questions and discuss the latest hot topics in the field of Instructional Technology. They will have the opportunity to make contacts and build relationships with peers all over the world. The need to reinvent the wheel will be reduced as designers share their strategies and solutions with one another. The events area will provide a calendar of activities not just for the IDEA community but for the field at large. Online chats and webcasts will be listed alongside international conferences, calls for papers and seminars.

The Tools section will contain descriptions, reviews, and forums of the latest software tools in the industry, allowing designers to learn about new software and other technology tools that may improve their projects. Designers will also be able to share ways in which they have used or manipulated tools to solve their design problems. This area will be a very valuable resource as designers consider purchasing options, particularly as we move toward standardization.

There are three other sections of the site that are more focused on the basic principles of instructional design. The first is Instructional Systems Design. This section of the site is intended to provide best practice guidelines, tools, examples and peer advice to support the Instructional Systems Design and Development Lifecycle. It follows the ADEPT model of instructional design mentioned above, but the information is relevant to all design models. This is an excellent resource for new Instructional Designers, particularly those without formal training in the field. The section titled Applied Theory and Research will provide centralized access to research and thinking relevant to the field in order for practitioners to be able to ground their practice in foundational principles. It is also intended to act as a focal point for identifying applied examples, expanding and clarifying current research, identifying needed research, and forming research collaborations. The final section, Evaluation, strives to encourage designers to implement evaluation practices into their projects by providing guidelines and tools.

Policies

All sections of the site are intended to be open to growth and change. We have already received suggestions for expansion and clarification and the site will continue to develop with the field. While the site will receive support from Brigham Young University and the Association for Educational Communication and Technology, much of the responsibility for contributing content and ideas for expansion will rest on the users. This decision was made for two reasons. First, "If content is supplied solely by the site provider, even if it serves focused interests, it loses its claim to community" (Figallo, 45). The site was intended to bring practitioners together to solve common problems and share cutting edge information. If the developers were to provide all of the information, designers would not feel a need to share their knowledge and expertise and the site would fail.

Secondly, the practitioners are the ones who really know the issues of concern in the field. They experience the real-world implications of technological advancements and theory implementation every day. They know where the field is and where it is headed. Who better, then, to decide the structure and content of a site that is meant to be useful to them? The site will allow two kinds of opportunities for practitioners to contribute to the site.

The first and most basic way for practitioners to contribute to the site will be to submit information. This information can range anywhere from comments on the discussion board to suggestions for new content areas to research and project demonstrations. All areas of the site will be open for users to contribute relevant content. "By assigning responsibility to the practitioners themselves to generate and share the knowledge they need, communities provide a social forum that supports the living nature of knowledge" (Wenger, 12).

For those willing to become more involved in the site, they will have the opportunity to take stewardship over certain areas of interest. These "content stewards" will be responsible for running discussion boards, organizing site content, soliciting informational contributions, and organizing events. Wenger, et al, stated that "All communities of practice depend on internal leadership, but healthy communities do not depend entirely on the leadership of one person. Leadership is distributed and is a characteristic of the whole community" (36). By allowing the practitioners themselves to have leadership roles, we hope to encourage participation and the constant evolution of the site to fit the needs of the designers.

By keeping the content current and relevant to the designers, the site will continue to be useful and the community will grow. As stated by Figallo, "Content that doesn't change with the times and the sophistication of the audience will soon be ignored. But content that is updated and improved to meet the changing needs and increasing knowledge of the audience will remain a compelling attraction" (92).

Systems

Wenger said that, "What allows members to share knowledge is not the choice of a specific form of communication (face-to-face as opposed to Web-based, for instance), but the existence of a shared practice—a common set of situations, problems, and perspectives" (25). While this assumption is at the heart of the site's purpose, it is also true that the proper tools can facilitate and encourage purposeful participation. The design team is currently researching the best tools to use in developing the actual site. The existing prototype demonstrates the content structure and possible functionality of the site but is not yet operational in most of the core capabilities such as discussion, search and data storage.

The choice of a discussion tool has been one of the hardest to make as there are literally hundreds, if not thousands, of products available, all with different feature sets and pricing scales. The team is also considering building a new tool a la Slashdot that will have all of the required functionality. A more time - and cost-effective approach, however, seems to be to adapt an existing system for use within the Exchange Area. Core requirements of the forum tool (many of which are reflected in the rest of the site) include self-registration, a content rating system, distributable moderator features, and the ability to set preferences. The leading contender at the moment is DiscusPro, but the team has not yet had the opportunity to test this tool and therefore has not made a final decision on its use.

One element that the developers feel is essential for the success of the community is an efficient search mechanism so that practitioners can find the information they need quickly. A generous donation by WexTech has provided the site with AnswerWorks, a cutting edge real-language search engine. All site content will be defined working within the framework of AnswerWorks technology in order to maximize the tool's ability to automatically generate content summaries and FAQs. This tool will make all of the information on the site easily accessible for practitioners.

Other system considerations include the type of server and database to use and whether or not tools for synchronous communication (chat and webcasts) and tailored content suggestions based on interest profiles will be added. All of these decisions will be made when the development team is complete.

Conclusion

Designing the IDEA community has been an interesting and exciting challenge. Creating a website for any professional group is a difficult task, but designing for designers has proved to be both rewarding and nerve-wracking. The IDEA design team has attempted to follow both a sound instructional design model and an accepted protocol for online community development. Issues such as typography, chunking, sequencing, and motivation have also been considered in depth. While these issues may be common in website design, they assume greater significance when the site audience specializes in them. The team has received both criticism and praise in all of these areas, and we are encouraged to proceed in developing the site. Many of those who have had the opportunity to review the site have expressed appreciation for inclusion in the review process and we hope that all practitioners will embrace the opportunity to make this site useful and interesting. Furthermore, while we have received many suggestions for improvement, the overall reaction to the community has been positive. Look for a fully operational version of the site in late spring 2003.

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Constructing Learners in 3D: An Investigation of Design Affordances and Constraints of Active Worlds Educational Universe

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Introduction

During the past decade, a proliferation of new and emerging technologies have been designed and adapted as environments for distance learning. Among the more interesting contenders of adapted technologies are three-dimensional (3D) virtual worlds. Three-dimensional virtual worlds can be roughly described as networked desktop virtual reality. While there are a variety of applications, typically most provide three important features: the illusion of 3D space, avatars that serve as visual representations of users, and an interactive chat environment for users to communicate with one another. Although most 3D virtual worlds have been designed primarily as social and gaming environments, one 3D virtual world application, Active Worlds, has delved into the educational arena by creating the 3D virtual universe, Active Worlds Educational Universe, devoted solely to education.

While 3D virtual worlds are a relatively new technology only recently being explored for use as distance learning environments, studies of text -based or chat virtual communities have provided compelling views of how technology influences the representation and social construction of users in a computer-mediated environment (Bruckman, 1997; Riner 1996; Turkle, 1995). Like text -based chat communities, 3D virtual worlds provide users with a sense of presence. Participants can engage in conversation, build, and interact within an environment. Unlike text -based chat environments, virtual worlds afford users a visual representation of place, space, and self that provides users with a sense of immersion and embodiment in the environment. While virtual worlds do provide a sense of embodiment, it is important to note that this embodiment may be encoded with values and beliefs not readily apparent to users. Research into race, ethnicity, culture, and gender in virtual communities argues that virtual communities are embedded with values and hidden assumptions that promote the interests of some users, while marginalizing other users (Bailey, 1996; Balsamo, 1994; Branwyn, 1994; Cherny, 1995; Dibbell, 1994; Milthorp, 1996; Morningstar and Farmer, 1994; Stone, 1995; Todd 1996; Turkle 1995). While new technologies offer more options for distance learning, it is important that researchers, educators, and practitioners be aware of how an application may construct a user/learner through the values and hidden assumptions encoded within an application (DeVaney, 1993).

Purpose of Study

The purpose of this study is to investigate how the design affordances and constraints of Active Worlds Educational Universe impact the construction of learners and the culture of an educational three-dimensional virtual world setting. Specifically this investigation will examine affordances and constraints that impact: (a) presence; (b) individual and collective representation; and (c) embodiment. The context of this study is Active Worlds Educational Universe, a three-dimensional virtual world universe created and supported by the developers of Active Worlds. The goal of this study is to reveal how values and assumptions embedded in the design of an educational application impact the presence, representation, and embodiment of learners.

Theoretical Framework

The underlying question that guides this investigation is how do educational computer programs construct their subjects? Ann DeVaney (1993) first posed this question in an article entitled, Reading Educational Computer Programs. According to DeVaney, questions such as this are important for addressing often neglected culture-bound issues of educational technology. In an era of diversity and inclusion, it is important the educators be vigilant in addressing ways in which educational technology predispose learners to certain actions which may valorize some learners and depreciate others.

Methodology

The methodological framework employed in this investigation is a liberal adaptation of Affordance Theory. Affordance Theory, as described by ecological psychologist, James Gibson (1977), expresses the relationship that exists between an animal (perceiver) and the environment (perceived). The relevance of liberally adapting Affordance Theory for an analysis of a 3D virtual worlds setting is that 3D virtual worlds are simulated environments. The affordances and constraints of the application impact opportunities for how an environment may be perceived.

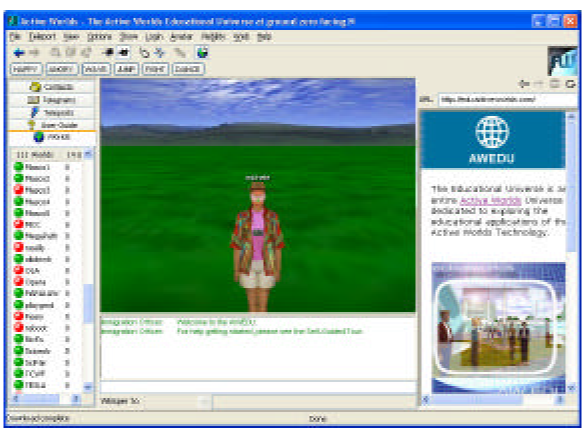
Methods employed in this qualitative investigation include participatory observations (Adler and Adler, 1994), informal interviews (Fontana and Frey, 1994) with learners, developers, and educators of Active Worlds Educational Universe, and interactions and observations with my students using Active Worlds Educational Universe.

Setting

The setting for this investigation is Active Worlds Educational Universe. Active Worlds first premiered in 1995. The client-server application consists of the Active Worlds Universe with over 1000 individual worlds for users to interact with other users worldwide. In 1999, the owners of Active Worlds created the Active Worlds Educational Universe, a universe devoted solely to education initiatives. The Active Worlds Educational Universe (AWEDU) affords user-extensible provisions and support for building new worlds and adding to existing worlds. World owners are free to define and customize their world in whichever way they choose by selecting objects from the AWEDU object library or by adding custom built objects.

The AWEDU browser interface is comprised of four main scalable windows which include a 3D environment; a chat dialogue window; an integrated web browser; and a window for added navigational and communicational functions (see Figure 1). The 3D environment is the primary setting for interaction. Learners represented as avatars, move and interact with each other and the environment by either moving their mouse or by using arrow keys on their keyboard. Directly beneath the 3D environment is the chat window. Communication is limited to text messages which are display both above the speaker's avatar in the 3D environment and in the chat window below.

Figure 1. The Active Worlds Educational Universe browser.



Findings and Analysis: Presence/Attendance

Initially this investigation examined how the learner was constructed by focusing on three categories: presence, representation, and embodiment. Initially presence was determined by looking at the affordances and constraints of hardware and software requirements, skills necessary to participate, and language accessibility. However, as this study progressed, the categories that are emerging are not as first believed, but rather representation and embodiment are all elements that construct the learners Presence. The category initially labeled as presence now seems more aptly described as attendance.

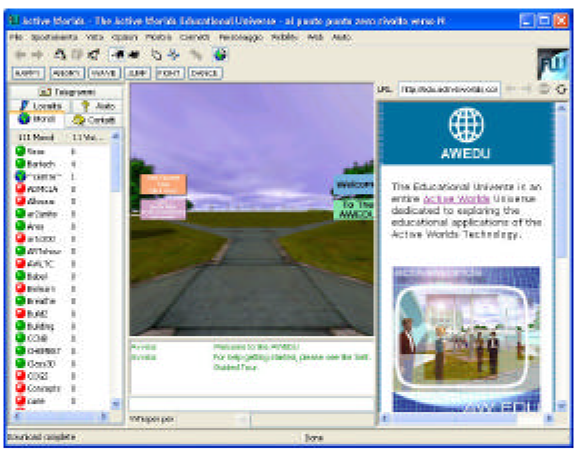
Findings

There are various affordances and constraints that impact a learner's attendance in the world. Hardware requirements include: Pentium 200mhz or equivalent, 64MB RAM, Microsoft Windows (95- XP), and DirectX 3.0. Currently there is no MAC version; however, Active Worlds Educational Universe is accessible on a Mac running Virtual PC. While there are few skills required to participate within the Active Worlds Educational Universe, basic skills required would include the ability or access to someone who can download the application from a website and install it.

Learners are constructed by language both in AWEDU and in the documentation. AWEDU is one of the few 3D virtual worlds to support many languages. While English is most often observed in some of the more commonly visited worlds, it is by no means the only language used. Depending upon the time of day and location, English may not be observed being used at all. The AWEDU browser supports the following languages: Spanish, Danish, English, Dutch, French, German, Finnish, Italian, Hungarian, Norwegian, Portuguese, and Swedish. Despite language support, some of the browser features remain in English (Figure 2.). English is also the primary language used for documentation. While there are provisions for multi-language support, clearly some knowledge of English would be an advantage for learners in this environment.

While the AWEDU browser officially only supports a select list of languages, it is not uncommon to find many other languages being used in various worlds including both Japanese and Russian. Additionally, since many languages use the same alphanumeric system as is used in English, many more languages are used than are represented by the browser.

Figure 2.The Italian language version of the AWEDU browser.



Analysis

Learner attendance is constructed by way of the hardware, software, downloading skills, and language. Learners must have access to a Pentium computer and have Internet access. In addition learners must possess the skills to be able to download an application and load it on a machine. This means the learner must also have the language skills to read the instructions or have access to a translation.

Learners' construction is impacted by language accessibility both in AWEDU and by access to documentation. Although the AWEDU browser supports multiple languages, the languages supported reflect primarily Western, European languages. Equally important to note is that not all functions are translated. Learners still to some extent must have English language skills or have access to a translation.

Findings and Analysis: Individual and Collective Representation

In AWEDU learner representation is constructed in various ways. The identity of the learner is essential forrecognition, while avatars serve as the visual representation of learners in the 3D environment. While these twoelements comprise and impact the direct construction of the learner, the environment also plays a strong role by illustrating world views displayed in the setting.

Findings: Identity

In real life, identity is often tied to some physical aspect of an individual. Appearance, facial features and voice are among the means by which we distinguish one another. In the AWEDU environment, these physical cues are not available. Learners are not recognized by voice, or by their appearance, but instead must rely on unique identities to identify one another. Within the Active Worlds Educational Universe registered users may select a unique identity. This identity/name may not be used by any other leaner. This provision allows learners to recognize and contact each other. A learner's unique name appears above his/her avatar the first time he/she uses the chat tool during a session. If the learner wishes to remain anonymous or lurk, not "speaking" will insure anonymity.

With a unique identity, learners may have extended communication options such maintaining a contact list which allows them to identify when another learner on their list is currently active. The may also send and receive telegrams from learners currently inhabiting other worlds. Although learners have the option of changing their unique name, any name change will be reflected in other learner's contact lists.

Analysis: Identity

A unique identity brings both privileges and accountability. It allows learners to establish both reliability and consistency in both the personal and social arena. Learners can build, develop contact lists, send and receive telegrams. This is important for establishing a degree of trust among learners. Along with the privileges of a unique identity comes a degree of accountability. Within a system where learners adopt alias identities a unique identity prevents learners from impersonating one another. In turn, this affords learners with some degree of self-governance among learners. The accountability established by a unique identity can also impose inverse limits on well meaning learners. Once a learner establishes a unique identity and other learners may add him/her to their contact list, any subsequent changes in his/her adopted identity will be reflected on the other learners' contact list. Initially this may not seem to impose limitations on how the learners represents themselves; however, in an environment where learners are free to re-construct themselves or develop alternate personae this can prove constrictive.

Findings: Avatars

The creators of AWEDU define "avatar" as "the visual representation of people who currently inhabit the virtual environment. In an AWEDU world, avatars serve not only as the visual representation of a learner, but also as the camera into a 3D environment.

AWEDU provides a stable of avatars that world owners may select and make available to learners visiting a world setting. Learners are limited to selecting from avatars provided by world owners. Because of the limited range of avatars, many learners may use the same avatar within an environment. Consequently, learners must rely upon the unique identify to identify other learners.

With few exceptions the AWEDU avatars represent young, fit, Western, Caucasians. There are more male avatars than female, and it is interesting to note that there is a greater range of body types, sizes, ages, and styles of male avatars than female. Within the selection of female avatars, there is little variety in size, weight, age, ethnicity, and race. Most of the female avatars represent young shapely women with either snugly fitting clothing or short dresses and high heels. There are also no avatars representing differently-abled persons. There are, however, a few alternatives for learners not wanting to be represented as humans or as a gender typically in the form of a bird or alien-type caricature.

AWEDU allows world owners to create and import custom-made avatars; however, creating an AWEDU avatar is no small feat, nor one easily accessible to many learners. Creating an AWEDU avatar requires a basic knowledge of 3D concepts. It also requires that a learner be fairly proficient with creating Renderware (RWX) objects or in using 3D modeling software such as Caligari's Truespace.

Analysis: Avatars

For most learners there is little opportunity for creating custom avatars. With the exception of world owners, learners are confined to using one of the prefabricated avatars provided by an individual world. For visual representation, learners must rely on avatars that may not reflect their personal values, culture, ethnicity, or physical bodies. The avatars are primarily idealized representations of young adults that clearly reflect Western body-image values.

Findings: Environment

Initially it may seem incongruent to include environment as a component in learner representation. However, in AWEDU while various factors may limit or prevent learners from creating and using custom-made avatars, many worlds provide opportunities for building within worlds. AWEDU is a user-extensible system which allows learners to add to and build within a world setting. Depending upon provisions determined by the owner of a world, learners can claim property by placing ground covering on a section and build. Once a piece of land is staked or covered by a learner, no other user may build on that land, or above and below it. To build or add to property claim, a learner merely chooses from a selection of pre-fabricated objects that exists in the object library and places the object in the desired location. The objects in the library range from a variety of building materials such as walls, doors, and windows to specific items such as televisions, glasses, and cars. There are also a full range of objects such as flowers, trees, grass, and bushes that allow users to create an outdoor setting as well.

Analysis: Environment

Throughout most of the worlds in the AWEDU, are elaborate buildings and roadways constructed by learners and developers. These environments sometimes reflect places that exist in the physical world, and sometimes border on fantastic. One question worth asking is why is there a need for buildings and roads? In life, buildings serve many purposes, but primarily they offer us shelter from the environment. In a virtual world setting, there is no impact from the environment. It doesn't rain, snow, and the temperature has no impact upon our avatars. There is no real sun and the ambient lighting never changes. Why have buildings? Why have ground or gravity? The stock objects reflect and anticipate how developers perceive AWEDU will be used. While the provision of stock objects affords an assessable means of building in a world, it also constrains how one might envision a world (Heim, 1998).

The objects provided by AWEDU also reflect values of how nature is to be regarded. While there are a plethora of tress, flowers, bushes and grass to select, it is important to note that there are no weeds, the grass is well groomed, and the trees never shed leaves or require attendance. Nature is contained and controlled. Nature is modeled on a culture in which is mechanized and submissive (Merchant, 1980). The values perpetuated clearly reflect Western values of nature and the environment with no mutual impact on either the environment from the avatars or upon the avatars from the environment. In AWEDU, nature is contained and subservient, and learners are both in control and impervious from impact. Both the types of objects for constructing structures and the objects available for constructing nature reflect also reflect Western values.

Findings and Analysis: Embodiment

It may seem somewhat incongruent to speak of embodiment in a computer-mediated environment such as AWEDU. Although there are avatars serving as representatives of learners, nothing really impacts the avatar. It doesn't get hurt, feel hungry, or become tired. Avatars do not feel gravity or in anyway impact the environment. Despite that lack of kinesthetic cues, surprisingly research reveals that users in 3D virtual world settings often adopt and maintain proximity customs from in real-world interactions (Jeffery & Mark, 1998). Embodiment in AWEDU is constructed by way of animated avatar gestures, actions, and emotions; learner point-of-view and navigation; and kinesthetics and the environment.

Findings: Gestures/Emotions/Actions

In an AWEDU world, avatars are rarely idle. Unless the learner specifically alters the performance settings, all avatars inhabiting a world will cycle through a series of gestures. The gestures are not controlled by learners, but instead are pre-programmed animations which consist of such movements as the folding and unfolding of arms, looking from side to side, looking at a wristwatch (which may not be present), shifting weight, tapping a foot, and patting hair. Some facial gestures include blinking and winking. Learner have no direct control over these gestures, but are limited in whether or not to display them on their own systems.

Learners are only able to command a few emotions and actions of their avatar. The emotion commands might include such emotions as happy (the users avatar jumps up and down), and angry (pointing and shaking hand). Actions that can be controlled by the user include: wave, jump, and fight. These actions are not reflected from the learner's perspective.

Findings: Avatar Point-of-View, Navigation, and Kinesthetics

In AWEDU, the avatar serves two distinct purposes: it serves as a visual representation of the learner and it serves as the camera by which the learner views the 3D environment or scene. Learners have the option of selecting between first person perspective or an orthographic or third person perspective. The orthographic view allows users to see themselves (or more correctly, their visual representations) in 3D. This feature is helpful for choosing an avatar and building within the world. In order for the learners to move through simulated 3D space; it is necessary for the avatar or camera to move. Avatar navigation is limited to moving forward and backward and side to side. Learners may additionally look up and down as well as fly and descend.

There are few affordances that provide for much kinesthetic cues and experiences. Learners' cannot control avatar limbs, and other than navigational movement, very little is reflected from either first-person or third-person perspective. While avatars do not register impact with each other, depending upon specifications designated by a world owner, avatars may register impact upon encountering an object.

Analysis: Embodiment

Learner embodiment is constructed through gestures, emotions and actions, navigation and viewing perspective. From the perspective of cultural kinesthetic or non-verbal behavior it is interesting to examine the implication of some of the gestures that animate learner avatars. In most North American cultures when engaging in a conversation, looking at one's watch, or looking from side to side might indicate boredom or impatience. Additionally, to wink at someone may imply a range of different meanings within the context of a conversation. Although learners have no direct control over gestures, the non-verbal behavior conveyed through gestures may be in direct conflict to what is being communicated through the textbox.

Learners have limited control over actions and emotions. They have the option of displaying an action or emotion; however they have no control over how the action or emotion is displayed. None of the animations are reflected from a first-person perspective but can only be viewed from third-person perspective.

There are few affordances for embodiment in the AWEDU environment. For the most part, learners are prevented from displaying much non-verbal communication but must rely on text to convey emotions. This reliance on text might lead one to assume that the user is limited to text in constructing a sense of embodiment. Embodiment to some degree in AWEDU is relegated to the realm of navigation and proximity. The ability to see other learners and to move around may be sufficient to construct at least a limited sense of embodiment for learners. However, depending upon the purpose for which AWEDU is being used, it may be important to question how the limits of embodiment imposed on the user might limit the types of experiential knowledge that may be gleaned from these environments.

Discussion and Conclusion

One of the considerations that should be addressed by using AWEDU as a learning environment is whose world view is being promoted in this environment? AWEDU is embedded with cultural information and values. Choices made by the developers reflect and perpetuate ontological and epistemological views of the developers and in turn, learners in this environment are constructed by cultural values that may not reflect their own world views. Research into race, ethnicity, culture, and gender in virtual communities argues that virtual communities are embedded with values and hidden assumptions that promote the interests of some users, while marginalizing other users (Bailey, 1996; Balsamo, 1994; Branwyn, 1994; Cherny, 1995; Milthorp, 1996; Stone, 1995; Todd 1996; Turkle 1995) and AWEDU is no exception. To enter this virtual environment requires one to move into Cartesian space; to temporarily accept the notion of a mind/body split (Pryor and Scott, 1993). This temporary acquiescence is a product of Western cultural values and is not shared by all cultures (Todd, 1996). The paradox of the move into Cartesian space is that body hidden or obscured is both liberated and repressed (Stone, 1995). Learners are both emancipated from physical-bound representation, yet a new construction of self is filtered through technology.

AWEDU is a product of a Western ontology which is reflected in both how the learner and the environment are constructed. The affordances and constraints of the application reveal Western values both in how the learner and nature/environment are represented and by the lack of impact either have upon the other. The purpose of this investigation is not to discount the potential AWEDU might offer as a learning environment, but rather to apply a critical-cultural lens in which to view how this application might impact potential learners. In an era in which inclusion and diversity imbricate education, it is important we challenge educational developers to rethink the impact their designs have upon the relationship between learners and technology. Despite the constraints AWEDU imposes on learners one way in way in which this technology may prove most educational is that it a revealing mirror that reflects both values and assumptions about our culture and all it entails.

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Learning in Complex Domains

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Abstract

We have been successful in prescribing effective instructional strategies for learning in well-defined domains. Yet, we do not know how to design effective instruction for complex domains. Scientific attitude with regard to the design of environments to support learning in complex domains requires measures of learning outcomes in a variety of settings in order to determine what type of instruction work best, when, and why. This paper presents the results of a preliminary study about assessing progress of learning in complex domains. The assessment methodology is based on the use of causal influence diagrams. The domain of application of the methodology is instructional design. The paper concludes with a discussion of implications for instructional design research.

Introduction

An important, yet little understood question remains as how to facilitate learning and promote expertise in complex domains. Our knowledge about the facilitation of learning has significantly increased in the past two decades. Now, we know quite well how to facilitate learning in well-defined domains. However, as the learning goals and situations increase in complexity, our existing knowledge about the facilitation of learning becomes insufficient. Part of the problem is that we do not yet understand how people develop expertise in such domains (Dreyfus & Dreyfus, 1986; Ericson & Smith, 1991).

A number of researchers increasingly argue for the need to address issues pertaining to learning in and about complex domains (Spector & Anderson, 2000; Sterman, 1994). This is an important issue because complex systems exist in abundance in our daily lives. Economy, environmental problems, the spread of epidemics, resource allocation in large project environments, instructional design, and training are all examples of complex domains. Furthermore, the tasks humans face in their daily lives are becoming more and more complex due to the advancement of the technologies involved. Machines are already carrying the routine, procedural tasks, which can be automated. Therefore, with the advancement of technology, humans are now left with the more complex tasks.

Spector et al. (2001) argue that complex domains present the most significant challenges for the future well-being of our species on this planet. This is well supported by Dörner (1996) who states the learning problem most clearly in “The Logic of Failure”. He analyzes several disasters that involved poor human decision-making in complex domains, including the Chernobyl nuclear reactor incident in Russia. His conclusion of that analysis is that those involved were highly educated, well trained, and strongly motivated to do the right thing, yet, they failed. This and other examples in the book clearly demonstrate the need to develop effective strategies to facilitate learning and promoting expertise in complex domains.

Why is it difficult to make good decisions in and about complex domains? Complex domains can be depicted as a collection of many interrelated components or variables. The relationships between these interrelated components are mostly non-linear and fuzzy. Furthermore, these relationships may change over time and may cause delayed effects and uncertainties due to dependency on human perceptions about some aspects of the system (Christensen, Spector, Sioutine, & McCormack, 2000; Sterman, 1988, 1994). Therefore, it is difficult to understand and deal with complex systems (Dörner, 1996; Seel, Al-Diban, & Blumschein, 2000). On the other hand, simple domains do not possess that kind of dynamic relationships. Rather, a simple domain can be characterized by a predominantly linear relationship among its components or variables. Therefore, it is much easier to comprehend how a simple system works.

Advances in educational technology have led to interest in providing meaningful support for learning about complex domains (Alessi, 2000; Spector & Davidsen, 1997; Sterman, 1994). From a research perspective, these domains present the most significant challenges, both for determining factors, which contribute to learning and for designing effective learning environments. There are a number of researchers who believe that we can do better by building on graduated complexity (see Spector & Anderson, 2000). However, there are no well-established methods to assess learning outcomes in complex domains. As a consequence, it is difficult to argue that one approach is more effective than another in supporting learning in and about complex learning. Scientific attitude with regard to the design of environments to support learning in complex domains requires measures of learning outcomes in a variety of settings in order to determine what type of instruction work best, when, and why.

The purpose of this paper is to discuss the results of a preliminary study about assessment of learning in complex domains. The goal of this research effort was to investigate the potential of causal influence diagrams for assessing progress of learning in complex domains. The domain of investigation was instructional design. This study was based on four main assumptions: (1) learning can be characterized in part as the acquisition of expertise; (2) those considered expert in a complex domain tend to produce similar causal influence diagrams for problem situations in that domain; (3) those new to a complex domain tend to produce varied causal influence diagrams for such problems that are noticeably different from those of experts; and (4) different pedagogical methods will be more or less effective in producing desired learning outcomes. The value of this study lies in its potential to demonstrate whether expert instructional designers create recognizably similar causal representations of common problem scenarios. If this can be established then these representations can provide a benchmark for learner progress by comparing how learner representations change through instruction to resemble or fail to resemble expert patterns. As a result we can test the effectiveness of different instructional approaches in facilitating learning, and thus, we can contribute to understanding the development and promotion of expertise in complex domains.

Method

Participants

Six expert instructional designers participated in this study. All of them held graduate degrees (5 with Ph.D. and 1 with master's) in instructional design or a related field. They were employed in academia or in business. Mean age of the participants was 55.5 years. All of the participants had experiences in practicing instructional design and development; teaching ID and related courses; and conducting research in the field of instructional design and technology. The average for full-time experience in practicing instructional design and development was 19.83 years (min. 10 yrs; max. 34 yrs.); for teaching ID related courses, it was 5.33 years (min. 0 yr; max. 15 yrs); and for field research, it was 5.75 years (min. 1 yr; max. 18 yrs). Table 1 presents frequency counts of instructional design activities participants regularly performed in their current job.

Table 1. Frequency distribution of instructional design activities participants regularly performed

ID Activity	Frequency (N=6)	Percent
Conduct needs assessment	3	0.50
Determine solution alternatives and approaches	6	1.00
Propose solutions	4	0.67
Write learning objectives	4	0.67
Conduct task analysis	2	0.33
Identify types of learning outcomes	3	0.50
Assess learner's entry-level skills	3	0.50
Assess learner characteristics	5	0.83
Develop test items	3	0.50
Select instructional strategies	6	1.00
Select media formats	5	0.83
Conduct formative evaluations	4	0.67
Conduct summative evaluations	3	0.50
Manage instructional/training projects	4	0.67

Materials

Materials consisted of three parts: (i) A background survey; (ii) A worked out example including a sample problem scenario and a sample solution for that scenario; (iii) Problem scenario to be worked out by participants.

The problem scenario (see Figure 1) was constructed in such a way that it resembled an authentic instructional design problem. It included design and development of instructional materials on the topic of integrating technology into middle school science teaching to be delivered via the Internet to rural teachers all across the USA within established project specifications.

Procedure

The study was conducted in two consecutive sessions. The first session was an informational session. Biographical information of participants was collected via background survey. Then, a brief description of the second session was presented.

During the second session, the participants were provided with an example explaining the task they were about to undertake. Then, they were given the problem scenario and were asked to: (i) take some time to individually reflect on the problem scenario and provide their assumptions and contextual remarks; (ii) create a representation of the given problem scenario identifying the key factors (such as entities, rates, or processes) and the relationships between the key factors; (iii) annotate each node (factor) and each link (relationship) in their representation by further elaborating on the details; (iv) provide recommendations for the solution of the given problem scenario based on their analysis as reflected in their representations.

Protocol analysis was used to analyze participants' annotated representations of the given ID problem scenario, their assumptions and their recommendations for solution. Three main sources of information were used for the development of the coding scheme: (i) instructional design elements, which emerged from the initial qualitative analysis of participant data; (ii) established elements and activities in instructional design models (for a review of instructional design models, see Gustafson & Branch, 1997); and, (iii) general methods and guidelines suggested by Ericsson & Simon (1984) to develop a coding scheme for protocol analysis. Through frequency counts, the researcher sought for a recognizably similar pattern between the expert representations.

You are the manager of a group of instructional developers and educational technologists at a small private enterprise named *Learning Designs for Fun and Profit, Ltd.* located in the mid-western United States. Your team is working on a project called "Six Simple Steps" that involves the development of a set of six short learning modules on the topic of integrating technology into middle school science teaching to be delivered via the Internet to rural teachers all across the USA. The project team includes a manager (you), an instructional designer, a media and graphics specialist, a web specialist, a subject matter specialist, and a consulting middle school science teacher. The project is currently at the end of the eighth month of a twelve-month effort. There is a bonus of 10% for on-time completion according to established requirements. There is no provision for cost overruns other than renegotiating the contract, which is with a large book publisher.

The completed set of modules is supposed to be ready for a one-week field test at selected schools in six states in two weeks time. Four of the six modules have been completed and have been tested informally within your enterprise. Those four are believed to be ready for the field test. Work has not yet begun on the remaining two modules: (a) Supporting Web-based Collaborative Experiments in Earth Science, and, (b) Conducting Webquests for Science Education. The framework and approach used in the previous four modules are somewhat adaptable and suitable for the remaining two modules. Based on the time and expertise used to develop the first four modules, it appears very unlikely that the team can complete the remaining two modules and conduct an internal test within two weeks. In order to resolve this situation, your task is to first determine what factors are relevant to successful completion of the effort. Based on that analysis, you will make a recommendation to the President of the company with regard to resource allocation to support the completion of the effort.

Figure 1. Instructional design problem scenario.

Results

The analysis of the protocols has consisted of two steps, namely: the examination of participant protocols in search of overall patterns and the coding of events related to those patterns.

The qualitative analysis was guided by the generation of initial research hypothesis to further elaborate on the similarities between the expert responses to the given instructional design problem. These questions evolved through the initial analysis of the protocols. The questions addressed how expert instructional designers approached complex design problem solving task and whether it was possible to graphically represent the common elements in their approach.

Table 2 presents the frequency distribution of resulting coding categories. From the ID process perspective, it was evident that expert instructional designers viewed the instructional design process in its entirety, including all of the design elements (i.e., instructional analysis, design, development, evaluation, and feedback) that are addressed in a generic ID model.

A number of common themes emerged from the expert protocols. These confirmed the findings of the previous studies (Goel & Pirolli, 1989; Perez et al., 1995; Rowland, 1992) on the characteristics of instructional design experts. Experts tried to get a holistic picture of the problem situation, viewed the problem in its entirety, and then they focused on one component of the problem, generated an initial design and evaluated it. Based on the results of evaluation, they accepted, rejected, or modified it. The expert designers then extended the particular solution to other areas of the "whole design" and evaluated it. From the responses of the participants, it was evident in this study that expert instructional designers viewed the instructional design process in its entirety, including all of the design elements (i.e., instructional analysis, design, development, evaluation, and feedback) that are addressed in a generic ID model.

Table 2. Coding categories and their frequency counts

Coding Categories	**Frequency (N=6)**	**Percent**
1. Instructional analysis (includes determining goals and objective; task analysis; target group analysis; etc.)	2	0.33
2. Design (includes sequencing, determining modules, duration of instruction, construction of design templates, test items, etc.)	6	1.00
3. Develop module (includes instructional materials and media)	6	1.00
4. Pilot testing (includes formative evaluation of instructional materials developed, analysis of the pilot test results, and feeding the results of pilot test to improve design template)	5	1.00
5. Client (includes requirements, constraints, flexibility, budget, deadlines, satisfaction, etc.)	3	0.50
6. President requirements (includes requirements, constraints, commitments, and flexibility)	3	0.50
7. Project budget (estimated budget vs. actual costs)	4	0.67
8. Personnel- requirements, expertise, availability (design & development team, SME, pilot test group, etc.)	5	0.83
9. Delivery schedule (estimated vs. actual)	5	0.83
10. Overall design & development time (estimated vs. actual)	5	0.83
11. Outsourcing	2	0.33
12. Team expertise	3	0.50
13. Quality of materials developed	3	0.50

Expert Causal Influence Diagram

Guided by the research question, a second level of analysis aimed at constructing a causal influence diagram (CID) based on the similarities of the expert representations. This stage involved both the analysis of the nodes (factors) and the relationship between these nodes (links) across expert representations. Annotations of nodes and links were used to clarify the meaning attached to these elements by the experts.

Causal influence diagram is a commonly used mapping technique by system dynamics community to represent the casual relationships between the system components (Ford & Sterman, 1998; Vennix, Anderson, Richardson, & Rohrbaugh, 1994; Vennix & Gubbels, 1994). It can be viewed as a kind of concept mapping technique tailored especially for dynamic and complex domains. It visually represents the dynamic influences and interrelationships that exist among a collection of variables. A causal influence diagram consists of a collection of nodes (key factors) and links. The nodes maybe entities that can be counted, such as products or people, or they might be rates or processes that represent how things are changing. An annotated causal diagram has a description associated with each node to indicate the specific nature of that factor. The links connecting nodes are directional to show how one conceives of the causal relationship among the factors (e.g., a rate of change in weight might have a causal influence on blood pressure - the arrow in this case would point from *rate-of-weight-change* to *rate-of-blood pressure-change*). The links are also annotated as either + (SAME) or – (OPPOSITE) to indicate whether a change in the causal factor tends to create a change in the same or opposite direction in the affected factor.

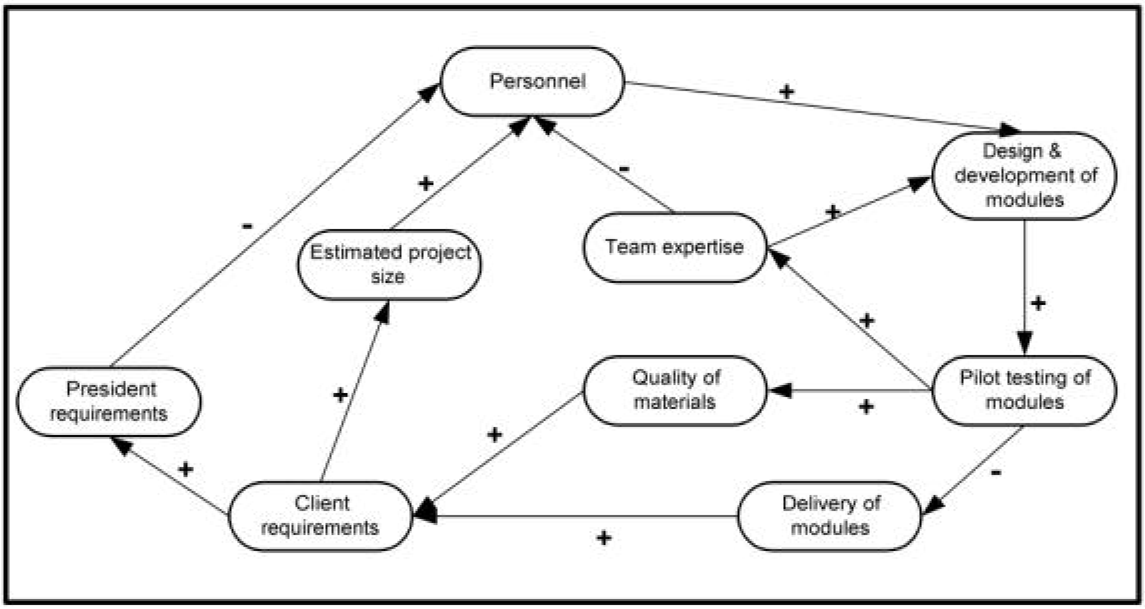

Figure 2. Casual influence diagram developed from the similar patterns in expert responses

Figure 2 presents the causal influence diagram developed based on the similar patterns between representations of expert instructional designers. In a way, this diagram represents the underlying model that expert instructional designers utilize while they are dealing with similar instructional design problems.
According to this expert causal influence diagram (Figure 2), expert's mental model of the key factors and relationships of these key factors in the given problem case can be described as follows: Client's requirements, determines the project size, scope, budget, and timelines. Increased client requirements mean increased pressure on the personnel to meet client requirements. Initial project specifications state the number of personnel that can be hired for the project. As the size of the project increases, so does the required number of personnel. If more personnel are hired then it will be possible to more quickly design and develop the materials. Therefore, one of the recommendations from experts was to try to re-negotiate with the client & the president of the design company to hire additional staff or to outsource some of the design work.

More modules mean more pilot testing. Pilot testing insures the quality of the materials produced, but it also slows down the delivery of the materials. However, pilot testing also contributes to the team expertise. The more pilot testing is conducted, the more knowledge and experience they will have about what works, what doesn't work, and how to design the materials better and quicker. If team expertise increases, the need for more personnel decreases because existing personnel will work faster and better. More materials delivered means more client satisfaction. Another way to increase client satisfaction is to increase the quality of materials delivered. As client satisfaction increases there will be more orders for the instructional design company. In turn, pressure of the president on the personnel will decrease.

Expert Recommendations for Solution

As far as the recommendations for solution are concerned, a number of common themes emerged from the expert protocols. First, experts wanted to examine the whole production process, including resources (personnel, budget estimates, etc.), task division, and production schedule to determine causes of the problem. The second common expert reaction was to analyze the status of remaining resources and other production variables. Based on these two sources of input, experts typically focused on the main piece of the problem (according to their individual judgments), recommended a solution, and extended their solutions to include other pieces of the overall problem.

Based on their earlier experiences, some experts provided a number of rule-of-thumbs (heuristics) that could be applied to the given problem scenario. After the early analysis of the problem, two main approaches were observed. Some of the experts wanted to report this to president and to the client for a possible renegotiation before revising the project management plan. Others did not consider this as an alternative. They preferred to revise the overall project management piece to ensure on time delivery. In order to push the production forward, a number of alternatives were proposed. The most common ones included construction of design templates based on the pilot testing data of earlier modules, reusability of previously developed materials, and outsourcing.

Team expertise also emerged as an important factor in the development process. Experts argued that after the development and pilot testing of the first four modules, the ID team would have the expertise to more quickly finish the remaining modules. The feedback from the pilot testing from the first four modules could be used to improve the design template. By this way, it would be possible to use this template to develop the rest of the modules. If time is of concern, experts suggested not to pilot test the remaining modules. They agreed on that it would be a compromise the quality of the materials, however, they argued that since previous materials were pilot tested and the design template was improved based on the results of the pilot testing it would not be a big compromise as far as the quality was concerned.

Discussion

The goal of instruction is the facilitation of learning (Gagné & Merrill, 1990; Scandura, 1995; Spector & Anderson, 2000; Tennyson & Morrison, 2000). Now, we are fairly successful in facilitating learning in well-structured, relatively simple domains. However, majority of real-life situations are not well-structured. Humans often face complex, ill-structured problem solving situations while performing. Unfortunately, an important yet little understood question remains as how to facilitate learning and promote expertise in such complex, ill-structured domains (Spector & Anderson, 2000; Sterman, 1994)

Spector et al. (in press) propose an investigative design framework for facilitating learning in complex domains. It includes specific instructional methods that can be manipulated in controlled studies to determine which method works best in facilitating learning in complex domains.
An assessment methodology based on causal influence diagrams is at the heart of this design framework. Causal influence diagrams are commonly used in the field of system dynamics to model a complex, dynamic system in a way that helps to understand and analyzes their underlying mechanisms and structures (Laukkanen, 1998). Causal influence diagrams have been investigated (Christensen et al., 2000; Spector & Davidsen, 1997a, 1997b) as an assessment tool in a variety of domains. These studies aimed at determining whether or not expert patterns of thinking about given problem scenarios in complex domains existed; whether novice patterns were recognizably different; and whether or not improvements in learning after instruction could be assessed using this methodology (Christensen et al., 2000). The basic answers to these questions were positive (Spector et al., in press).

This study could be considered as a preliminary attempt to validate the results of previous studies in the complex domain of instructional design. However, there are a few differences between the procedures involved in this study and in the previous studies. First of all, in this study, expert instructional designers were <u>not directly</u> asked to create a causal influence diagram representing the given problem scenario. This was done to avoid any possible confusion that could have aroused from lack of background knowledge with that specific mapping technique (in previous studies participants had been provided with brief a introductory workshop on system dynamics -including CID- or they already possessed the related background). Instead of directly being asked to create a CID, the participants in this study were asked to create a *representation* of the given problem scenario, which includes the key factors (entities, processes, or rates) in the problem and the relationships between these key factors (links). They were also instructed to annotate each node (factor) and link (relationship) in their representations in order to prevent any misinterpretation during analysis and to have a richer set of data with respect to their representations. Furthermore, participants were provided with an example problem scenario, an example solution for that scenario, and an explanation. The example solution included a very simplified version of a causal influence diagram but it was called a *representation*.

Secondly, in this study the participants were asked to provide their assumptions and contextual remarks before creating their representations. This allowed the researcher to better understand how these experts interpreted the problem scenario as well as their approach to solving a complex instructional design problem. The data provided from this section proved to be very helpful during analysis. It did not only include assumptions and contextual remarks but also some initial reactions to the problem scenario, a number of heuristics, rules-of-thumbs, related previous experiences as well. It was evident that this additional part helped participants to reflect on the problem scenario based on their previous experiences before actually proceeding with the representation.

The third difference between this and previous studies was the recommendation section. After participants created and annotated their representations, they were asked to provide their recommendations for the given problem scenario, based on their representations. This data gathered from this section was helpful in understanding what experts would do in similar problem situations. The contribution of the data gathered from this section was also indispensable to further understand how experts approach problem solve in the domain of instructional design. This final remark concerns the expert representations gathered between this and the previous similar studies (i.e., Christensen et al., 2000; Spector & Davidsen, 1997a, 1997b). In our study, experts were highly creative as far as the way they created their representations were concerned. Since they were not directly instructed to create causal influence diagrams, their representations looked somewhat different than what a CID would look like.

Some experts came up with very rich, detailed but visually somewhat different-looking representations. A close examination on the characteristics of these experts showed that as the years of experience increased, generally, the level of detail and the creativity put into the representation also increased. This is not surprising given the previous research on expertise (Chi et al., 1988). But there were a few outliers to this rule. For instance, one of the experts who had 20 years of experience in instructional design provided much more comprehensive, very detailed representation than the one with 34 years of active, hands-on experience. With the help of the background survey, it was possible to provide an explanation for such situations. The expert who had 20 years of experience stated that he regularly managed instructional/training design projects in his current job besides designing and developing instructional materials. On the other hand, the expert with 34 years of experience only actively performed tasks related to the design and development of instructional materials. Since, the problem scenario included managing instructional design resources this difference in the type of experiences seemed reasonable to explain for the rather less experienced designers creating a more comprehensive representation than the more experienced one. In other words, since experts draw from their previous experiences, the type of design tasks they are regularly involved becomes another very important factor in how they approach particular design problems.

Despite the differences between the procedures of this and previous similar studies, experts' representations in this study exhibited recognizably similar patterns. Furthermore, from these similar patterns it was possible to create a causal influence diagram that represents a common expert view of the given problem scenario (see Figure 1, p. 5). Given these promising results of this exploratory study, a follow-up study is planned with larger number of experts and novices with the aim of validating the results of this study and related previous studies in the domain of instructional design. If it can be concluded that expert instructional designers create recognizably similar causal representations of common problem scenarios and the representations developed by novices are significantly different than those of experts, are rather chaotic, and are not comprehensive then expert representations can provide a benchmark for learner progress by comparing how learner representations change through instruction to resemble or fail to resemble expert patterns. As a result we can test the effectiveness of different instructional approaches in facilitating learning, and thus, we can contribute to understanding the development of and facilitating the promotion of expertise in complex domains.

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A Critical-Realist Response to the Postmodern Agenda in IT

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Abstract

Although an invigorating approach to IT theory and research, the postmodern agenda would benefit from clearer articulation and further refinement of ontological, epistemological, and methodological positions. Consequently, I reveal possible weaknesses in the position and, in the spirit of scholarly dialogue, counter with a critical-realist perspective that presents a potentially more innovative and defensible approach to the discovery of scientific knowledge. In the end, I concur with the postmodernists that there are issues such as race, gender and ethnicity that must be addressed in IT. My point of difference is that as a scientific venture, we must be more public and transparent in our discourse for change to take place.

Introduction

For little over a decade a steady stream of work that promotes a postmodern posture has infiltrated instructional technology (IT) theory and research (Bryson & De Castell, 1994; Conlon, 2000; Hlynka, 1991; Lawson & Comber, 2000; Lien, Jeng, & Yin, 1998; Sherman, 2000; Solomon, 2001; Yeaman, Hlynka, Anderson, Damarin, & Muffoletto, 1996). Although there certainly are thought-provoking contributions and benefits provided by this provocative perspective, my sense is that our postmodernist colleagues continue to struggle to clarify their views. Accordingly, I request greater clarity along three stances: 1) the rejection of positivistic, rationalist science, 2) the acceptance of a (radically) constructivistic epistemology, and 3) the reliance upon a singular method of inquiry. My aim is to gently 'push back' so as to further scientific development in our field. Additionally, I offer my own view—a critical-realist perspective—that may permit for further progress in the discourse. Before initiating this dialogue, though, it is necessary to clarify what I mean by the postmodern agenda in IT.

Extrapolating from Solomon's (2000, p. 8) account *postmodernism* can be conceptualized as an intellectual movement, a condition, or a philosophy that claims certain values and assumptions (Bailey, 1999; Bryson & De Castell, 1994; De Vaney, 1998;Yeaman, et al., 1996). As an intellectual movement, postmodernists have argued for, in place of science and rationality, a focus on the deconstruction of metanarratives to reveal inherent gender, class, race, ethnic, and sexual inequalities extant in a given discipline or domain of inquiry (Bailey, 1999; De Vaney, 1998; Sherman, 2000). As a condition, postmodernism is a reaction to the values of 'modernity' including rational science, uninterrupted progress, and deterministic technology. Two outcomes of this condition that directly impact education are that students have become subjugated to rational science and learning has been commodified (Conlon, 2000; De Vaney, 1998; Sherman, 2000). Finally, postmodernism can be seen as a philosophy, the perspective that informs our present discussion. As a philosophy, postmodernism promotes particular assumptions linked with the movement and condition as follows: (a) *pluralism*: there is no dominant worldview and all should be allowed to coexist, (b) *eclecticism*: ideas and methods should be applied in the manner of the *bricoleur*; (c) *truth*: a relativistic stance that gives precedent to subjective experience; (d) *knowledge*: a rejection of universal metanarratives in favor of constructivism; (e) *language*: the primary mediator between individuals and society; (f) *complexity*: rejection of deterministic predictability in favor of chaos; and (g) *self*: a multi-dimensional entity in constant struggle with the previous assumptions (Sherman, 2000, p.52; Solomon, 2000, p.12-15). As I will illustrate below, these assumptions underlie the three prominent stances of the postmodern agenda toward theory and research in IT.

Thus, my presentation runs as follows. First, I interpret and then critique three stances within the postmodern agenda regarding rational science, a constructivistic epistemology, and deconstruction as a mode of inquiry. The responses I forward are that the postmodern stance on science is outdated, the epistemology questionably defensible, and the inquiry insufficient. Keeping with my primary aim of promoting critical dialogue I conclude by presenting what I interpret as a contributory refinement—a proposal for a critical-realist perspective on IT theory and research.

A Critique of Three Stances within the Postmodern Agenda

My intent in this section is to engage the advocates of postmodernism in what can be viewed as a continuing critical, yet overall healthy, dialogue (cf., Reeves, 2000; Reigeluth, 1997; Schwen, 2001; Wilson, 1997). It is in this spirit that I have enclosed perspectives and references that support the postmodern agenda (see Appendix A).

The Rejection of Positivistic, Rationalist Science

From my interpretation, advocates of the postmodern agenda resonate most clearly with the critique of conventional positivistic, rationalistic science in IT (De Vaney, 1998; Solomon, 2000; Wilson, 1997; Yeaman, et al., 1996). This stance is supported, in part, by assumptions concerning *truth, knowledge*, and *complexity*. The postmodern objection is that conventional research and development in IT, driven by its behavioral science roots, has been concerned primarily with "the use of precision-based methods, measurement, replicability, predictability and order" (Solomon, 2000, p. 5). This stance is understandable given that a primary source of the postmodernism perspective is critical theory (Alvesson & Deetz, 1996; Solomon, 2000, 2002; Yeaman, et al. 1996). Briefly, critical theory maintains that since science is an inherently social process, in which egos and ideologies frequently overcome rational thought, it must be riddled with nontheoretical interests. For instance, in their critical examination of the 'technicist view' of educational technologists, Bryson and De Castell (1994, p. 207-210) conclude that existing social norms and relations of power between researchers and students were cloaked in a discourse of value-neutral technology, the discourse itself skewed by modernist visions of progress held by the researchers. Consequently, postmodernists question whether rational science alone is sufficient to offer the best path to scientific knowledge in IT (Solomon, 2000, 2002; Wilson, 1997; Yeaman et al., 1996).

My response to this stance is that postmodernists have taken an extreme opposition on a view of rational science that may itself be anachronistic. That is, the idea of science as a practice of uncovering some ultimate reality in search of a final truth is so outdated as to be a caricature (Willower, 2001). Moreover, despite what the postmodernists may claim or imply, this critical position on science is historically far from unique. On the contrary, philosophers of science and social scientists have debated this issue from early in the last century (Bernstein, 1976; Bhaskar, 1975; Court, 1999; Kuhn, 1962; Popper, 1962). As a way to refresh the dialogue, then, what I offer below is a more innovative mind-set. My contention is that protocols derived from a critical-realist perspective may allow us to address more adequately the tensions of domination and emancipation so oft-cited by postmodernists (Bryson & De Castell, 1994; De Vaney, 1998; Sherman, 2000; Yeaman, 2000; Yeaman et al., 1996). The point here is *not* that the postmodernist agenda has abandoned rigorous empirical methods, e.g., ethnography, action research, and narrative inquiry (although I will argue that they rarely fully employ these methods). The issue is that they have yet to offer an alternative to the *logic* of scientific discovery, by which the use of methods is governed (Corson, 1999; Popper, 1962; Swann, 1999; Thornton, 2000). Thus, the clarity I am seeking here requires that postmodern advocates better articulate the alternative logic of discovery of knowledge they propose in place of science.

An Acceptance of a (Radically) Constructivistic Epistemology

Drawing from their assumptions on the importance of *pluralism* and *language*, and the notions of *truth* and *self*, the intent of the postmodern agenda is to replace monolithic, grand narratives contrived by scientists with multiple, alternative perspectives that are permitted to coexist (Bryson & De Castell, 1994; Lawson & Comber, 2000; Solomon, 2000, 2002; Yeaman, et al. 1996). This notion of the possibility of subjective interpretation is clearly a byproduct of the relationship postmodernism has to *postructuralism*. From the poststructuralist viewpoint, there is no authoritative, foundational truth that we can come to know. On the contrary, each individual constructs his or her own knowledge of the world and thus any one construction should be permitted to coexist with any other (Solomon, 2000, 2002; Yeaman, et al., 1996). From one instructional technologist's perspective (Hay, 1994, p.23), this situation has resulted in three crises in educational theory and practice. The first crisis in representation challenges the conventional, foundationalist view on truth. As a result, what we consider as knowledge and what we convey to practitioners or teach our students is called into question. The second crisis, related to the first, deals with authority. If knowledge and truth are questioned, on what basis can we justify our position as scientists and practitioners? Finally, the third crisis calls into question the status of the self. This notion of an extreme subjectivity, where the individual is constructed from discourse, seriously undermines the educator's justification that she knows more about the learner than the learner himself does.

In this reformulation of knowledge and its scientific discovery, the postmodernists have committed two critical errors. First, the insightful observation that science is not conducted by rational logic alone does not preclude that *all* knowledge is relative. The issue here is that if the postmodern position on epistemology is taken to an extreme, then no account can be made for intersubjective understanding among scientists. Although individuals can (and do) uniquely construct knowledge, some consensus must be reached for scholarly exchange to take place on a collective level. As Bailey (1999) has cogently stated in his response to the postmodern attack on science, "science is a public inter-subjective activity… and thus all science, however flawed its individual practitioners may be, is ultimately accountable" (p. 35). Thus, the crises in educational theory and practice might in some way be alleviated if postmodernists contemplate that social norms, such as those imposed by professional communities of scientists and teachers, enforce regulative accountability of knowledge and truth (Wenger, 1998, 2000). A second error has to do with the postmodernists stumbling over their own attempts at breaking down myths and metanarratives. If, as they claim, 'everything is subjective' then an argument cannot be made for the preference of one agenda over another. If the postmodernists claim that there are other (or 'better') ways of coming to know truth, then subjectivity has been defeated (Bailey, 1999; Dawson & Prus, 1993, 1995).

A Potential Over-reliance on a Singular Method of Inquiry

Deconstruction takes as one of its major tenets that "virtually any facet of cultural life can be interpreted as a text and subsequently deconstructed." (De Vaney, 1998, p. 76; Solomon, 2000, p. 11). This stance clearly draws from assumptions regarding *pluralism*, *truth*, *language*, and *self*. Despite the postmodernist resistance to algorithms, Yeaman, et al. (1996, p.260) have described deconstruction as a process for revealing inherent dualities that are usually associated with traditional binaries, e.g., good/bad, global/local, nature/technology, normal/abnormal, male/female, and oppressor/oppressed. In many instances, the methodology follows closely that of discourse analysis (Gee, 1999) but with a particular predilection to reveal the inadequacies of 'modernity'. The essence of the methodology is based on the belief that since science and knowledge are primarily mediated by language, and foundations upon which to ground any one perspective no longer exist, endless interpretation is appropriate and encouraged (Solomon, 2000, 2002; Yeaman, et al. 1996). As an example of this deconstructive interpretation, De Vaney attempts to illustrate how contemporary educational technologists, driven by modernist prerogatives, have ignored gender, race, and class differences to construct a subject malleable to software and media that are to varying degrees overtly materialistic, narcissistic, sexist, and hedonistic (1998, p.77).

Despite the relevant, penetrating insights gained from this alternative methodology, it is not without weaknesses. As Reed (2000, pp.525-527) has indicated, deconstruction suffers from at least five shortcomings: 1) *constructivism*: as noted above, reality is literally 'talked and texted'; 2) *nominalism*: conceptualizations and explanations are nothing more than 'names' or 'fictions'; 3) *determinism*: ironically, human agency is downplayed in favor determinate rules and practices; 4) *localism*: micro-level analyses ignore more permanent, hierarchical institutionalized structures; and 5) *reductionism*: ideologies are stripped of their cultural and historical context. More serious than the process of deconstruction, is the incompleteness of the overall product. That is, once a deconstruction has taken place postmodern advocates seldom, if ever, demonstrate the logical next move of action for improvement or empowerment (although Bryson and De Castell (1994) provide an exception). Echoing these sentiments, Reeves (2000, p.24) notes that although benefits can be gained by revealing biases in educational innovations, postmodern research is potentially sterile when comes to the actual improvement of conditions for teaching and learning. Thus, what I encourage the postmodern contingent to consider is that what is needed is not only deconstruction, but also *construction*, for example, in the style of action, development, or formative research (Reeves, 2000; Reigeluth, 1997).

In summary, the argument I have constructed is that without a socially available object of study or protocol for determining how to hold scientists accountable for their knowledge, the postmodern agenda may fail to bring the laudable advancements or improvements they seek. My question to postmodernists is that if everything begins and ends with interpretation, then how are we to perform our tasks as scientists, informing both colleagues and practitioners of ever more sophisticated understandings and suggestions for innovation?

Advancing the Dialogue—A Critical-Realist Perspective on IT Theory and Research

What I am not presenting here is a definitive argument, but merely a tenable counter-position to the postmodern agenda from which to take a critical stance toward theoretical and research practice in instructional IT (Schwen, 2001). As I hope to illustrate, however, the critical-realist perspective on the nature of the subject of inquiry and the means to come to know that subject are an improvement on postmodernist views.

The Social Reality of Our Subject of Inquiry

The critical-realist perspective takes as the subject of inquiry not accepted causal social structures and mechanisms (a sort of naïve empiricism), but the presuppositions scientific practice has about these 'objective things' (Corson, 1999). Accordingly, the objects of our study should be the theories and models we, as a community of scholars, construct of social structures and mechanisms that influence learning and performance (cf., Engeström, 1987; Wenger, 1998). Along the lines of Bhaskar (1975), the proposition offered here is that it would contribute greatly to scientific development in IT if we took these conceptualized social structures and mechanisms (such as communities of practice or activity systems) as *real*. Thus, scientific work should be occupied by hypothesizing the existence of social structures and mechanisms, and then to detail their operation (Corson, 1999).

Although similarities may be found with postmodernism in this perspective, the fundamental difference is ontological. Whereas postmodernists would permit for the infinite regress of interpretation and subsequent instability of reality, the critical-realist would counter by offering that for open, public scientific practice subject to refutation, it is more fruitful to assume that a socially constructed reality exists for scientific inquiry (Reed, 2000; Tsoukas, 2000). Another way to say this is that postmodernist analytical and methodological work tends to conflate agency and structure, resulting in a 'flat' ontology (Reed, 1997). Michael Reed has a nice quote that captures this preference for flux and transformation: "The world of the actor-network theorist, as that of the ethnomethodologist [both representative of the postmodern turn], seems to consist almost totally of verbs and hardly any nouns; there is only process, and structure is regarded as its passing effect" (1997, p. 26). Consequently, what I am proposing is that the critical-realist perspective provides a workable mind-set for scientists in IT. Denying the tenability of this mind-set could potentially undermine attempts to address the metanarratives hypothesized by the postmodernist scholar. For conceptual and empirical evidence of how this mind-set might be brought into play, the reader is referred to the work of Cook and Yanow (1993), Engeström (1987), Gherardi, Nicolini, and Odella (1998), Henricksson (2000), Wenger (1998, 2000), and Yanow (2000). Each of these pieces posits social structures and mechanisms (e.g., 'organizations as cultures', activity systems, communities of practice, situated curricula) that influence learning and performance in collective settings. Grounding this argument more clearly in IT territory, it is clear that a notion of a persistent reality gives us leverage to discuss issues of race, class, and gender that are now considered critical to responsible development of knowledge and technology in our field (Voithofer & Foley, 2002).

A Critical Posture on Knowing: A Post-Popperian Perspective

From a post-Popperian perspective, the logic of the growth of scientific knowledge is based upon the premise that there is an asymmetry between verification and falsification: "While no number of true singular observation statements can verify or prove the truth of a universal theory, one true singular observation statement can refute it" (Swann, 1999, p. 22). The simple logic proposed by Popper (1962; Swann, 1999; Thornton, 2000) to refute false claims can be represented as follows:

$$PS_1 ?\ \ TT ?\ \ EE ?\ \ PS_2$$

In this formula, PS_1 refers to a first problem statement formulated by an unexpected encounter with 'objective' reality; *TT* refers to a tentative theory proposed to explain that problem; *EE* refers to the process of error elimination to refute any portion of the theory; PS_2 denotes the reformulated understanding and thus growth of knowledge. Thus, a critical posture emerges as the focus here is not on attempting to establish 'truth', but on striving vigorously to remove error from existing, yet admittedly tentative, knowledge.

An integral part of this process, then, is the formulation of bold theories that subsequently have a high probability of falsifiability (Swann, 1999; Thornton, 2000). This is accomplished by formulating *prohibitive hypotheses* that contend to refute a universal statement derived from a theory by identifying limiting conditions to reveal errors. An example might be as follows: "There *does not* exist a situation in which this set of learning principles, X, when adopted in practice *does not* lead to greater performance with regard to certain objectives or standards, Y, in comparison with an alternative, Z" (adapted from Swann, 1999, p. 28). Thus, instead of adhering to a method of attempting to verify the 'truth' of a particular theory (which is the conventional hypothetico-deductive approach and the view of rational science that postmodernists appear to distrust), the critical-realist stance is to search vigorously for instances were a theory has a high probability of being falsified. Examples of this approach and its potential contribution to educational research can be found in the work of Corson (1999), Hillier (1999), and Swann (1998).

Another way of labeling this position is to say that it is "post-positivist" (Philips & Burbules, 2000). As postpositivists claim: "[We] …are united in believing that human knowledge is not based on unchallengeable, rock-solid foundations—it is *conjectural* [emphasis in original]. We have grounds, or warrants, for asserting the beliefs, or conjectures, that we hold as scientists, often very good grounds, but these grounds are not indubitable. Our warrants for accepting these things can be withdrawn in the light of further investigation" (Philips & Burbules, 2000, p. 26). This statement contains (explicitly and implicitly) three critical points that summarize the commitments of a postpositive position. The first is that knowledge is *nonfoundational*. What this means is that the postpositivist does not accept the tenets of empiricism or rationalism that claim that knowledge is founded upon either experience or rationality. That is, neither experience nor rationality can be taken as the foundation upon which knowledge can be secured. The second commitment is toward a view of knowledge as *conjectural*. This commitment has been explained in the above paragraphs. The third (and what I deem most critical) commitment is toward seeking *warrants* for stated assertions. The distinction being made here is that the evidence collected to support any claims cannot be based on authoritative foundations nor can it be said to be "truth". Similar to the burden of detectives and lawyers collecting evidence to warrant investigation or prosecution, a scientist taking a post-positivistic posture must present evidence that fulfills domain-established processes by which claims and actions are authorized.

In the end, what I am trying to convey in this admittedly subtle argument are two things. First, acknowledging the existence of an 'objective' social reality will permit us to continue to conduct inquiry as a community of scholars. Second, a post-Popperian perspective on scientific discovery may be more palpable to postmodernists as it provides for the conjectural nature of knowledge.

Conclusion

My proposal here has been to encourage postmodernist colleagues to continue to refine their ontological, epistemological and methodological positions as well as overall critique of conventional scientific inquiry. In fact, Voithofer and Foley (2002) in response to Solomon's (2000) original article have begun to do so by identifying a list of possible priorities for research within the postmodernist agenda. Three of these priorities entail an interest in how technology shapes pedagogy and curriculum (p. 7), a preference for multidisciplinary and interdisciplinary approaches (p. 8), and a concern with language and meaning (p. 8). To their credit, these authors are striving to bring about the degree of clarity in the postmodern position that I ask for here.

Certainly, then, critical dialogue is needed in our field. Nevertheless, for the critique to be useful it must be open, public, and transparent to colleagues and practitioners alike. As I have attempted to argue here, a possible way to do so is to take a 'realist' position on the ontological status of the social objects under investigation and a 'critical' position as to what we can know about those objects. By these means we may better be able to attain the critical intersubjective understanding between scholars and practitioners that advances both theory and practice. I end this piece with a quote by organizational scientist, Haridimos Tsoukas, that echoes my sentiments:

> We are realists simply because reality is where is (sic) has always been, outside our heads. Insofar as we create structures through patterns of sustained interaction, from the micro-level of the small group right to the macrolevel of global economic systems, we are confronted by real structures which we only partially and often indirectly and unintentionally have helped create. Such structures cause us to form beliefs about them. In turn, our descriptions of these structures (more precisely, how we describe them), are matters which depend on the language-based institutionalized meanings a community of actors have historically adopted. It is processes of (history-shaped) social construction, unfolding in time and space, that we, as organizational [and IT] researchers, should seek to study (2000,p. 534).

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Appendix A

Alternative Perspectives to the Critical-Realist Approach

Below I have listed three questions that are pertinent to this lively discussion. Associated with each question are selected pieces that will help to inform the reader interested in taking one or more of the positions. I look forward to our debate.

1. Has it not already been well-articulated that rational science is inadequate for instructional technology and so the postmodern agenda is legitimate?

   Solomon, D. L. (2000). Toward a postmodern agenda in instructional technology. Educational Technology Research and Development, 48(4), 5-20.

   Wilson, B. (1997). Thoughts on theory in educational technology. Educational Technology, 37(1), 22-27.

   Yeaman, A. R. J., Hlynka, D., Anderson, J. H., Damarin, S. K., & Muffoletto, R. (1996). Postmodern and poststructural theory. In D. Jonassen (Ed.) Handbook of research for educational communications and technology (pp. 253-295). New York: Simon & Schuster Macmillan.

2. Is it not valuable that issues raised by the postmodern agenda be brought to the forefront in our theory and practice?

   Conlon, T. (2000). Visions of change: information technology, education and postmodernism. British Journal of Educational Technology, 31(2), 109-116.

   Jonassen, D. H. (2000). Transforming learning with technology: Beyond modernism and post-modernism or whoever controls the technology creates the reality. Educational Technology, 40(2), 21-25.

   Sherman, L. W. (2000). Postmodern constructivist pedagogy for teaching and learning cooperatively on the web. CyberPsychology & Behavior, 3(1), 51-57.

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3. Has their not been relevant empirical work to validate the contribution of the postmodern agenda to instructional technology research?

   Bryson, M., & De Castell, S. (1994). Telling tales out of school: Modernist, critical, and postmodern "true stories" about educational computing. Journal of Educational Computing Research, 10(3), 199-221.

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Evaluation Results from Distance Learning Courses for U.S. Department of Education Middle School Coordinators

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Abstract

This paper discusses the evaluation of a set of on-line distance learning events (brief courses) provided to United States Department of Education Middle School Drug Prevention and School Safety Coordinators (MSCs) by the National Training and Technical Assistance Center for Middle School Coordinators. It includes descriptive information about the on-line events, and some of the guiding questions of the evaluation design. Attention is also given to the importance of thinking through the different types of evaluation data that can be gathered about on-line of events, and the potential applications of this information with illustrative examples from data collected about the MSC events.

Introduction

The United States Department of Education's (USED) Safe and Drug-Free Schools and Communities Program (SDFSCP) provides funds for virtually every school district in America to support drug and violence prevention programs. In 1998, USED implemented "principles of effectiveness" that required all SDFSCP-funded programs be research-based. To help schools identify and adopt research-based drug and violence prevention strategies, the 1999 Safe and Drug-Free School appropriation of $566 million included $35 million for the first year of a new Middle School Drug Prevention and School Safety Coordinator (MSC) Initiative.

The initiative supported the hiring and training of full-time Middle School Coordinators (MSCs) in each of three years (1999, 2000, 2001). From 1999 to 2001, approximately 925 coordinators were hired. MSCs were funded for three years and were expected to do such things as: help schools identify and adopt successful research-based drug and violence prevention strategies; assess school crime and drug problems; and work with parents, schools, and community organizations to ensure that these problems were addressed. One restriction on the initiative was that the funds could not be used to support direct delivery of prevention services by MSCs.

The Safe and Drug-Free Schools appropriation also included funds for the creation of a National Training and Technical Assistance Center for Middle School Coordinators. Funded by the USED Office of Elementary and Secondary Education, this Center was operated by Health and Human Development Programs (HHD), a division of Education Development Center, Inc. (EDC) in Newton, Massachusetts. Social Science Research and Evaluation, Inc. (SSRE) served as evaluator for the National Training Center.

This paper discusses the evaluation of a set of on-line distance learning events (brief courses) provided to MSCs by the National Training Center. It includes descriptive information about the on-line events, and some of the guiding questions of the evaluation design. Attention is also given to the importance of thinking through the different types of evaluation data that can be gathered about on-line of events, and the potential applications of this information with illustrative examples from data collected about the MSC events.

Methods

This section first briefly describes two different types of trainings provided to MSCs: face-to-face core training workshops, and (2) on-line continuing education distance learning events. It then describes the evaluation design, testing instruments, and data collection schedules used for the on-line events.

Face-to-Face Core Training Workshops

Between February 2000 and April 2002, nine five-day face-to-face core training workshops were provided to MSCs. MSCs were required to attend one of these very similar workshops. Each consisted of both large group presentations and small group activities/discussions. Large group presentations were designed to present state-of-the-art information on different areas such as assessing local needs and assets, designing prevention programs to meet desired results, and using technology to maintain connections and locate resources. These presentations were interspersed with and complemented by small group activities in which coordinators had the opportunity to apply new knowledge or information through discussions and case study work.

On-line Events

MSCs were also given the opportunity to participate in nine different on-line continuing education events that were held between April 2001 and September 2002. The events, which each lasted between four and five days, were intended to: (1) deepen skills the MSCs acquired during the core training, and (2) foster the exchange of information and ideas that help transfer knowledge into practice. USED urged, but did not require, MSCs to participate in one or more of the events.

The events covered a wide range of topics such as needs assessment; prevention program identification, selection, and implementation; sustainability; linking prevention to academic success; and crisis intervention (see Table 1 for a list of the titles/topics of the nine events). Although the content of the events differed, they shared many structural characteristics. Each event consisted of (1) an introduction and broad overview of the topics to be covered, (2) a narrative component that either presented information using examples from real life situations or adopted a case study approach where information was imbedded in a story about a fictional cast of veteran MSCs, (3) an event discussion area that was facilitated by one or more Training Center staff with expertise in the topic(s) covered by the event, (4) a summary of the major discussion themes in the discussion area that was updated at the end of each day by the event facilitator, (5) a set of daily activities, (6) links to additional resources, (7) a list of references and an annotated bibliography of materials used to generate the event content, and (8) an event support area for MSCs experiencing any technical difficulties.

Table 1. On-Line Event Titles/Topics

On-line Events for Middle School Coordinators
1. Using Existing Data in Your Needs Assessment
2. Identifying Priorities and Strategies for Your Prevention Initiative
3. Promoting Prevention Through School-Community Partnerships
4. Selecting Research-Based Prevention Programs for Your School
5. Implementing Research-Based Prevention Programs in Schools
6. Sustaining Your Prevention Initiative
7. Linking Prevention to Academic Success
8. Crisis Response: Creating Safe Schools
9. Middle School Coordinators as Change Agents

Evaluation Design

The US Department of Education required the National Center for Training and Technical Assistance to conduct a process and outcome evaluation of its services, including the on-line events. The goal of the process evaluation was to describe how the program was delivered (e.g., participant characteristics, satisfaction). The outcome evaluation was designed to assess what impact(s), if any, the program had (e.g., changes in knowledge, attitudes, and skills). Using a continuous quality improvement approach, evaluation findings were fed back to the program staff and the funder as they became available.

Evaluation Instruments and Testing Intervals

The primary source of evaluation data for the on-line events was on-line surveys that were built into each event. The decision to use on-line surveys was made for to a variety of reasons including: (1) the importance of matching the data collection method to the program's use of on-line learning; (2) the ability to incorporate the surveys directly into the events so that they would appear seamless, which, in turn, would help increase the response rates, and (3) due to the geographic distribution of MSCs, on-line surveying was more cost effective than doing multiple waves of mailed surveys. It should be noted, however, that there are many occasions when on-line surveys are neither the most appropriate, nor the most cost effective way of surveying one's target population.

Due to the timing of the grant, resources available, and other factors, the data collection points and the research design differed for the first three events, the second three events, and the last three events. The first three on-line events were evaluated using an on-line posttest and a six-month follow-up survey. Beginning with the fourth event, and continuing through the ninth, the evaluators were able to institute a pretest and posttest design. Three-month follow-up data were also collected for the fourth, fifth, and sixth events (see Table 2).

Table 2. On-line Event Testing Intervals

	Pretest	Posttest	3-Month Follow-Up	6-Month Follow-Up
Events 1-3		Yes		Yes
Events 4-6	Yes	Yes	Yes	
Events 7-9	Yes	Yes		

Following participation in each of the nine events, MSCs were asked to complete an on-line post-event questionnaire. These questionnaires included items asking MSCs to rate different aspects of the event (e.g., organization of the website, quality of the materials, links to other websites, role of the facilitators), items about the usefulness of the information, items about the likelihood of MSCs recommending the event to their peers, items about overall satisfaction with the event, a set of ten knowledge items, and several open-ended items that allowed MSCs to report the most and least helpful features of the event and to write any additional comments or suggestions.

Beginning with the fourth event, and continuing through the ninth event, MSCs were asked to complete an on-line pre-event questionnaire. These questionnaires included items about the participants' background (e.g., years of experience in school-based prevention, which of the nine core trainings they had attended, which of the previous on-line events they had completed), a set of ten knowledge items about information contained in the event, and a set of five behavior items about activities the MSCs had engaged in during the three months prior to the event.

Approximately six-months after the first three events, and three-months after the fourth through sixth events, MSCs were asked to complete an on-line follow-up questionnaire. The follow-up questionnaire asked MSCs to assess retrospectively the amount of information they received, the usefulness of the information, the frequency of using the information, and the relevance of the information. The knowledge and behavior items from the pretest and posttest also appeared on the questionnaire. Finally, an open-ended item asked MSCs to provide one example of how they applied the information from the event to their work.

Response Rates

Several studies have found that response rates for on-line surveys have been lower than those obtained using other methods such as face-to-face surveys, telephone surveys, and mailed surveys (Couper, 2002). On average, one can expect to obtain response rates of about 80% to 90% for face-to-face surveys, 85% for telephone surveys, and 60% to 75% for mailed surveys (Dillman, 1978). There are, however, a number of strategies that can be used to increase survey response rates. For example, Dillman (1978) was consistently able to achieve response rates of nearly 75% in mailed surveys.

Prior to each of the on-line events, the event was promoted by posting an announcement on the MSC website, and by mailing a pamphlet and sending an e-mail to all of the MSCs who attended one of the core training workshops. MSCs then had an opportunity to register for the event on the MSC website through an on-line registration system. For the events that included a pretest, MSCs were sent an e-mail invitation to complete the test before the event, and invitations were also posted on the Introduction page and the Discussion Area of the event. At the end of each event, MSCs were sent an e-mail invitation to complete a posttest. Also, invitations were posted on the last page of the event and in the Discussion Area, and non-responders were sent an e-mail reminder one week after the event. For the three- and six-month follow-up surveys, MSCs were sent an e-mail invitation, and non-responders were sent up to two more e-mails at one week intervals.

Consistent with the literature, the average pretest response rate was 53%, the posttest survey response rate was 47%, the three-month follow-up response rate was 54%, and the six-month follow-up response rate was 65% (see Table 3).

Table 3. On-line Event Response Rates

	Pretest	Posttest	3-Month Follow-Up	6-Month Follow-Up
Event 1		84%		77%
Event 2		68%		61%
Event 3		50%		64%
Event 4	36%	44%	50%	
Event 5	43%	23%	58%	
Event 6	67%	57%	54%	
Event 7	66%	51%		
Event 8	66%	53%		
Event 9	56%	42%		
Overall Rates	53%	47%	54%	65%

There are several factors that may have contributed to these comparatively low, but still respectable response rates. First, several of the events were conducted toward the end of the academic year. This is a very busy time for all school staff, including MSCs, and the scheduling of these events may have had a detrimental effect on the amount of time that MSCs had available to participate in data collection activities. Similarly, the follow-up for several of the events took place at the beginning of the new academic year, which can also be a very busy time for school personnel. Another factor that may have influenced the follow-up response rate was that MSCs may have changed jobs over the summer, their e-mail addresses may have changed at the start of the new school year, and MSCs from the first cohort of the grant might not have been brought back since their three-year position was about to expire.

Due to limitations of the web-course software, it was not possible to verify which of the MSCs who registered for the event actually participated in the event. It is possible that some MSCs may have pre-registered for an event to secure a spot, but later decided not to participate or were unable to participate due to scheduling issues. Since our denominator for each of the response rates is based on the number of MSCs who registered for the event, it is likely that the response rates in Table 3 are under-estimates of the MSCs who responded and who actually took part in the event.

Evaluation Questions

A fundamental research principle is that what you learn depends on what you ask and how you ask it. Essentially, your purpose should guide your decisions about what data to collect. Before collecting any data, you should ask yourself three questions: (1) what do I want to know, (2) why do I want to know it, and (3) what would I do if I did know it? While it is fairly easy to conduct an on-line survey, especially with all the new on-line software packages available, it is difficult to create a good survey. There is a large body of literature on survey and questionnaire design, and just because a survey is conducted on-line does not mean that these rules no longer apply. Before creating a survey, a social scientist or someone familiar with the literature should be consulted. Something as "simple" as the way a question is worded can have a profound impact on the data and the methods available to analyze the data.

As mentioned above, process evaluation data are used to describe how the program was delivered (e.g., participant characteristics, participant satisfaction), and outcome evaluation data are used to assess what impact(s), if any, the program had (e.g., changes in knowledge, attitudes, and skills). In this study, process evaluation questions included: (1) who is being served (e.g., the number of people, demographic information, technical expertise), (2) who is not being served? (3) are participants satisfied with the events, and (4) are there ways that the process can be modified to make it better? Outcome evaluation questions included: (1) what are the short-term impacts, (2) what are the long-term impacts, and (3) is the pedagogy making the most effective use of resources?

Who is Being Served?

One of the most basic issues an evaluation can address is to describe the people who are being served. This can range from very simple, but very important, information on the number of people being served (for example, 56% of the 924 MSCs who participated in the face-to-face core trainings participated in one or more of the on-line events), to more descriptive information about the participants' gender, age, race, and other characteristics. In addition to demographic information, the pretest questionnaires asked MSCs to report on background characteristics such as, number of years experience in school-based prevention (including any experience from before they were hired as an MSC), the date when they began their position as an MSC, the core training workshop in which they had participated, the Internet connection speed for the computer they most often used to access the event, whether or not they had participated in an Introductory event that was provided to all MSCs to teach them how successfully navigate the on-line events and assessed whether or not their software was capable of running all of the features of the event, and in which other events, if any, they had also participated.

Demographic and background information is valuable for both the funding agency and for the service provider. For example, demographic information on race/ethnicity can help a service provider determine whether or not the event materials are culturally appropriate for all of the participants, and information on participants' previous experience using the Internet can help forecast potential problem areas that will require technical assistance. This type of information is also useful when dealing with a sample of people from a larger population (as was the case with the MSC on-line events). By collecting demographic and background information, it is possible determine how well the people you are serve represent the larger group. Demographic and background information can also be used to compare the outcomes (such as change in knowledge, attitudes, and skills) for different subgroups of participants. For example you could ask if the on-line events produced similar outcomes for MSCs with more versus less experience in school-based prevention.

Who is Not Being Served?

Although the opportunity to collect data about people who do not receive services does not often present itself, this type of information can be used to identify any barriers to participation (e.g., lack of time, unfamiliar with the use of web technology). In this study, since all of the MSCs were required to participate in one of the core training workshops, it was possible to identify MSCs who did not participate in any of the first three events that were offered. Following the delivery of the first three on-line events, 269 MSCs who did not participate in one of the events were sent an e-mail invitation to participate in an on-line survey designed to assess the main reason that they chose not to participate and to assess the likelihood of their participating in future events. Of the 269 MSCs who received an invitation, 175 MSCs (65%) completed the questionnaire.

The first item in the questionnaire asked about the main reason MSCs chose not to participate. It included six response options: (1) I cannot access the Internet (no computer, software, provider, knowledge), (2) I did not have enough time to participate, (3) I registered for an event that was cancelled, (4) I do not like the idea of taking on-line courses, (5) I was not interested in the topics, and (6) I did not know about the events. MSCs were also given the option of writing in another reason that did not appear on the list. The most frequent responses given were that they either did not have enough time to participate (50%), or that they had registered for a later event that was cancelled (24%). Additional comments from the open-ended option seemed to corroborate these two themes (e.g., scheduling conflicts with the course of interest, failed to make time to participate, anticipated registering for an event that was later cancelled). Very few MSCs selected the more “negative” options such as, “I do not like the idea of taking courses on-line” (8%), or “I was not interested in the topics” (5%). This was important information, because it suggested that MSCs who decided not to participate in the first three events did not do so because of dissatisfaction with the topics or an aversion to using the Internet as a medium for information dissemination (Formica and Harding, 2001a).

Another item asked MSCs to indicate the likelihood of their participating in future on-line events using a five-point scale: Not At All Likely, Not Very Likely, Somewhat Likely, Fairly Likely, and Very Likely. Eighty-nine percent (89%) of respondents indicated that they were either “Somewhat Likely” (28%), Fairly Likely (36%), or “Very Likely” (25%) to participate in future on-line events. The finding that only 12% of respondents indicated that they were not likely (“Not At All Likely” or “Not Very Likely”) to participate in future on-line events was consistent with the findings from the previous item. The reason for non-participation seemed to center around lack of time as opposed to a less desirable alternative such as lack of interest or skill. This information was used as a basis for a decision to shorten the length of the on-line events from five days to four days in an attempt to be more accommodating to MSCs with busy schedules and to ameliorate a perceived barrier to participation.

Are Participants Satisfied with the Services?

Process data about participant satisfaction with different components of an on-line event (e.g., quality of the information, satisfaction with the facilitators) can point to ways the event design might be improved. Collecting data on overall satisfaction with the event can help predict whether people are likely to participate in future events.

For the MSC project, posttest items asked participants to rate their satisfaction with several different components of the event (organization and layout of the event website, quality of materials, role of the facilitators, links provided to other websites, download speed of the webpages), and their overall satisfaction with the event on a five point scale: Very Dissatisfied, Somewhat Dissatisfied, Neutral, Somewhat Satisfied, and Very Satisfied. The percent of MSCs who indicated that they were either “Somewhat Satisfied” or “Very Satisfied” with the on-line events ranged from 79% to 97% (see Table 4). Overall, across all nine events, 92% of posttest respondents indicated that they were either “Very Satisfied” (62%), or “Somewhat Satisfied” (30%). Only 8% of respondents indicated that they were “Neutral” (4%), “Somewhat Dissatisfied” (3%), or “Very Dissatisfied” (1%). These high ratings indicated there was not a need to modify any event. Satisfaction with different components of the on-line events also received high ratings, indicating that it was not necessary to modify their components.

Table 4. On-Line Event Satisfaction Rates

	Very Dissatisfied		Somewhat Dissatisfied		Neutral		Somewhat Satisfied		Very Satisfied	
Event 1	6%	2	6%	2	6%	2	39%	14	44%	16
Event 2	4%	3	5%	4	12%	10	41%	33	38%	31
Event 3	2%	1	6%	3	4%	2	39%	21	50%	27
Event 4	4%	4	1%	1	3%	3	23%	21	69%	64
Event 5	2%	1	3%	2	5%	3	28%	16	62%	36
Event 6	1%	1	1%	1	1%	1	28%	20	68%	48
Event 7	1%	1	1%	1	2%	2	31%	29	65%	62
Event 8	3%	2	1%	1	0%	0	17%	13	79%	61
Event 9	0%	0	3%	2	0%	0	30%	21	67%	46
Overall Rates	1%	15	3%	17	4%	23	30%	188	62%	391

Indirect satisfaction data can also come from other sources such as participation records (e.g., how many people participated, do people participate in more than one event if there are multiple events), and questions about whether or not people would recommend the service to their peers. For example, over half (56%) of the 924 MSCs who participated in the face-to-face core trainings participate in one or more of the on-line events, and 75% of the MSCs who participated in an on-line event participated in more than one event. MSCs were asked whether or not they would recommend the event to other MSCs on a five point scale: Strongly Recommend They Not Participate, Recommend They Not Participate, Neutral, Recommend They Participate, Strongly Recommend They Participate. Across all nine events, 95% of posttest respondents indicated that they would either Strongly Recommend (53%) or Recommend (42%) the event to other MSCs, and an additional 5% indicated that they were Neutral. Amazingly, only one MSC indicated that they would “Not Recommend” the event, and none of the MSCs in any of the events indicated that they would “Strongly Not Recommend” the event to other MSCs. In addition to serving as a good litmus test of the quality of the services that are being provided, this information is also useful for marketing services to future participants and to funders.

Are There Ways the Process Can Be Modified to Make It Better?

Open-ended write-in questions can be used to assess whether participants have any specific suggestions for modifying the delivery of on-line services. In this study, MSCs were asked three open-ended questions at the end of the posttest questionnaire: (1) what were the most helpful features of the event, (2) what were the least helpful features of the event, and (3) please write any additional comments or suggestions. These data were used to identify the strengths and weaknesses of the events that were not apparent to the event designers. For example, as a result of information generated from responses to these items given in the first three events, the entire design of the course website was changed to increase the size of the primary event window, to reduce the size of toolbars, and to relocate the navigation bars. While open-ended questions can be a very rich source of data, they should be used sparingly, particularly with large samples, because it is very costly and time consuming to analyze and present the qualitative data they provide.

What Are the Short-Term Impacts?

Probably the most important evaluation issue is whether an on-line service has any positive impact. Did the people who participated in the MSC events gain anything as a result of their participation? In the MSC project, one method for measuring short-term impact (immediate effects of the events) was to use a set of approximately 10 knowledge questions per event that represented the content of the event. These same questions were asked on the pretest and on the posttest, and analyzed to determine whether there were any statistically significant differences between these two testing points.

For the six events on which both pretest and posttest data were collected, paired t-tests were used to assess differences between the knowledge items at the time of the pretest and the time of the posttest. Results indicated that MSCs made gains on between eight and ten items out of the 10 knowledge questions in any given event. In addition, many of these differences were statistically significant ($p \leq .05$), indicating that these differences were most likely not due to chance alone. Given the consistency of these findings, it is reasonable to assume that even more of these differences might have achieved statistical significance with a larger sample of respondents. Overall, these data supported the conclusion that MSCs were making short-term gains (increased knowledge) as a result of participating in the events (Formica and Harding, 2001b; Formica and Harding 2002a).

What Are the Long-Term Impacts?

Information about long-term impact is often very difficult to collect because participants may have moved, switched positions, or changed contact information. However, when it is possible to collect it, this is very powerful information because it can be used to assess whether or not participants have changed their behavior (which often cannot be determined in the short time period between the pretest and posttest), and whether any knowledge gained as a result of the services provided has been retained.

In the MSC project, long-term impact was assessed by asking MSCs to report at the time of the pretest and again at follow-up on a set of behaviors that they would be expected to have engaged in as a result of the lessons learned in the events (e.g., convening a group of school and community stakeholders to help select an appropriate prevention program). Data from the three events where there was both a pretest and a follow-up questionnaire indicated that MSCs were more likely to indicate that they had taken part in the desired behavior in the three months following completion of the event than they were in the three months before the event. Specifically, MSCs showed change in the preferred direction on three of five items in the fourth event (all 3 were significant), on all five items in the fifth event (all 5 were significant), and on all five items in the sixth event (3 of which were significant). These results provided strong evidence that MSCs were likely to engage in desired behaviors following their participation in these events (Formica and Harding, 2002a).

To assess long-term impact we also: (1) repeated knowledge items on the follow-up questionnaire and compared them to the posttest in order to determine whether or not there were any significant declines in knowledge or whether it was retained; and (2) used open-ended items to obtain anecdotal information about whether and how MSCs applied information gained through the on-line event. In general, results of analyses conducted on the knowledge items from posttest to follow-up indicated that MSCs did not show any significant declines in knowledge at either three or six months following participation in the events (Formica and Harding, 2002a; Formica and Harding (2002b). In addition, virtually all of the MSCs who responded to the follow-up surveys were able to provide at least one example of how they applied information from the event to their work as an MSC (Formica and Harding, 2002a). For example, in response to this item on the follow-up survey for the fourth event on selecting research-based programs, one MSC wrote, "I put together an Advisory Committee consisting of school, community, and youth resources to review prevention efforts, identify strengths and weaknesses, review prevention strategies, and select programs that met our needs and abilities. We are now implementing a program." As with the satisfaction data, these success stories can again be used to market an on-line service to a funder and to future participants. And anecdotal data such as this can sometimes have a more profound effect on the reader of an evaluation report than pages full of data.

Is the Pedagogy Making the Most Efficient Use of Resources?

Outcome evaluation data can also be used to help determine the answers to such questions as whether or not the method of information dissemination is making the most efficient use of time and resources. For the first three on-line events, based on research indicating that large numbers of participants in distance learning events might be detrimental to the quality of services, the events adopted a two-tiered model of participation (Giguere, Formica, & Harding, 2002; Ko & Rossen, 2001; Palloff & Pratt, 1999). In this model, MSCs were able to register as either an active participant or as an auditor. Active participants were required to log on to the event at least once a day, review event materials, participate in event activities, and contribute to the facilitated discussion area. Auditors were not required to log on at lease once a day, were not required to participate in event activities, and were able to view the facilitated discussion but could not contribute to it. Only 50 MSCs were able to register as active participants, the remaining registrants were placed into the auditor category. The rationale for this model was to be able to be able to provide the event to all MSCs, but to not overwhelm the event facilitator in the discussion area and to allow the opportunity for more meaningful interaction with the facilitator than might be possible with large numbers of participants.

Surprisingly, results from analyses comparing active participants versus auditors found that the differences between these two groups were both small and statistically not significant for the amount of information they felt they acquired, their ratings of the usefulness of the information they received, self-reported time spent participating in the events, the true/false items tailored to each event, overall satisfaction with the event, or willingness to recommend the event to other MSCs (Formica & Harding, 2001b). Given the lack of differences, it was determined that the events should be open to all MSCs at the same level of participation. In response to concerns from the event facilitators that they would not be able to adequately respond to all of the messages in the Discussion Area an additional staff member was assigned to help deal with the increase in messages. While the direct effect of this model change was not systematically evaluated, participant satisfaction ratings did not show decline following this change (see Table 4), and the short-term and long-term impact measures did not seem to be detrimentally affected. In short, this change allowed the Center to serve more MSCs in a more intensive manner without negatively affecting the quality of the services provided. This approach was also more time and resource effective than having to repeat an event multiple times. Another indirect effect of this change was that the time and resources saved were channeled into the creation of additional events.

Discussion

While most often used to conduct marketing research and website satisfaction, the authors found that the use of on-line surveys can be a useful way to conduct a process and outcome evaluation of large-scale national training efforts such as the MSC project. Results indicate that respectable response rates can be achieved using this method when adopting proven strategies traditionally used to increase response rates to mailed surveys. In addition, when dealing with a geographically distributed population, on-line surveying can be a more cost effective method than conducting multiple waves of mailed surveys. On-line surveys also hold other less obvious advantages such as reduced cost of data entry and increased accuracy due to the elimination of data entry and data entry error.

This paper also emphasizes the importance of defining process and outcome evaluation questions at the beginning of a project to enable the use of a continuous quality improvement approach where evaluation findings on how the program was delivered and what impact(s), if any, the program had can be fed back to program staff and the funder. By applying this framework up front and using three basic guiding questions: (1) what do I want to know, (2) why do I want to know it, and (3) what would I do if I did know it, the evaluation can provide meaningful data to help inform the delivery of services and the ability to adequately report findings at the end of the project.

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2001 AECT Member Needs Survey

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Abstract

This survey was carried out on behalf of the Association for Educational Communications and Technology (AECT). The 2001 survey assessed the needs of AECT's members and identified the Association's weaknesses. A total of 553 usable survey responses were received. According to the quantitative data gathered, most respondents were on the whole satisfied by the services provided by AECT with regard to conferences, publications, and online services. Members appeared to be more aware of certain online services as compared with others. However, the vast majority of those who had used any of the online facilities were generally satisfied with their experience. Meanwhile, the qualitative comments expressed by the respondents provide a more rich and complex picture, describing specific situations, problems, and/or issues that provide insight into the quality of AECT services.

Introduction to AECT

The Association for Educational Communications and Technology (AECT) is a professional association of thousands of educators and others whose activities are directed towards improving instruction through the use of technology. Established in 1923, AECT has become a major organization for those who are actively involved in designing instruction and utilizing a systematic approach to learning. Providing an international forum for the exchange and dissemination of ideas for its members and for larger audiences, AECT is dedicated to the improvement of instruction. It is the world's largest publisher of information concerning instructional technology (AECT History, 2001). The Association's mission is to provide leadership in educational communications and technology by linking professionals who hold a common interest in the use of educational technology and its application to the learning process (Mission and Goals, 2001).

AECT Members

The Association's 3000+ members and subscribers work in academia, the armed forces, industry, museums, libraries, and hospitals. AECT members carry out a wide range of responsibilities in the study, planning, application, and production of mediated communications for instruction (AECT History, 2001). Its members enjoy a wide range of benefits, including: free subscription to the *TechTrends* journal; discounts for subscription to *Educational Technology Research & Development (ETR&D)*, *Distance Quarterly Review*, and other AECT publications; access to numerous online services (including e-newsletter, membership directory, online publications, and listservs); discounts to the annual conference and summer leadership institute; and lower rates on automobile insurance (Membership Benefits, 2001).

AECT Conferences

Conferences are an important function of AECT. It initially held national conferences in conjunction with the National Education Association (NEA). Then, in 1952, AECT held a separate conference from the NEA for the first time and by 1971 was no longer an official department of the NEA. Between 1982-1984, a major change took place in the configuration of the national conference. This is when AECT sponsored an international exposition of communication materials and devices along with the National Audio Visual Association (NAVA). This exposition, called COMMTEX International, was later known as INFOCOMM International due to co-sponsorship by the International Communication Industries Association or ICIA. In 1994, AECT broke away from the ICIA and held its own trade show, known as InCITE until 1999 (Frick, Duvenci, Kim, Richter, & Yang, 2001). The timing of the

Conference was then changed in 2000 from February to November in order to coincide with the National School Board Association (NSBA) trade show.

Introduction to the 2001 Survey

The following research questions were identified following a literature review of past AECT member surveys and interviews with the AECT leadership regarding the vital aspects of the members and their needs:

1. What are the typical demographics of AECT members?
2. What AECT services are members aware of and using?
3. What services provided by AECT (particularly with regard to publications, conferences, and the AECT Web site) are satisfactory to members?
4. What services provided by AECT (particularly with regard to publications, conferences, and the AECT Web site) are unsatisfactory to members?

Methodology

We decided to survey the entire population of past and current Association members as listed in the AECT database. Following a literature review of past AECT member surveys and interviews with the Association's Executive Director, the survey questionnaire instrument was prepared. In order to carry out data collection in the most efficient and economical manner, a Web-based survey instrument was used. Additionally, a small percentage of respondents filled out paper-based submissions during the 2001 Conference in Atlanta, Georgia.

Data Analysis and Reporting

When we began to work with the data, there were a total of 553 usable responses. We analyzed the quantitative data (i.e. those that were generated by radio buttons and check boxes) using the *SPSS* statistical software package. Simultaneously, we did a content analysis of the qualitative data generated by open-ended questions using two independent coders.

Findings

Survey Respondents

Roughly 94 percent of the 553 usable responses were made up of online submissions; only six percent of the respondents submitted a paper version at the 2001 Atlanta conference. Nearly 94 percent of the respondents were active and current AECT members, only around two percent were non-members, and the rest were not sure of their membership status. Meanwhile, the biggest chunk of respondents (35 percent) had been AECT members for around one year at the time of the survey and around 92 percent of the respondents resided within the United States. Higher education was the biggest field among the survey respondents with around 70 percent being associated with higher education, either as faculty or as students. Other respondents included those from K-12, from private business/non-profit sectors, and those who were retirees.

Services Most Beneficial and in Most Need of Improvement

As can be seen from Figure 1, the annual conference, access to publications and networking were perceived to be the most beneficial services provided by AECT. Online services and professional development were also seen as significant benefits of AECT membership. Meanwhile, the annual conference and online services were also voted by the respondents to be the aspects *most* in need of improvement among the services provided by AECT (see Figure 2). Other services significantly in need of improvement were communication between members and administration, professional development, access to publications, and organizational restructuring.

FIGURE 1: Services Most Beneficial to Members (n=553)

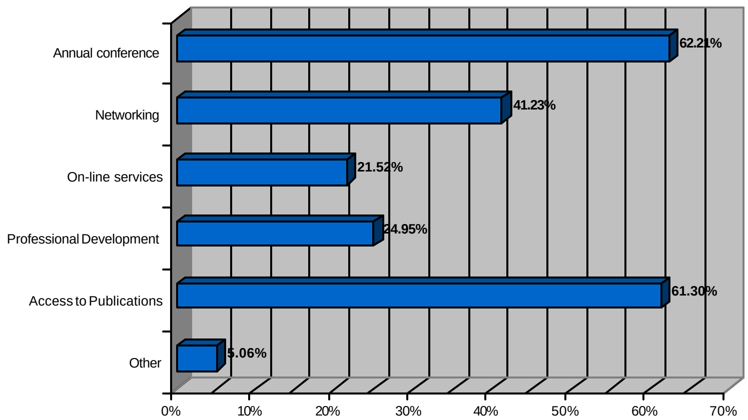
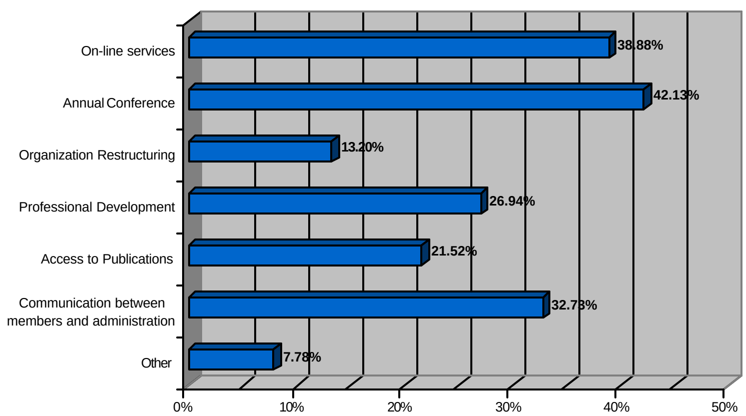


FIGURE 2: Services Most in Need of Improvement (n=553)



Qualitative comments by respondents also mentioned a need for improvement with regard to leadership, focus, networking, resources, employment, administration, marketing, lobbying, etc. Many of these comments expressed severe disappointment with the Atlanta conference, particularly the scheduling of presentations and the high expense. Timing the survey right after the conference appears to have added to these conclusions. Several comments also stressed a need for increased focus on the part of the Association. Other comments provided feedback regarding AECT's on-line services, publications, and communications between AECT leadership and members.

Opinions Regarding AECT Publications

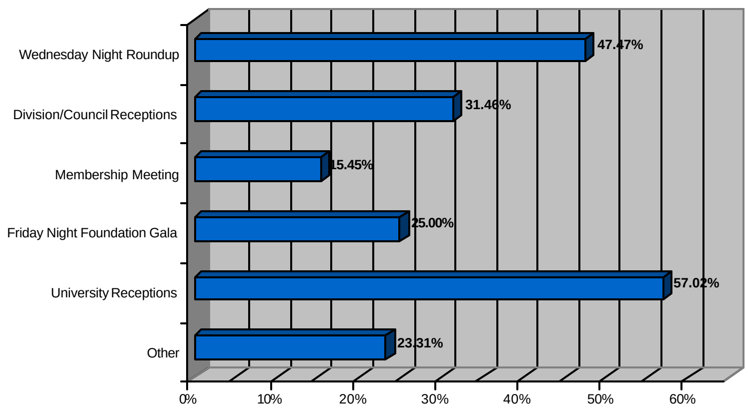
AECT seemed to be performing adequately with respect to its flagship publications, since nearly 71 percent of respondents (n=469) indicated being either *satisfied* or *very satisfied* with *TechTrends* and around 81 percent of respondents (n=343) indicated likewise for *ETR&D.*

Opinions Regarding AECT Conferences

Out of the three recent AECT annual conferences, most respondents had attended the Atlanta conference in November 2001 (53% of n=553), followed by Long Beach in 2000 (28% of n=553), and then Denver (26% of n=553). Figure 3.1 shows types of activities respondents found helpful for meeting people at conferences.

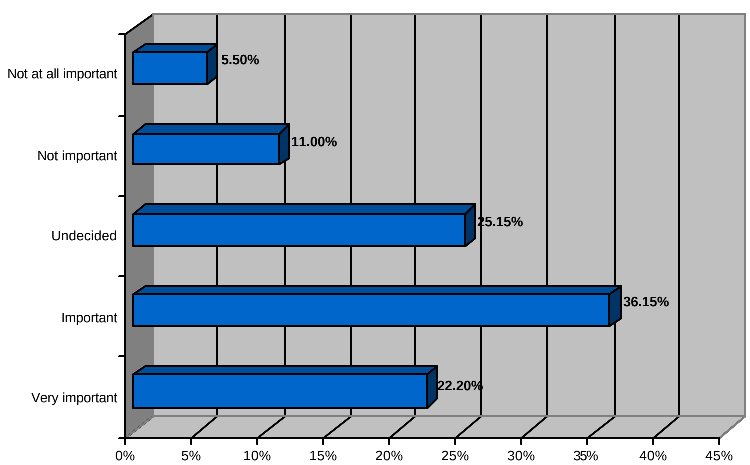
Meanwhile, through qualitative comments, a number of respondents stressed how much they liked having an area with tables and chairs in the lobby area of the hotel for informal meetings between sessions.

FIGURE 3.1: Conference Activities Helpful for Meeting People (n=356)



AECT changed the timing of its Annual Conference in 2000 from February to November in order to coincide with the NSBA trade show. The majority of the respondents (75% of n= 478) agreed with this change. Also, nearly 59 percent of the respondents felt that the trade show was important or very important for the conference (see Figure 3.2).

FIGURE 3.2: Importance of Trade Show for Conference (n=509)

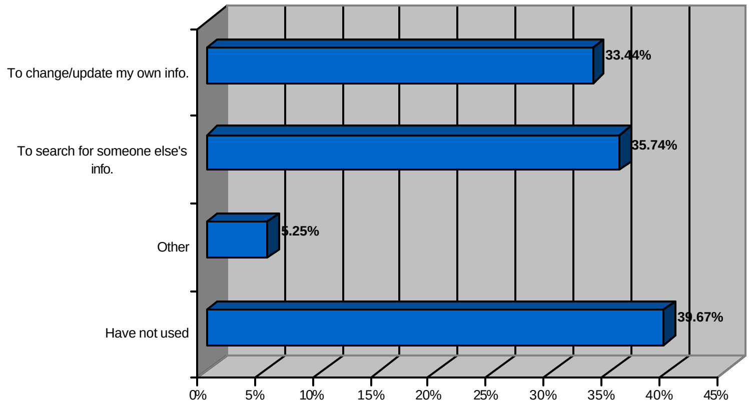


Opinions Regarding AECT's Online Services

Ninety-five percent of the respondents (n=550) said they have visited the AECT web site at: http://www.aect.org. Sixty-eight percent (n=541) responded that they have tried to log on to the site as a member, of which eighty-seven percent (n=349) managed to log on successfully.

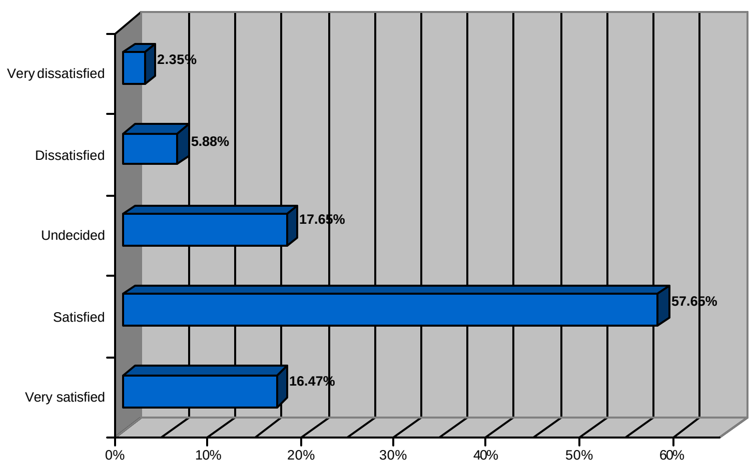
Fifty-six percent of the respondents (n=548) were aware of the web site's online membership directory. Those who had used the directory had done so to change/update their own information, or to search for another member's information (see Figure 4).

FIGURE 4: Usage of Online Directory (n=305)



Sixty-seven percent of the respondents (n=507) were *not* aware of the availability of *ETR&D* in electronic format on the web site. Ninety percent of these said they would use it had they been aware. Of those who read *ETR&D* online, around 74 percent were satis fied (or very satisfied) with it (see Figure 5).

FIGURE 5: Satisfaction with *ETR&D* Online (n=85)



Similarly, the majority of respondents (around 56 percent of n=516) were *not* aware of the availability of books in electronic format on the web site, but said they *would* have read them online if they knew of their existence. Most (roughly 80 percent) of those who *had* read books online expressed satisfaction with them (see Figure 6). The same trend was also seen with regard to purchasing books electronically (see Figure 7).

FIGURE 6: Satisfaction with Books Online (n=119)

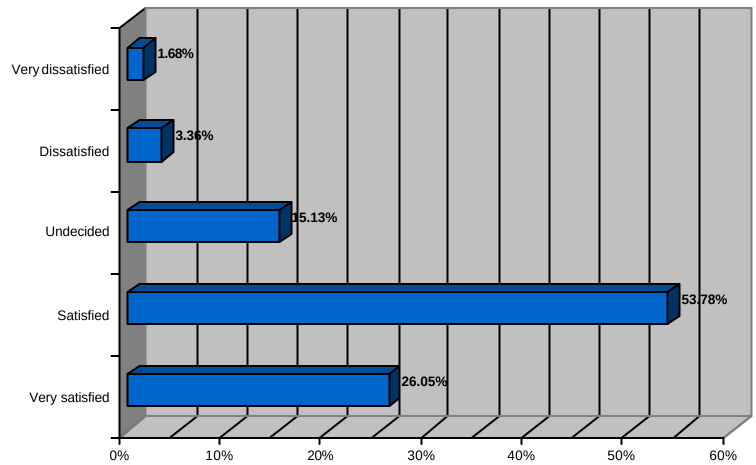
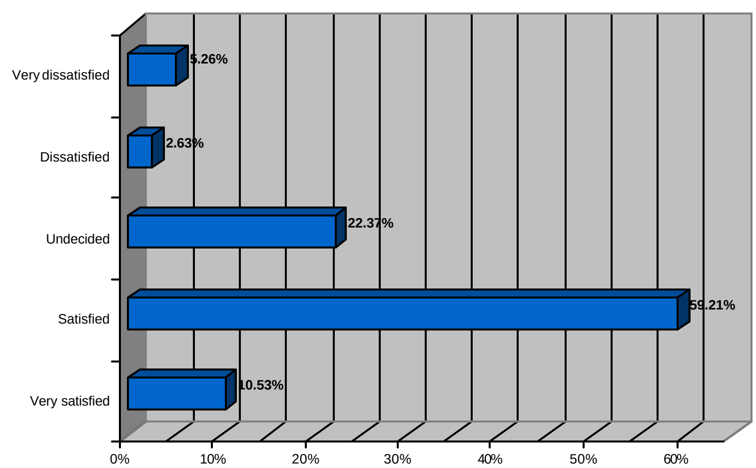
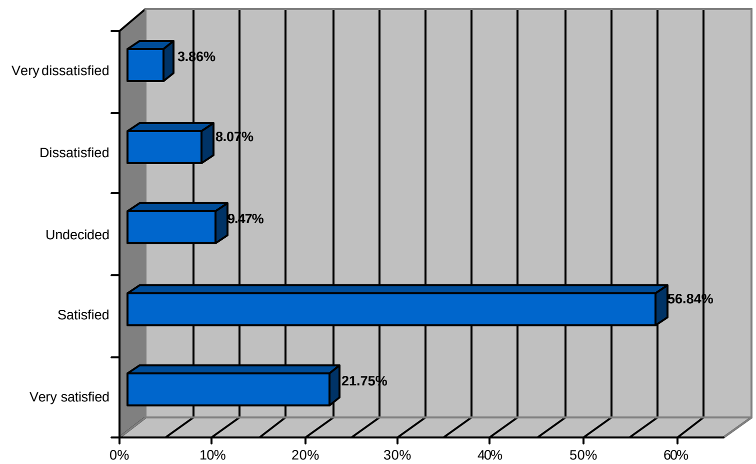


FIGURE 7: Satisfaction with Purchasing Books Online (n=76)



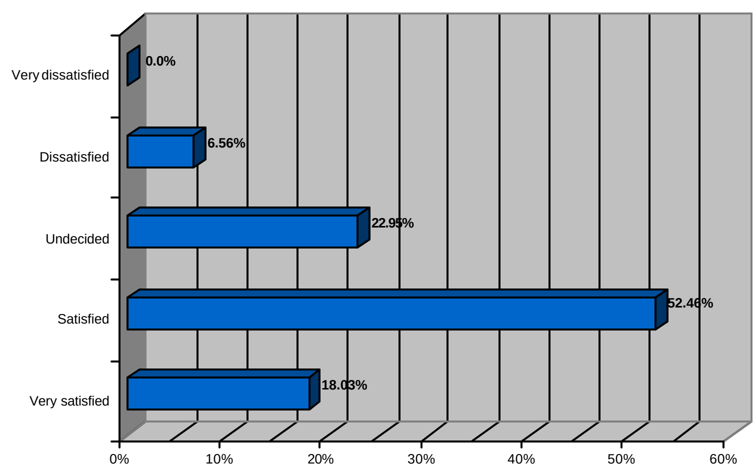
Meanwhile, the majority of respondents (around 58 percent of n=496) was *indeed* aware of the availability of online conference registration facilities on the Web site *and* used these facilities. Twenty-eight percent were aware, but did not use the online registration. Most (roughly 78 percent) of those who *had* registered online expressed satisfaction with the experience (see Figure 8).

FIGURE 8: Satisfaction with Registering for Conference Online ($n = 285$)



On the other hand, while the majority of respondents (around 60 percent of $n = 498$) *were* aware of the availability of online registration for the summer leadership meeting, more than three-fourths of the 498 respondents did *not* use this facility. Once again, most (roughly 70 percent) of those who *had* registered online expressed satisfaction with the experience (see Figure 9).

FIGURE 9: Satisfaction with Registering for Summer Leadership Meeting Online ($n = 61$)



Regarding submitting *new* membership applications via the Web site, most respondents (69 percent of $n = 490$) were aware of this option and were almost equally divided into those that used this option and those that did not use it. Of those that did submit new membership applications online, most (78 percent) expressed satisfaction (see Figure 10). The exact same trend was observed with respect to respondents' use of the Web site's facilities to *renew* memberships online (see Figures 11 and 12).

FIGURE 10: Satisfaction with Submitting New Membership Application Online (*n*=182)

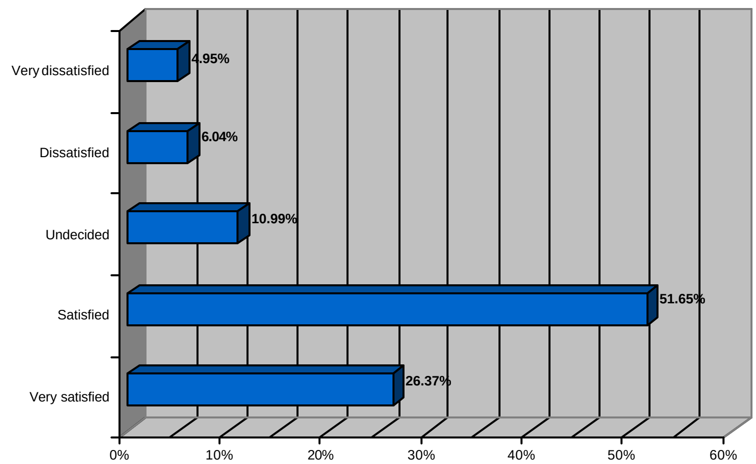


FIGURE 11: Online Feature (Renewing Membership Electronically) (*n*=491)

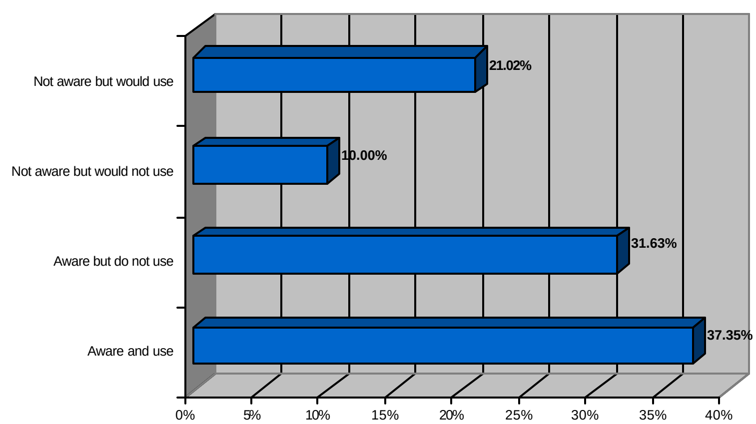
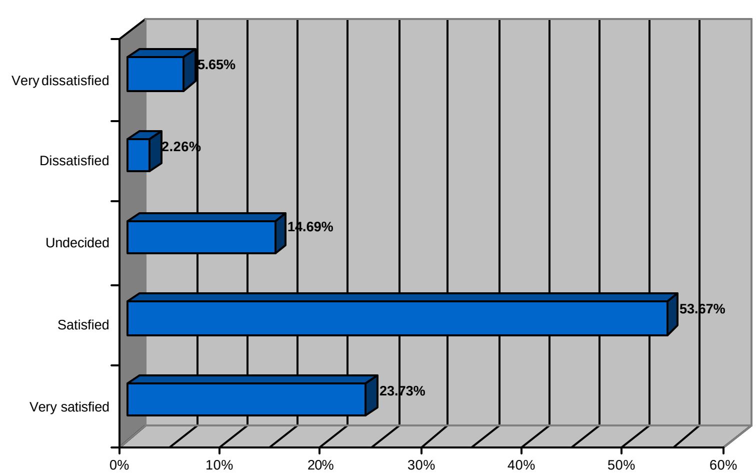
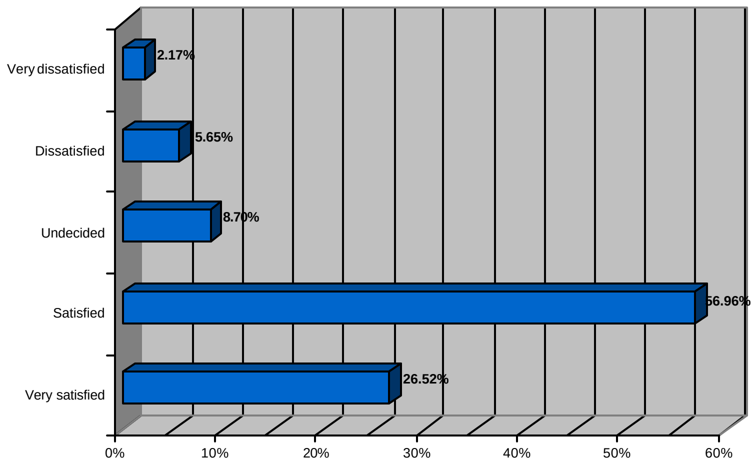


FIGURE 12: Satisfaction with Renewing Membership Online (*n*=177)



When it came to submitting conference presentation proposals through the Web site, the majority of respondents (47 percent of $n = 491$) were aware of *and* used this facility. Of these, most (nearly 84 percent) expressed satisfaction with the experience (see Figure 13).

FIGURE 13: Satisfaction with Submitting Conference Presentation Proposals Online ($n = 230$)



With respect to reading job postings electronically, the findings showed significant proportions of the respondents (35 percent each) divided into the "not aware, but would use" and "aware, and use" categories (see Figure 14). But once again, most (roughly 70 percent) of those who did reading job postings electronically were satisfied (see Figure 15).

FIGURE 14: Online Feature (Reading Job Postings Electronically) (n=514)

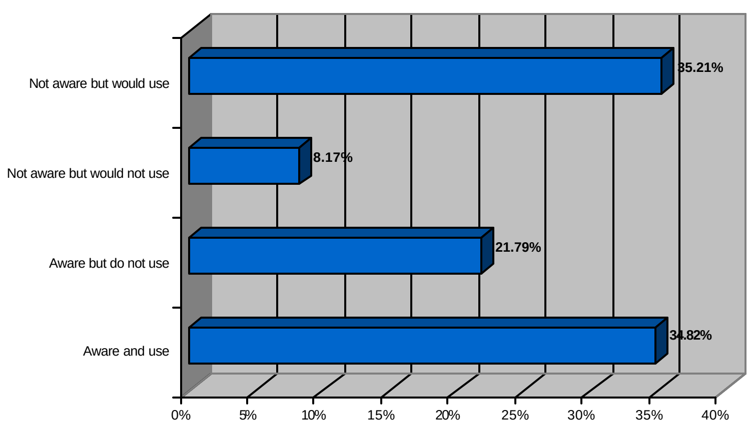
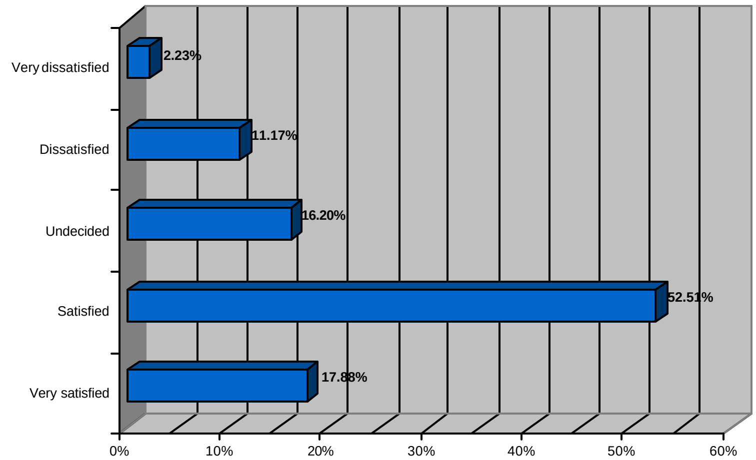
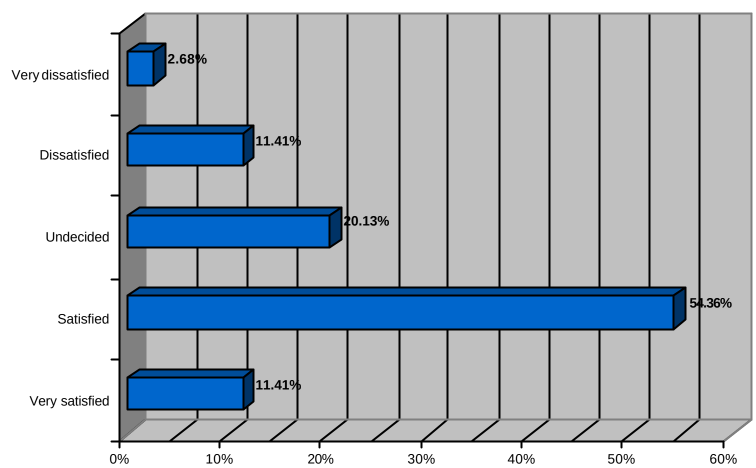


FIGURE 15: Satisfaction with Reading Job Postings Online (n=179)



Meanwhile, the majority of the respondents (around 40 percent of n=512) were *not* aware of the availability of listserv newsletters, but said they *would* have availed of them if they knew of their existence. Most (roughly 66 percent) of those who *had* availed of these listserv newsletters were satisfied (or very satisfied) with the experience (see Figure 16).

FIGURE 16: Satisfaction with Listserv Newsletters (n=149)



Open-ended Comments

Lastly, many respondents wrote qualitative comments regarding things they wanted to say about AECT's services as a whole. Twenty-five responses touched on the need for defining the focus of AECT, 17 responses stressed the need for improved communications between the AECT administration and membership, 81 responses mentioned improving the conference, 61 responses mentioned the need to improve on-line services, three responses suggested active marketing of AECT to new members, 19 comments expressed happiness with AECT's performance and provided encouragement, 26 responses mentioned the need to improve AECT's leadership, 19 suggested improving AECT publications, 10 mentioned the need for better employment postings, and 11 comments mentioned the need for improved networking.

Conclusion

The 553 respondents were largely current AECT members and mostly from higher education. It can be seen from the *quantitative* data collected by this survey that most respondents were on the whole satisfied by the services provided by AECT. More than half the respondents found the annual conference and AECT publications to be most beneficial. Within the conferences, they found events such as the university receptions, Wednesday Night Roundup, and the division/council receptions to be most useful for networking. Most respondents were also in agreement with the decision to change the conference date from February to October/November. Most also considered the concurrently-held NSBA trade show to be important to them.

Meanwhile, most of the respondents were satisfied with the flagship publications *TechTrends* and *ETR&D*. Furthermore, a majority had visited the AECT Web site and successfully logged on as members. Most were aware of the availability of the online membership directory, which the used for various purposes. Respondents did not seem to be very much aware of the availability of *ETR&D* and books in electronic format, the facility to purchase books online, and the availability of listserv newsletters. They were most aware of the possibility to register for the conferences and summer leadership meetings online, of the ability to submit and renew Association memberships online, and the ability to submit conference presentation proposals online. The respondents were divided with respect to awareness about online job postings. However, the vast majority of those who *had* used any of the above facilities were indeed satisfied with their experience.

The current survey results indicate a marked improvement in AECT services when compared with the 1999 findings. At that time, one of five respondents indicated that they perceived "*nothing*" to be beneficial from their AECT membership; and the electronic presence of AECT (the Web site) was literally embarrassing to some respondents and perceived as needing significant improvement by most. At that time, AECT was experiencing financial difficulties, had recently moved the national headquarters, hired a new executive director, and restructured and streamlined the organization's governance. The 2001 survey results reported here represent a marked improvement. AECT has made significant enhancements to its Web services, and members are using them. Nonetheless, respondents in 2001indicated that the annual conference can still be improved and there is room for further improvement in electronic services. Overall, there appears to be an increase in member satisfaction with AECT services since 1999.

The current survey does not provide much evidence from non-members or from recent members who have not renewed. How do they feel? Why are they not joining or not renewing? While 2001 respondents seemed happier with the benefits of AECT membership, the challenge is to attract and retain new members.

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Star Instructional Design: Evaluation of Web-Based Instruction in Medical Science

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Abstract

The purpose of this study was to evaluate Web-based instructional modules that simulated medical diagnosis. The modules were designed by a medical sciences professor for use by second-year medical students in his pathology course. Medical students were subsequently surveyed during their third-year clinical rotations when they were working in real settings. The survey instrument was based on the 5-star instructional model, most recently published as "first principles of instruction" (Merrill, 2002). We report the results of this survey from two cohorts of medical students. After statistical analysis and elimination of several less consistent questions, our 5-star rating scale had an overall internal consistency reliability of 0.94. The medical sciences professor was not aware of Merrill's first principles when originally developing the Web-based modules. Third-year medical students surveyed in this study agreed that the modules incorporated first principles of instruction. Merrill postulates that instruction is most effective when it utilizes first principles.

Background of this Study

In September, 2001 a medical sciences professor approached this team of researchers with a request to assist in the evaluation of Web-based modules that he had designed and been using in his second-year pathology course. Although his class was small (*n*=25), the modules represented a large commitment in terms of time and effort. He was interested in 1) knowing if the modules were effective, and 2) having an evaluative tool designed for long-term use. The modules are publicly available at http://bl-msci-007c.ads.iu.edu/c602web/602/start.htm.

The modules have been in use for the past two years in his class. They were designed as supplements to create "real-life" situations for students where diagnostic skills could be practiced. As the modules unfolded, students were required to make decisions based on initial perceptions, questioning of patients, results of tests that could be administered, etc. After each module, students were required to take a quiz, the score of which counted toward their grade in the class.

The pathology course is part of a regional medical school program. Medical students enroll in their first two years at one of nine local campuses. The students whom we surveyed had used the online pathology modules during their second year at a regional campus, but were contacted during the third year after having completed two or three clinical rotations. Rotations occur at hospitals and other supervised clinical settings where students are required to make diagnostic decisions that affect the lives of real people.

As this team of researchers sought a tool with which to evaluate these modules, David Merrill's 5-Star Instructional Design Rating system was selected as a starting point. The 5-star rating scale is based on Merrill's (2002) first principles of instruction. The reader should note that the medical professor who designed the Web-based pathology modules was unaware of Merrill's work at the time. The professor was interested in evaluating the effectiveness of his modules. Since he had not collected pre- and posttest achievement data at the time the medical students used the pathology modules, it was not possible to get direct measures of instructional effectiveness. However, if medical students were to rate the modules with an adapted version of Merrill's 5-star rating scale, then this would be a post-hoc indicator of their effectiveness.

Literature Review

The Web-based instructional pathology modules evaluated in this study present three areas of interest to researchers: 1) techniques for developing medical student skills; 2) the use of problem-based learning to improve medical school preparation; and 3) methods of evaluating real world problem-based learning as to whether it effectively prepares students for patient interaction. Much of the literature regarding medical school education focuses on the development of clinical and patient-centered skills (Haidet, Dains, Paterniti, Chang, Tseng & Rogers

2001). For example, Peterson, Holbrook, Hales, Smith and Staker (1992) considered history taking, the patient examination and laboratory results as the cornerstone of most diagnoses. To better illustrate the importance of this point Hasnain, Bordage, Connel & Sinacore (2001) stated, "The great majority of medical diagnoses, up to 90% in the case of chest pain, for example, are made on the basis of the history alone. Although this is well established, the history-taking behaviors of medical students and residents have received little attention as a measure of diagnostic reasoning." (p. S14) Peterson et al. (1992) concluded that expert doctors emphasize history but medical students cling to diagnostic tests. As they gain more experience, the students show an improved use of history and improvement of patient interviewing skills. In addition, the test results and a physical exam provide support for decisions made based on history. In fact Peterson et al. reported it was difficult to evaluate these three tools individually because they were each so vital to a reliable diagnosis in practice. Medical programs have been using a variety of methods to teach a level of proficiency in these three critical skill areas. Some studies have investigated the use of mentoring relationships (Chou, 2001), while others have engaged students in simulations (Sakowski, Rich & Turner, 2001; Zvara, Olympio & MacGregor, 2001). These studies all stressed early acquisition of the techniques to build clinical skills.

The use of problem-based learning (PBL) is well documented in the research literature. While there are multiple characterizations of the term 'problem-based learning,' for the purposes of this paper we accept the definition put forth by Albanese and Mitchell (1993), where PBL is defined as "an instructional method characterized by the use of patient problems as a context for students to learn problem-solving skills and acquire knowledge about the basic and clinical sciences." (p. 55) What distinguishes problem-based learning is the presentation of a problem before students have learned basic diagnostic concepts. In addition, most problems do not provide students with all of the information necessary to solve them. They need to seek resources and additional information as they move toward a solution. Furthermore, problems that are presented to students should be compelling and interactive. Faculty instructors' responsibilities are to support student solutions, not provide answers or direction (Albanese & Mitchell, 1993).

Going beyond the PBL literature, Merrill (2002) has identified four additional phases -- derived from extant instructional theories -- that are necessary for instruction to be most effective. Together, he refers to these five as "first principles of instruction." Learning is promoted when:

1. Learners are engaged in solving real-world problems.
2. Existing knowledge is activated as a foundation for new knowledge.
3. New knowledge is demonstrated to the learner.
4. New knowledge is applied by the learner.
5. New knowledge is integrated in the learner's world. (Merrill, 2002, pp. 44-45)

Methodology

In designing the assessment tool, we took each of the five principles and brainstormed a series of ten or more questions for each principle. Questions were tested for wording and understanding with current medical school students and many were either discarded or reworded. The list of questions for each principle included negatively worded queries as well as positive ones. The list was narrowed to a final, comprehensive list of 31 questions, which were then randomly ordered in the assessment. In addition, several introductory questions were placed at the front of the assessment as a means of collecting demographic data and open-ended questions were added at the end to give participants a venue for explaining or expounding upon answers.

Two cohorts of students were surveyed in the fall of 2001 and 2002. Each group of students had completed at least two clinical rotations; however, many of the students in the 2001group had completed three at the time of responding to the survey. The survey was administered by means of an online survey and testing tool used by the institution. This tool was selected because students had already taken several tests and surveys with the tool and were familiar with it; it allowed for remote access from their diverse clinical assignments; and it protected the students' anonymity while preventing multiple submissions by the same individual. The professor who developed the modules contacted the participants by e-mail. They were given a link to the modules and information regarding the length of time they would be available.

Results

Eleven students responded to the survey in each cohort, for a total *n* = 22. The results from both years were pooled into one set of responses. The medical professor who designed the modules was asked if the second group of students would have experienced different modules than the first, and he assured the team that only minor changes had occurred over the two years. The larger *n* would allow for a more effective evaluation of the reliability of the questions.

The reliabilities of the survey scales were examined by first looking at each group of questions according to Merrill's five principles and analyzing them using Cronbach's alpha coefficient for internal consistency. After running the test on all of the questions in each category, we looked to see if the scale for each of the five principles could be improved by removing items that were less consistent with the scale. Consequently, the pool of questions was reduced from 31 to 22. Confirmatory factor analysis of the scales was not possible due to the relatively small sample size. The resulting scales and questions are listed in Table 1.

Table 1. 5-Star Scales for Evaluating the Pathology Modules and their Reliabilities

Instructional Principle	*Scale Items*	*Number of Reliable Questions*	*Alpha Value*
Problem	-The online pathology modules were presented in the context of real world problems. *The medical problems posed in the online pathology modules were unrealistic. - The online pathology modules utilized very practical medical situations. - I have encountered medical situations in my clinical rotations that were similar to case(s) presented in the online pathology modules. * I have not had ANY cases that resemble the examples in the online pathology modules.	5	.84
Activation	*When I began each module, I was overwhelmed by all the new information, and didn't know how to begin. *The online pathology modules had little relevance to what I really need to know to become a doctor	2	.67
Demonstration	-The online pathology modules showed examples of what was to be learned rather than merely give information to me. * The online pathology modules were no different than reading the book. -The graphic images and video clips in the online pathology modules made the procedures and techniques clear to me. - I found the graphic images and video clips in the online pathology modules helpful. -There were sufficient examples of normal and abnormal conditions to make appropriate diagnoses.	5	.73
Application	-Through the online pathology modules, I had an opportunity to practice and apply the knowledge and skills I had just learned. -The manner in which information was presented	5	.77

	in the online pathology modules helped to clarify misunderstandings or misconceptions that I had. -The online pathology modules provided me with an opportunity to practice diagnostic decisions in a "safe" environment. -By completing successive pathology modules throughout the course, I gained a sense of my intellectual development. -The step-by-step design of the online pathology modules allowed me to apply what I had been learning in class.		
Integration	-The online pathology modules provide techniques that encouraged me to integrate the new knowledge or skill into my medical school experiences. -The pathology course provided me with opportunities to demonstrate what I learned on the online pathology modules. - Concepts that I learned in one online pathology module could be used to help me. *The information I gained from the online pathology modules was not useful to me after completing the pathology course. - I have used concepts that I learned through the online pathology modules in diagnosing patients.	6	.83
Combined First Principles		22	.94

*Response values for items with negative wording were reversed for analysis.

Reliabilities varied for each of the five categories. The lowest reliability of alpha = 0.67 was associated with the 'Activation' scale, after removing all but two questions. The highest reliability was observed for the 'Problem' scale with alpha = 0.84. When examining all 22 remaining questions, we found that the scale as a whole had an alpha value of 0.94, a high level of reliability. Since the reliability value is higher when looking at the scales combined than any of the individual scales, this may indicate that the five-star criteria have greater reliability when applied together rather than separately. Four of the scales had reliability above 0.7, which according to Nunnaly (1978) is an acceptable level for Cronbach's alpha.

In addition, we looked at subject's average ratings for each of the five principles. The mean average scale value for each principle was approximately 2.0. The scale used on the survey ranged from 1 = strongly agree, 2 = agree, 3 = neither agree nor disagree, 4 = disagree, to 5 = strongly disagree. Scoring of negatively worded questions was reversed before analysis. The overall mean rating of 1.86, based on the scales created using all five first principles of instruction, indicated that students agreed that the online pathology modules were effective forms of instruction. Activation showed the greatest discrepancy with responses ranging from 'strongly agree' to 'strongly disagree.'

Table 2. Descriptive Statistics for each Scale

First Principle	*Minimum*	*Maximum*	*Mean*	*Std. Deviation*
Problem	1.00	2.60	1.80	.41
Activation	1.00	4.50	2.02	.73
Demonstration	1.00	2.40	1.65	.42
Application	1.00	2.60	1.97	.38
Integration	1.00	2.60	1.92	.43
Combined First Principles	1.10	2.46	1.86	.37

Overall we felt that the 5-star criteria did indeed provide an excellent framework from which to develop scales to assess these online pathology modules. The students responded positively to the questions. Information collected from the open-ended questions provides some insights as to what aspects and modules respondents found most useful in their current situation. Of the responses received, CBC review was mentioned the most often with five responses. Other modules that were mentioned specifically were: myocardial infarction, diabetes, blood pathology, cardiac pathology, gallstones, lung cancer, woman with morning stiffness, chest pain, dyspepsia, vaginal bleeding, abdominal pain, hematology, leukemia and alcoholism. Clearly, for some reasons, these stood out in the minds of the respondents, many of them listing more than one module.

Summary and Conclusions

The first goal of this study was to evaluate the relevance of the information presented in the pathology modules to students enrolled in their third-year clinical rotations. As can be seen in student responses to the problem-oriented criteria for the first principle, the pathology modules seem to have been effective towards this goal. For example, to the question, “I have encountered medical situations in my clinical rotations that were similar to case(s) presented in the online pathology modules”, 20 out of 22 respondents stated they agreed or strongly agreed with this statement. Responses to such questions support the usefulness of the information presented to students during the clinical rotations and encourage the collection of longitudinal data. A stronger argument can be made using the average rating according to all five criteria combined. The average rating of 1.86 indicates that the respondents agreed that the modules helped them generate ideas and apply diagnostic concepts to real world situations, and actively practice skills that they would later use in clinical experiences.

Responses for improving the modules were diverse, but there were two suggestions that were repeated by multiple respondents. These included having the modules be more interactive with more multimedia, and making them more difficult. Students also commented on choices that were presented in the module. For example, some of the choices were mentioned as being clearly wrong (i.e. letting a patient go home when they were clearly not well). There was some interest expressed in having more choices as well as more difficult choices. Additionally, a student suggested that the pathology modules should incorporate topics from other classes. This suggestion, if valid, may point to one reason why activation scored lower than the other four principles. Incorporating material from other classes would increase the amount of activation of prior knowledge required of students for each case. In upgrading and maintaining the modules, this should be taken into consideration.

This study could prove to be a valuable place to launch new studies. First, results could be compared with other data sources such as class rankings and the USMLE (US Medical License Examination) results for validity studies. Secondly, these modules are beginning to be used at other institutions. Comparisons of student responses across different contexts would be valuable to show the effectiveness of the modules removed from the class setting in which they were originally used. Finally, additional support for depth of the evaluation could be established by pairing this tool with practical measures of clinical skills such as supervisor evaluations of clinical students.

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A Communications Protocol in a Synchronous Chat Environment: Student Satisfaction in a Web-based Computer Science Course

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Abstract

The effects of a communications protocol in a synchronous on-line chat environment on the satisfaction of students in a Web-based computer science course was studied. Two undergraduate faculty members who teach Web-based courses, and 42 students in four separate undergraduate computer science courses participated in the study. Students completed a pretest which measured their prior experience, current attitudes, and expectations with regards to synchronous chats in a Web-based course. Two classes of students were introduced to a communications protocol by the instructors which was used throughout the course while in synchronous chat. The other two classes did not use a protocol. A posttest was administered to all students at the end of each course which measured student satisfaction with the synchronous chats held throughout the semester. A communications protocol, in the context of this investigation, is a set of rules or guidelines that are adhered to by all participants while engaged in a synchronous electronic discussion.

This study answered the question: What effect does a communications protocol in a synchronous on-line chat environment have on the satisfaction of students in a Web-based computer science course? The study showed that the use of a communications protocol in on-line synchronous chats had no effect on student satisfaction with Web-based courses.

Introduction

The purpose of this study was to improve student satisfaction with synchronous chat in a Web-based undergraduate computer science course. The study examined the effects of a communications protocol in a synchronous on-line chat environment on the satisfaction of students in a Web-based computer science course. This study sought to answer the question: What effect does a communications protocol in a synchronous on-line chat environment have on the satisfaction of students in a Web-based computer science course?

Although there has been a significant amount of research done on synchronous computer-mediated communications, the literature on real-time, computer-based communication in instructional settings is sparse (Murphy & Collins, 1997). Only a few studies have attempted to examine the use of communication protocols in electronic chats, and, of those, none have looked at the role such protocols may play in student satisfaction with interaction in Web-based distance-learning courses.

Interaction has been repeatedly cited as an essential ingredient of the successful implementation of Web-based courses (Shotsberger, 2000). In a recent study (Donaldson & Thomson, 1999), interpersonal communication that includes instructor-to-student and student-to-student interaction was regarded as “important” or “extremely important” by 83.2 percent of the students taking a Web-based course. With synchronous communication, the opportunity to interact with teachers on a routine basis was deemed “very effective” or “effective” as an instructional tool by all participants (Shotsberger, 2000).

Interaction is a key factor in student’s learning satisfaction, and it assists in maintaining the persistence of distance students (King & Doerfert, 1996). A factor that has been identified as influencing student satisfaction with synchronous interaction is structured dialogue and interaction which has been designed into the course and includes both learner-to-learner interaction and instructor-to-learner interaction. Also, prior experience with computer-mediated communication influences student satisfaction with interaction in general in a Web-based course (Vrasidas & Stock-McIsaac, 1999).

The chat room (an electronic meeting place where participants can communicate with each other at the same time but in different places) is currently the most likely candidate to replace the interactivity of the traditional classroom when used in a virtual classroom environment (Williams, 1999). Within the synchronous chat environment, it is possible that new methods of creating shared systems of significance may have implications for the academic discourse (Reid, 1991). Synchronous environments can sometimes increase the opportunity for learners to improve critical thinking, problem solving, and communication skills (Marjanovic, 1999). Synchronous chat environments potentially are motivational and can function as an effective tool for interactive learning (Sorg, 2000). Paulsen (1995) identified several techniques that can be used in a synchronous chat environment which include: a) debates, b) simulations or games, c) role play, d) case studies, e) transcript-based assignments, f) brainstorming, g) Delphi-like techniques, h) forums, and i) group projects. Advantages of chat rooms include ease of logistics, convenience, anonymity, and record keeping. Disadvantages include conversation lag time, lack of person-to-person interface, deindividuation (or the tendency to not perceive participants in chats as individuals, limited modes of communication, artificiality, and lack of flexibility in accommodating different learning styles (Coleman, Paternite, & Sherman, 1999). These disadvantages can lead to a questioning of the quality of synchronous computer-mediated communication and can be a deterrent to participation (Perdue & Valentine, 2000).

The use of chat environments can result in greater collaboration, social interaction, and positive engagement and can assist in providing an effective forum for immediate feedback and brainstorming tasks. Chat environments, however, may not encourage reflective thought (Pena-Shaff, Martin, & Gay, 2001). Knowledge construction, through interaction and collaboration with peers and experts, is possible in synchronous chat environments (Chou, 2001). A chat room may not be the only method for synchronous interaction in virtual classroom environments, but it can serve as an alternative to or can augment other traditional forms of interaction. Through the use of engaging and structured activities, interaction can be enhanced (Koszalka, 2002). Further, certain subject matter may lend itself well to synchronous chat environments (Williams, 1999). The disadvantage of not being able to organize a conversation in a synchronous chat environment is one issue that can be addressed by either improving upon software that is used for such purposes or by improving on the communication conventions that are used while in the chat environment (MacDonald & Caverly, 2000).

Learners need support to engage in discussion (ask questions, make comments, lead discussion, etc.), keep track of their discussion, and to organize their interface when participating in synchronous electronic discussion (Veerman, Andriessen, & Kanselaar, 2000). There are different approaches to interaction management in synchronous chat environments. Some approaches include using techniques similar to face-to-face interactions such as introductions, framing, outcome explanation, and group goal setting for a chat session (Rintel & Pittam, 1997). Dialogue structuring is another approach where implicit structuring can induce group discussion by working through key questions. The results can be a sense of greater orientation on the subject matter and less of a chance for discussion to drift off-topic (Hron, Hesse, Cress, & Giovis, 2000). Other approaches, such as 3-D virtual chat environments using chat software that differs from traditional text-based interfaces, can be effective in overcoming transactional distance (Altun, 1998), although pitfalls to such approaches include group sizes which are too large, a lack of familiarity with the technology, and poor facilitation skills on the part of the instructor (Ingram, Hathorn, & Evans, 2000).

Research that has focused on communication conventions in instructional electronic chats shows that students recognize a need to use such conventions and protocols in order to communicate clearly and minimize misunderstandings in their on-line transactions with others (Murphy & Collins, 1997). This research points to the need for continued study of various means of conducting instructional electronic chats if these chats are to be an integral part of Web-based courses.

Method

Participants

The study was conducted over one semester in four separate Web-based courses of instruction. The total subject pool included 62 students who completed the pretest instrument with 42 of those students also completing the posttest instrument resulting in 42 matched subjects. The main study courses included: Relational Database Concepts (comparison group) n=15; Advanced C++ Programming (comparison group) n=8; Computer Ethics (treatment group) n=10; C++ Programming (treatment group) n=9.

Design and Procedure

The pretest and posttest questionnaires and instructions that were used for this study were pilot-tested at the University with 30 students who were taking a Web-based computer science course. Internal consistency was high for both the pretest (Cronbach's alpha=.89) and the posttest (Cronbach's alpha=.85). Pretest questions numbers eight and nine (numbers five and six on the posttest) were eliminated from analysis due to variations in question wording from the pretest to the posttest that may have been confusing to students participating in the study.

Prior to the study, two instructors were trained in the use of a communications protocol in synchronous chat environments. Each instructor was assigned a comparison group course and a treatment group course. Identical Web-based pretest surveys were created for each of the four courses and were administered between January 21 and February 1, 2002. Students voluntarily participated in the study by completing the pretest and then, at end of the semester, completing the posttest. An incentive in the form of a raffle of two gift certificates, redeemable at the campus bookstore, was used to increase participation. Privacy and confidentiality were maintained through the use of anonymous tracking of pretest and posttest responses.

Students in the treatment group courses were oriented on the use of the communications protocol for synchronous chat that was then used throughout the semester for all synchronous chats. Students in the comparison group courses were not oriented on the use of the communications protocol and did not use a protocol for synchronous chat at any time during the semester.

Results

The first step in the analysis was to determine whether or not differences concerning experiences with Web-based learning existed between the treatment students and the comparison students that might influence the study results. This was determined by assessing student responses to posttest questions 'a' through 'c' that asked about prior participation in Web-based courses, participation in on-line chats during the semester, and frequency of participating in on-line chats during the semester. Although members of the comparison group were more apt to be first-time students in a Web-based course than were treatment students (10 vs. 4), this difference was not found to be statistically significant based on the results of a chi-square analysis $X^2(1) = 2.36$, p=.11. (see Table 1).

Table 1: Crosstab Analysis by Condition for Posttest Item A

		Condition		
		Treatment	Comparison	Total
Post A: Was this the first Web-based course that you have ever taken?	Yes	21.1% (4)	43.5% (10)	33.3% (14)
	No	78.9% (15)	56.5% (13)	66.7% (28)
	Total	100.0% (19)	100.0% (23)	100.0% (42)

The number of students who participated in the synchronous chats was equal across the comparison and treatment groups (see Table 2) which also proved not to be significant $X^2(1) = 2.31$, p=.14.

Table 2: Crosstab Analysis by Condition for Posttest Item B

		Condition		
		Treatment	Comparison	Total
Post A: Did you participate in any on-line chats during the semester?	Yes	94.7% (18)	78.3% (18)	85.7% (36)
	No	5.3% (1)	21.7% (5)	14.3% (6)
	Total	100.0% (19)	100.0% (23)	100.0% (42)

Between the comparison and treatment group, 66.7% of the students participated in at least four or more synchronous chats during the semester. Although the comparison group was more apt to participate in greater than 10 synchronous chats, this result proved not to be significant $X^2(1) = 16.13$, p=.24.

Given that there were no significant differences between the two groups on these demographic variables, the first analysis conducted was an analysis of variance (ANOVA) comparing the posttest scores of the comparison and treatment students using their pretest scores as a covariate (see Table 3). For this analysis, results were only processed for those students who indicated that they had participated in a Web-based course prior to the study as assessed by question 'a' on the posttest (N=28). There were no significant differences between the treatment and comparison group on any of the seven variables between the pretest and posttest. The comparison group actually scored higher on six of seven items showing a possible trend, but the differences were small and non-significant.

Table 3: Analysis of Variance for Students With Prior Experience in a Web-based Course (N=28)

Source	Treatment Mean (1-5); 5 preferred	Comparison Mean (1-5); 5 preferred	*df*	*Mean Square*	*F*	*p*

Posttest #1: Overall, how satisfied were you with this Web-Based course?	4.20 (n=15)	4.31 (n=13)	1,27	.068	.046	.83
Posttest #2: How satisfied were you with the quality of the interaction in the class?	4.07 (n=15)	4.38 (n=13)	1,27	.011	.020	.89
Posttest #3: How satisfied were you with the interaction that occurred between yourself and the instructor?	4.07 (n=14)	4.62 (n=13)	1,26	1.69	1.40	.25
Posttest #4: How satisfied were you with the interaction that occurred between yourself and other students in the class?	3.33 (n=15)	4.00 (n=13)	1,27	1.50	1.67	.21
Posttest #7: Synchronous interaction (at the same time, e.g., chat rooms) in a Web-based course is important.	3.67 (n=15)	3.62 (n=13)	1,27	.616	1.09	.31
Posttest #8: How satisfied were you with the synchronous (at the same time, e.g., chat rooms) interaction in the course?	3.53 (n=15)	3.77 (n=13)	1,27	.011	.015	.91
Posttest #9: Overall, would you say that synchronous chat sessions contributed positively to your Web-based learning experience?	3.33 (n=15)	3.77 (n=13)	1,27	.473	.664	.42

The same analysis was repeated (see Table 4) for all students in both the comparison and the treatment group regardless of past experience taking a Web-based course (N=42). Again, there were no significant differences between the treatment and comparison group on any of the seven variables at posttest using pretest scores as a covariate.

Table 4: Analysis of Variance for All Students (N=42)

Source	Treatment Mean (1-5); 5 preferred	Comparison Mean (1-5); 5 preferred	*df*	*Mean Square*	*F*	*p*
Posttest #1: Overall, how satisfied were you with this Web-Based course?	4.26 (n=19)	4.09 (n=23)	1,41	.403	.285	.60
Posttest #2: How satisfied were you with the quality of the interaction in the class?	4.11 (n=19)	4.13 (n=23)	1,41	.027	.031	.86
Posttest #3: How satisfied were you with the interaction that occurred between yourself and the instructor?	4.06 (n=18)	4.65 (n=23)	1,40	3.63	3.53	.07
Posttest #4: How satisfied were you with the interaction that occurred between yourself and other students in the class?	3.42 (n=19)	3.61 (n=23)	1,41	.069	.074	.79
Posttest #7: Synchronous interaction (at the same time, e.g., chat rooms) in a Web-based course is important.	3.68 (n=19)	3.74 (n=23)	1,41	.421	.701	.41
Posttest #8: How satisfied were	3.68	3.70	1,41	.347	.385	.54

you with the synchronous (at the same time, e.g., chat rooms) interaction in the course?	(n=19)	(n=23)				
Posttest #9: Overall, would you say that synchronous chat sessions contributed positively to your Web-based learning experience?	3.53 (n=19)	3.78 (n=23)	1,41	.211	.304	.59

Paired t-tests were also performed to measure pretest to posttest change for both the treatment and comparison group. The results of these tests show that there were no significant changes from the pretest to posttest for either group.

Discussion

The results of this study indicated that the use of a communications protocol in synchronous chat did not have any effect on student satisfaction with Web-based courses. The result was similar regardless of whether students had prior experience taking a Web-based course or not. Also, students did not have any significant gain in scores from their pretest to posttest responses.

Based on this single study, it is difficult to determine exactly why the use of a communications protocol in synchronous chat had no effect on student satisfaction. In prior surveys conducted at the University, students have indicated that a contributing factor to feelings of dissatisfaction was the lack of organization and the general chaotic nature of synchronous chats. Based on the results of this study, the type of synchronous chat may also need to be examined as a contributing factor to student dissatisfaction.

One of the strengths of this study was that it utilized an empirical approach which employed a comparison and treatment group. Another strength of the study was that it used instruments that were shown to have high reliability. Although the sample sizes were small, pretest to posttest mean scores indicated no trends in the data between the comparison and treatment groups which suggests that even if larger sample sizes were used, the results would not have changed.

A weakness of the study was that the questionnaire designs (the pretest and posttest) were more appropriate for students with prior experience with Web-based courses. The pretest questionnaire could have been designed using questions that better differentiated between experienced and non-experienced students and provided questions that specifically focused on this difference among students. Another weakness is that all of the questions in both the pretest and posttest were close-ended. The addition of some open-ended questions would have offered participants an opportunity to further expand on or to provide clarification regarding their responses. This qualitative data may have illuminated the question of why the use of a communications protocol had no effect.

A limitation of the study is the fact that of the 42 students who participated in the study, only 27 students actually had prior experience with Web-based courses. Also, the study was conducted with students in a single university setting. Another limitation is that all of the students who participated in the study were taking one or more computer science courses, thus their knowledge of and ability to apply technology may have been more sophisticated than that of other students who may not have a technical background.

Implications

Implications for faculty who may or may not use a communications protocol in synchronous chat are inconclusive. Currently, most instructors at the University use chat as a form of virtual office-hour whereby students can, at their option, attend a weekly chat to ask questions, make comments, or observe other student-to-student or student-to-instructor interactions. As discussed in the following section, the study of the effect of a communications protocols in synchronous chat is a suitable area for continued research due to a lack of conclusive research in this area.

Recommendations

Recommendations for further research include exploring other Web-based applications of chat in addition to virtual office-hours such as instruction, lecture, and social interaction (while using a communications protocol). Such research may contribute to a better understanding of how communications protocols impact the synchronous chat environment.

Faculty at the University who currently use a communications protocol while conducting their synchronous chats should continue to do so. Faculty who currently do not use a communications protocol may still want to consider using one; however, the potential benefits are inconclusive. A major recommendation for further study includes examining the differences in satisfaction between the various types of synchronous chats (instruction, lecture, office-hour, and social interaction) when a communications protocol is used.

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Motivational Level of a Computer-based Simulation: A Formative Evaluation of the US Army Recruiting Simulation (USAREC)

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Abstract

The purpose of this study was to conduct a formative evaluation of a computer-based simulation program that specifically focused on the motivational effectiveness of a simulation and to link motivational effectiveness with various instructional simulation components. the primary focus of the evaluation was to find out how the simulation supports learning motivation. the Instructional Materials motivational Survey (IMMS) (Keller,1993) was applied as the measuring instrument for the formative evaluation. Based on ARCS (Attention, Relevance, Confidence, Satisfaction) motivational design model (Keller, 1987b) the IMMS was modified to accommodate specific needs of the evaluation. From the data analysis, instructional simulation components were identified and recommendations were made to improve motivational effectiveness of the simulation. The relationship between components inherent with instructional simulations and learning motivation is also discussed.

Introduction

Instructional Simulations—What and Why

Instructional simulations provide a learning context that provides opportunities enabling learners to perform acquired skills or knowledge under a friendly environment. The modern era of instructional simulation began in the 1950's as a combination of war gaming, computer science and operations researches (Crookall & Wolfe, 1998). Today instructional simulations are widely applied in business and management education as effective instructional tools in facilitating learning processes (Faria, 1998).

Instructional simulations are known for their effectiveness in promoting active learning (Rosenørn & Kofoed, 1998; Wolfe & Crookall, 1998) rather than passive learning activities. Learners are able to engage peers interactively for intellectual collaboration (Spector, 2000) and work with colleagues on challenging tasks to gain desirable and persisting improvement in understanding (Resnick, Levine & Teasley, 1991; Scott, Cole & Engel, 1992). Using instructional simulations to teach as means of experiential learning also enables learners to be involved in the learning process more thoroughly while learning motivation is increased due to interactive instructional approach (Ivy and McQuillen, 1986).

Instructional Simulation Development Issues

Although the instructional simulations of past decades were widely accepted in educational settings, researchers and educators are still striving to formulate this instructional method into an applicable science (Wolfe& Crookall, 1998). Ruben (1999) was concerned that the rush to embrace instructional simulation as the innovative instructional method can mismatch necessary developmental evaluation with regard to design and application, and specifically to issues of validity, reliability, and utility. In considering computer-based instructional simulations, Gredler (1992) suggested the complexity of development should be considered during the developmental processes by implementing effective evaluations.

Learning Motivation, Simulations, and Instructional Evaluation

Instructional simulations are well recognized by their ability to motivate learners (Ivy & McQuillen, 1986; Burn & Gentry, 1998). However there is no sufficient knowledge as to understand exactly how simulations influence learning motivation (Yaconich, Cannon & Ternan, 1997). In order to gain a better understanding, this study uses Keller's ARCS motivational design model (1987b) to investigate the relationship between simulations and motivation. Due to the importance of motivation when it comes to initiate and support learning behaviors, motivational components should be thoroughly assessed and evaluated. However instructional evaluation often neglects the motivational components because of its inherent complexity (Armstrong, 1989; Baird & White, 1982; Lee, 1990; Merrill, 1980). **ARCS Motivational Design Model and IMMS**

Keller’s ARCS motivational design model (Keller, 1987b) prescribes a practical approach in designing motivational instruction, which synthesized various inputs that have already been discussed and suggest strategies for instruction that motivation theories apply (Driscoll, 2000). The ARCS motivational design model (Keller, 1987b) was not initially developed for computer-based instructional design. Studies proved that it can be modified to accommodate the applications on computer-mediated or web-based instructional developmental evaluation (Keller and Suzuki,1988; Keller and Song, 1999). Keller (1993) then utilized an instrument, Instructional Materials Motivation Survey (IMMS), as a situational measure of students’ motivational reactions to instructional materials based on the ARCS motivational design model (Keller, 1987b) for broader applications.

Program Description

The US Army Recruiting Simulation (USAREC) was initially developed with the intention to experiment with innovative economic theories. Currently USAREC is designated as a diagnostic and planning simulation (Gredler, 1992) for the US Army as a training tool. The design and development of this tool was not based specifically on any particular instructional design model.

The simulation characteristics include the following items.

- Browser-based multimedia simulation tool
- Deliverable through secured network due to sensitivity of the information involved
- Multiple teams can operate the simulation simultaneously and further to compete with each other
- Learning facilitation supported by both artificial agents (databases) and human agents (participants)
- Modulated components enable program designers to modify the simulation efficiently according to the instructional subjects or objectives

Data Collection Methods

In order to investigate motivational support provided from the simulation and how the motivational evaluation can be effectively conducted, the IMMS developed by Keller (1993) was employed as the measuring instrument on learners reaction. The study questionnaire included 36 rating questions corresponding to each component of ARCS Motivational Design Model (Keller, 1987). Qualitative data were also collected from the short answers questions included in the questionnaire.

There were 12 participants surveyed in the study. Participants were randomly selected from doctoral programs, MIS program and MBA programs in the Krannert School of Management.

Quantitative data is the main component from the measuring instrument in accordance with Keller’s IMMS (Keller, 1987). Each rating question allows participants to rate their initial reaction from 1 to 5 (“Not True” to “Very True”). Average rating points of each category of the ARCS model is calculated in order to illustrate the general reaction towards each category.

In order to collect the qualitative data, an interview with the program author was conducted to gather background information and further identify the underlying developmental principles and instructional objectives. The open-ended questions attached to the IMMS questionnaire were the main source for the student’s qualitative responses.

In order to further analyze the quantitative data, we develop a coding system based on elements of designing and developing computer-based instructional program. Each code and its associated implication is shown in Table 1. By coding the qualitative data, we categorized learners’ reactions corresponding to each ARCS model component. During the coding process, if a qualitative response reflected multiple codes, then the response was coded for multiple codes.

Table 1. Instructional coding system with associated implication

Code	Implication
Interface	This code represents responses regarding interface design and the navigation system design seen in the simulation.
Content	This code represents responses regarding content presentation, logic of layout, and established relevance between the simulation and participants' experiences.
Learning Support	This code represents responses associated with learning process, customizability of the simulation, instructional support provided from the simulation, and general learning- related reactions.
Implementation	This code represents responses regarding issues associated with the infrastructure that supports or jeopardizes the implementation of the simulation, such as unexpected server problems. This code focuses on the implementation of the program that includes capabilities of personnel, technology, overall managerial issues, and the design of implementation procedures.

Results

Quantitative Data

On a five-point scale, the average rating for the 12 participants was 3.86 for Attention, 4.01 for Relevance, 4.06 for Confidence, and 3.60 for Satisfaction. The Satisfaction component obtained the lowest rating of all four ARCS components. Confidence rating is the highest among all four components. The simulation has a moderate level of support in stimulating Attention and establishing Relevance.

The average rating for the Attention component of the ARCS model was 3.86 out of 5.0. The simulation's interface design is the main simulation feature that was attractive to participants. One inherent interface factor that might have an impact on higher levels of Attention was the variability of multiple participant interactions. The unpredictability of how other participants would interact during a simulation session might contribute to stimulate participants' curiosity during the learning process.

The average rating for the Relevance component was 4.01. Participants consider the concepts, technical application, and logical content layout effectively establish relevance with their previous experience and current and future research interests.

The Confidence component obtained the highest average rating of4.06. Participants perceive the possibility of gaining success by actively engaging with the simulation. User-friendly navigation built in the USAREC also enables participants to go through the simulation without feeling frustrated.

The Satisfaction component had the lowest rating 3.60, as compared to the other three components. The unfinished session caused by technical difficulties failed to satisfy participants' seeming expectation.

Qualitative Data

To make sense of the qualitative responses and how they are linked with the ARCS components, the numbers and percentage of qualitative responses from each ARCS component were categorized by proposed codes (see Table 2).

Table 2. Instructional codes compared across ARCS components (frequency and percent)

Participant Responses	Attention n=15		Relevance n=8		Confidence n=10		Satisfaction n=7	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Interface	11	73	3	37	5	50	0	0
Content	5	45	8	100	7	70	4	57
Learning Support	2	18	0	0	2	20	5	71
Implementation	2	18	1	12	3	30	5	71

As shown in Table 2, 73% of participants' responses from the Attention associate with the Interface design issues of the simulation. All responses from the Relevance are coded by issues related to content, which indicated the importance of program content while intending to establish relevance. The content is also relatively influential in helping participants feel confident in finishing the program.

Learning support and Implementation of the simulation are identified as major elements to influence perceived satisfaction from participants toward the simulation.

The questionnaire asked specific questions related to ARCS. For the Attention component, there were 15 responses. We then coded the responses using the four codes. For the 15 Attention responses, 11 talked about design, 5 mentioned Content. Among the total eight responses from Relevance component, three addressed the Interface design of the simulation while all of them were associated with the Content. Seven out of ten responses on Confidence component of ARCS were related to the Content while majority of responses on Satisfaction component are associated with Learning Support and Implementation of the simulation.

Table 3. ARCS components compared across instructional codes (frequency and percent)

	Interface n=19		Content n=24		Learning Support n=9		Implementation n=10	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Attention	11	58	5	21	2	22	1	10
Relevance	3	16	8	33	0	0	1	10
Confidence	5	26	7	29	2	22	3	30
Satisfaction	0	0	4	17	5	56	5	50

In order to cross-examine the relationship among ARCS components and the coding system, the qualitative data based on given codes is rearranged in Table 3. More than half (58%) of Interface-coded responses are associated with the Attention component. This might indicate that instructional interventions associated with Interface issues may influence the attention component of motivation.

Among the 24 Content-coded responses, 33% are from the Relevance and 29% are associated with the Confidence. These results indicate that the program content may have an influential effect to establish relevance and participants' confidence related to motivation, which also supports the finding from Table 2. Both learning support and program implementation are influential in making participants feel satisfied. Learning Support-coded and Implementation-coded responses tend to relate closer to Confidence and Satisfaction components than to Attention and Relevance.

As indicated in the qualitative data results, participants' responses tend to focus on: the design related issues when reporting on the Attention component of the simulation; the content related issues of the simulation when reporting on the Relevance and Confidence components; and learning support and implementation related issues when reporting on the Satisfaction component of the simulation.

Regardless of the ARCS component the qualitative data is associated with, we see a tendency that participants for this study responded to learning motivation questions by evaluating the overall simulation primarily for its content and interface design perspective.

Table 4. Coded responses versus total responses

	Total Responses per Code	Total Responses	Percentage
Interface	19	40	47.5 %
Content	24	40	60 %
Learning Support	9	40	22.5 %
Implementation	10	40	25 %

Discussion

General Motivational Support

In general, participants rated the simulation as instructional software that stimulates attention, establishes relevance, and builds confidence. The rating for the Satisfaction component of the ARCS model was noticeably lower than others. Qualitative responses indicated that the students didn't have opportunities to complete the simulation due to experienced technical difficulties. During the simulation session, the server responsible for data processing was acting more slowly than usual, which drastically decreased participants' satisfaction level toward the program and influenced learning motivation.

As indicated by Keller (1987b), in order to achieve desired motivational outcome on the Satisfaction component of ARCS model, meaningful opportunities should be provided to participants to allow them exercise newly acquired skills or knowledge. USAREC was designed to provide meaningful opportunities to participants however the infrastructure supporting dissemination of the program failed to accommodate this need. Since USAREC is intended to be accessible simultaneously by multiple users, the responsible sever needs to be capable to processing immense amounts of calculations and provide feedback to participants simultaneously. During the session for the study, participants and the facilitator encountered several technical difficulties causing delayed automated feedback and slowed data processing. Interrupted session thus caused participants to feel bored and led to a lower rating on Satisfaction component of the ARCS model.

Keller (1987b) indicated that Confidence within the ARCS model could be constructed by building a positive expectation for success, stimulating learning experiences that support or enhance learners' beliefs in their competencies. A debriefing session was conducted after the simulation, which provided participants to reflect on their previous actions and results. The "actual" learning in USAREC depends on the evolving reflection and discussions occurred during debriefing sessions. The simulation establishes an environment that allows learners to evaluate their own performance collaboratively with peers and hence to construct their confidence.

Participants are likely to evaluate the performance of the simulation by looking at its content and interface design. The learning support and program implementation from the simulation play important roles in stimulating participants' satisfaction toward the program. Qualitative responses coded as program implementation also indicated its negative influence on learning motivation caused by the simulation technical problems.

ARCS Ratings versus Performance

Motivation is important in learning, but there is also an important effect on performance. In the case of the simulation, the performance is the use of the simulation thereby impacting learning. Keller (1987b) suggested that either insufficient or excessive motivation could lead to lower performance (see Figure 1).

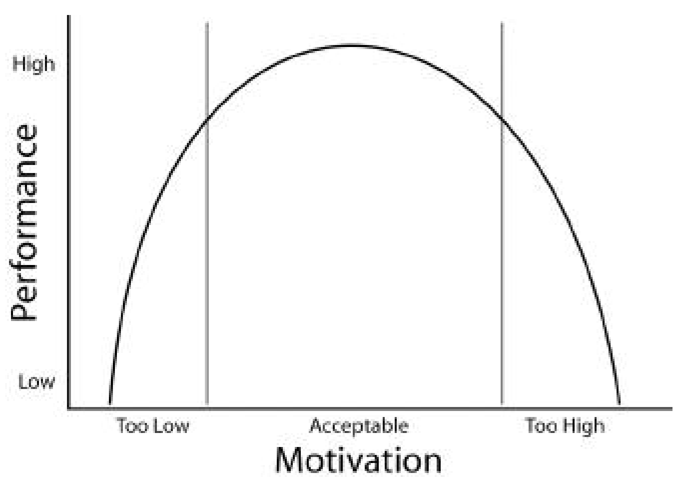

FIGURE 1. Relationship between motivation and performance

The half-inverted U curve (see Figure 2) that shows the relative placements of the ARCS model components versus predictive performance. The figure illustrates the result from the audience analysis on their entry motivational level. We suggest the highest level of performance should correspond to the highest rating from IMMS scale, that is, five. The acceptable range of motivational level might result in higher degree of performance. By placing measured motivational levels on the half-inverted U curve, ARCS component-specific motivational objectives can be identified and further to design and develop corresponding instructional strategies. In our case, ratings on Attention, Relevance, and Confidence components were relatively higher than Satisfaction component, which helped us rationalize the lower limit of acceptable motivation level.

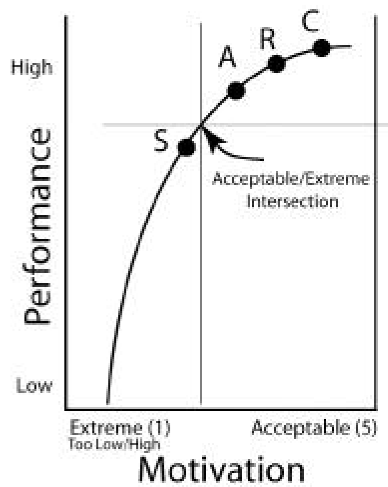

FIGURE 2. Half-inverted U curve—Relative motivation levels of ARCS components versus performance level

Recommendations

Effective Implementation to Improve Motivational Effectiveness

In order to improve USAREC's motivational effectiveness based on Keller's ARCS motivational design model, the simulation needs to provide opportunities for participants to apply acquired knowledge and skills. The developmental team could focus on issues of enhancing the simulations stability and reliability. It is recommended that the simulation be administered in a closed network that has independent servers and connection bandwidth. This will likely avoid jammed connections and increase the server's calculation speed. Depending on the criticality of the simulation's operations, a backup server may be necessary to take over any troubled session. Capable technical support personnel should be standing by on site where the simulation is delivered in order to immediately respond to any situations. These suggestions will further help to evaluate the stability of the system. Once the system is stable and operating reasonably, then studens will be able to apply their knowledge and skills over multiple sessions thereby perhaps increasing their overall satisfaction level.

Need for Systematic and Comprehensive Evaluation for Instructional Simulation Development

The USAREC team did not implement any instructional design models to develop the program. This simulation required an immense amount of data processing. The process of designing and developing this simulation is rather complicated compared to other types of computer-based instructional programs. Also due to a high turnover rate of developmental team members, it is challenging to efficiently monitor the simulation's instructional qualities without a formal systematic approach. Thus we identify an urgent need to deploy comprehensive instructional evaluative means with an emphasis on program audience, instructional objectives, and technical infrastructure in order to improve the simulation's overall instructional and motivational quality. A comprehensive and systematic evaluation process should include audience analysis, formative evaluation, summative evaluation, and confirmative evaluation. Particularly the technical infrastructure that supports the implementation of the simulation should be consistently evaluated with regard to its compatibility, reliability, stability, and customizability.

Address Importance of Motivational Effectiveness in Evaluating Instructional Simulation

Keller's ARCS motivational design model intends to be implemented prior to the full launch of instructional development process. An audience analysis on their entry motivation level toward the instructional program is necessary to provide simulation designers information to identify motivational objectives and select appropriate instructional strategies to achieve desired motivation level. Insufficient or excessive motivation level can both lead to unwanted learning outcome (Keller, 1987). The instructional simulations' sound features associated with active learning, experience-based learning, problem solving, and high level of interactivity are effective to stimulate learning motivation. However it is relatively easy to over-motivate learners and make them feel overwhelmed or confused about not knowing where to begin or end. We recommend the implementation of a motivation level evaluation on the audience before, during and after the development of instructional simulations thereby optimizing programs' motivational effectiveness.

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Supporting Teachers' Performance and Student Learning Using a Wireless Handheld-based Assessment and Discussion Tool

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Abstract

A team of researchers joined a development company to create an interactive server-based application to be delivered using a classroom of wireless handheld devices. This study examines the instructional performance support issues related to the use of wireless network technology in a classroom. The development framework was based on prior professional development efforts and information on developing a network in a classroom by the researchers and their partner corporation. Specifically, this exploratory study looks at the instructional use and teacher performance support provided by the networked assessment and discussion tool. The results of this study include: instructional modes, learner usability and perceptions, teacher performance support, and instructional implications.

Introduction

Networking technologies have enabled the use of many applications, including e-mail, bulletin boards, and the Web. These tools and others associated with networking have transformed the way we interact. As networking technologies mature, educators have become interested in understanding and integrating these network technologies in their classrooms. With the introduction of inexpensive and pervasive wireless networking, new instructional methods are possible from the use of these tools.

Technology capabilities hold considerable promise for teaching and learning, but current practices may prove insufficient in optimizing available resources and preparing individuals to learn in a resource-rich environment. Hill and Hannafin (2000) point out that schools and classrooms need to become resource-intensive where digital resources can be readily generated and accessed per specific goal of teacher and/or students.

Along with encouraging the use of technologies in today's classroom, as with any educational process, there should be an assessment of the impact of these initiatives. The evaluation of any instructional tool cannot be overlooked if continued use of the instructional tool is expected to bring about an impact on learning for students of today and tomorrow.

Background

Roeing Corporation, in association with Lafayette Jefferson High School and Purdue University, developed an interactive software application for the purpose of increasing student learning. The software intent was to increase communication between teacher and students as well as among students. This classroom system was designed to enable a teacher to elicit immediate individual responses from an entire class, implement electronic testing, and promote creative classroom interactions. The system uses a wireless network to connect both students and teacher. Each student uses a PocketPC with a portable keyboard as a means of communication.

Our overall project goal was to develop and evaluate a communication tool that would allow students and teachers to communicate in more productive and creative ways, thereby increasing learning. The project objectives were twofold. First, the development/implementation/research team wanted to design and develop an instructional tool to support learning. Second, we wanted to conduct developmental research to investigate the support tool by studying instructional usability

Tool Design & Development

Design Specifications

In order to meet the project goal of increased learning through the use of a communication tool, the project team established several design features that we were interested in developing. We wanted the tool to facilitate learning by providing teachers with the ability to (1) pose real-time questions to the class, (2) view individual student responses, (3) allow teacher evaluation of each student's understanding of the topic, (4) administer exams electronically, and (5) allow interactive classroom collaboration.

Three design features were established to provide the functionality needed to create the desired learning environment. The three software features included:

(1) Automated Response—teacher can, in real-time, continually sample the opinions and cognitive responses of class members during the class
(2) Electronic Testing—teacher can deliver randomly selected closed and open-ended test items to a class of students
(3) Creative Interaction—teacher can collect and display narrative responses from a class of students

The ability for a teacher to get immediate individual interactive responses from students will allow the teacher to identify topics that warrant additional review before moving on to new material. This will allow a teacher to immediately review troublesome material. This may also greatly reduce the time a teacher spends grading tests and will allow more time for classroom activities.

Software Development

The system consisted of a wireless networked intranet server running the software application and a PocketPC for each student. Based on the design specifications, the software was developed so that teachers can use the system to create three types of interactions: a quick question (closed and open-ended items), a test (multiple items), and a discussion thread. The use of these features will be described in the results section.

The introduction of PocketPCs into the classroom instead of desktop PCs might allow existing classroom configurations to implement technology that would otherwise be limited to a PC lab environment. The hands-on environment might also spark additional improvements and enhancements of instructional concepts.

Developmental Research Methods

Based on the formative nature of this study, the research team determined that it was necessary to first conduct an exploratory study to determine the critical issues associated with the tool prior to conducing an experimental study. This exploratory study used surveys and observations as the primary data to determine the application's efficiency and appeal to users. Due to human subjects constraints, we were only able to utilize observation and system tracking data.

This study explored three major areas: (1) student learning and instructional usability (understanding comprehension of the connection between learning and the software functions); (2) technology integration (teachers' skills to integrate this system into their curriculum); and (3) usability of the interactive testing software on a PocketPC-based network.

Based on the study's focus, several questions emerge that guided the data collection and data analysis:

1. What is the classroom instructional usability of a wireless group response system (defined as student learning and engagement)?
2. What is the usability and feasibility of an electronic group response system (defined as ease of use, product efficacy, user frustration, and number of questions asked)?
3. How is classroom technology integration enhanced through the use of an electronic group response system?

Instructional Modes Findings

The data analysis for each software feature resulted in the identification of a related instructional mode. Based on research observations, instructor perspective, and tracking data, this study's findings are grouped around these three instructional modes. The instructor used the tool in three different instructional modes: the Rapid Assessment Mode (RAM), the Rapid Testing Mode (RTM), and the Open Discussion Mode (ODM).

Automated Response—Rapid Assessment Mode (RAM)

The rapid assessment mode is used to obtain an immediate assessment regarding student understanding. The instructor selects or creates a quick question and then presents it to the students. As students respond, their inputs appear at the instructor's workstation. If the instructor wants to assess students' perceptions or cognitive thoughts, this mode enables the instructor to rapidly assess all of the students. This mode allows instructors to quickly assess students, but also to complete the assessment in a comprehensive manner, i.e., to obtain desired inputs from all of the students. The sampling rate is not limited to that associated with spoken language assessments (such as air time, personalities, competition).

Quick questions are presented to students in both open- and closed-ended items, including multiple-choice and fill in the blank formats. The type of assessment item may be similar to that found in the RTM; however, the purpose of the mode is different.

RAM Use Summary

During the Fall 2001 Semester, the RAM was used in a total of 20 different class periods. Biology B2 used the RAM during 6 class periods. Biology B3 used RAM in 5 different class periods. Genetics R2 and R3 used RAM in 4 and 5 class periods, respectively.

There were a total of 179 quick questions asked in the RAM. Table 1 shows the totals per class period. This ranged from 2 to a maximum of 20 items. Overall, there was an average of 8.95 items asked per class that used the RAM. On the average, 95.98% responded to the items presented. This could include a correct, incorrect, or even a statement like "I don't know."

Table 1: RAM Use Summary

Date	ClassName	Total Items/Class	Ave % Response	SD	N participants
Totals	20	179			
Average		8.95	95.98	8.11	15.7

RAM—Techniques Used

In RAM, we found that the instructor used the quick questions with different techniques. These include using complete electronic questions (including Electronic Stem, Distracters, Response) and partial electronic questions (including Electronic Stem, Verbal Distracters, Electronic Response or Verbal Stem, Verbal Distracters, Electronic Response). In each case for the RAM, the instructor used the quick question to solicit quick, parallel responses via the hand-held computer.

<u>Complete Electronic Question</u>

The Complete Electronic Question technique is when the instructor uses an item with an electronic stem and distracters. These items can be created prior to class or during the class. As appropriate, the instructor will then present a quick question to the students for consideration. We believe that most of the questions used with this technique had been constructed prior to the class in which they were used.

<u>Partial Electronic Question</u>

The Partial Electronic Question technique includes both electronic stem with verbal distracters and verbal stem with verbal distracter. These items are usually created on an as-needed basis. The instructor will think of a question and want to rapidly assess the students, so he will create a partial question (with electronic or verbal stem) and then submit it to the students. This technique is used frequently and spontaneously (see Table 2).

No matter which techniques are used, in each case the student responds using the electronic tool. In considering the RAM, the instructor wants to rapidly assess as many students as possible. Whether the question is presented electronically or verbally, students submit their responses electronically, thereby providing the instructor with a rapid assessment.

Table 2: RAM Techniques Calculations

Electronic Question Technique	Count	Percentage
Complete Electronic Question	108	60.3%
Multiple Choice	55	50.9%
Short Answer	53	59.1%
Provided Distracters	103	95.3%
Distracters Not Provided	5	4.7%
Partial Electronic Question	71	39.7%
Short Answer	71	100%
Total Items	**179**	

Instructor's Role

The Rapid Assessment Mode provided teacher performance support, in the sense that it provided the instructor a rapid diagnosis of how the students were learning or had learned the material at a given time, as reflected by their answers. In our study, the instructor was able to be flexible in his use of this mode by combining different instructional approaches and media to "customize" the learning environment. This flexibility was also found with the Open Discussion Mode (see section on ODM).

In one biology class, for example, the instructor provided a review, using slides and a laser pointer. He asked the questions of the students verbally; however, the students responded by using the hand-held. In this way, the instructor was able to get a clear picture quickly of "where the students were at," allowing him to diagnose problems as needed.

> From the instructor: "We reviewed the parts of cells and their functions. For a good portion of the review I just sat at the desk and pointed to cell structures on the slide screen with a laser pointer. The questions were like this: "What cell structure am I pointing to?" or "What is the FUNCTION of the cell structure that I am pointing to?" These were not questions that I had typed in previously. Instead, I simply verbalized the questions (the "old fashioned way"!), so that what showed up on the students' screens was simply (for example): "Q#250" This progressed very smoothly. We were able to cover a lot of review material in a fairly time-efficient manner." [Instructor Reflection, Biology Class, November 26, 2001]

RAM—Discussion

Considering all of the qualitative data, two strategic themes emerged based on the instructor's use of the tool: confidence builder and increased student engagement and participation.

Theme: Confidence Builder

Because the rapid assessment mode provided rapid diagnosis of student learning at a point in time, the instructor was able to then pinpoint and call on those students who would not normally respond, perhaps due to a lack of confidence.

> From the instructor: "After everyone had answered, I would call on one student to say the correct answer out loud. I found myself, of course, calling on a student who had entered a correct answer. This allowed quiet, shy, under-confident students the opportunity to answer correctly in front of their peers when called upon by the teacher. I tend not to call on a quiet, under-confident kid, especially if I don't think he knows the right answer. This tool allows me to "read their minds" and call on the kid who I KNOW knows the answer. Possibly a confidence builder for that type of kid????" [Instructor Reflection, Biology, November 26, 2001]

The effective use of this mode also appeared to increase instructor confidence in moving ahead with the planned instruction. After presenting a question to the students, the instructor could rapidly assess whether the students were at the appropriate comprehension level to proceed to the next stage in the instruction.

> From the instructor: "At the beginning of the class I gave the kids multiple choice questions one at a time just to check for their retention of what we lectured on last time. Seeing all those correct answers rolling in…gave me confidence to charge ahead today with the pre-lab, knowing full well that the kids understood the basics well enough for us to move on." [Instructor Reflection, Genetics, December 13, 2001]

Theme: Increased Student Engagement and Participation

The use of the Rapid Assessment Mode enabled the instructor to confirm participation/student engagement. The instructor also used this mode to verify if students are following along. In doing so, students are encouraged to maintain engagement because each student can be assessed at any point during a class.

> From the instructor: "… in biology classes we used the computers in a lecture setting. Throughout the course of the lecture (in both periods) I occasionally sent the students quick questions to make sure they were all "with me". I'm convinced that this is a good way to make sure all of the kids are engaged…" [Instructor Reflection, Biology Class, December 5, 2001]

Further, not only can the tool promote participation, but also it can assess participation in a quick and easy manner. Again, because this assessment is rapid, students are more motivated to pay attention and focus on the class activities. Because students are more focused, the instructional content can be reviewed in a short amount of time.

> From the instructor: "Things seem to be going well with the project. The kids seem totally comfortable, competent, and confident with the computers. We have been doing some reviews on them (with quick questions). I like the way it "forces" every student to become actively engaged. I was struck Friday with the fact that a great deal of material can be reviewed in a relatively short amount of time. … when students are engaged in this kind of review session there isn't a lot of time wasted in the teacher having to manage class clowns and distracting comments because their minds are all FOCUSED - due to the fact that they HAVE to be engaged in this sort of activity!" [Instructor Reflection, November 3, 2001]

Electronic Testing—Rapid Testing Mode (RTM)

The rapid testing mode is used to present a series of questions to students. The teacher thereby obtains immediate data on the test results and grading so that same-period feedback is possible. This mode utilizes electronic questions like those used in the RAM. The mode's cognitive measuring ability is parallel to that of the RAM. However, in a typical RAM, a single question is presented and sometimes the questions are informal, i.e., the teacher presents the stem using spoken language. The RTM is more formal. This would be much like a paper and pencil type test. In the RTM, the instructor can present multiple questions to the users, and can provide an immediate feedback score based on their testing performance.

Due to the limitations of this study, the instructor did not use this feature enough to enable us to present findings and results related to this feature.

Creative Interaction—Open Discussion Mode (ODM)

The open discussion mode is used to engage students in an exchange of ideas to assess their comprehension, application of knowledge, analytical skills, and synthesis abilities. Using the ODM, the instructor presents discussion items to a group of students. This mode allows an instructor to pose an open-ended discussion topic or questions to students. The students discuss the topic or question by responding to the instructor and each other by entering their ideas and then submitting them to be shared with the group. All of the comments are presented on the screen of the handheld device in chronological order, starting with the most recent submission added to the top of the list. The instructor has the option of making student inputs anonymous.

The instructor manages the discussion by making submissions or by spoken language. As appropriate, the instructor presents a new or revised discussion topic/question.

ODM Use Summary

Detailed use of ODM is delineated in this section. The data are complied from research observations, system tracking, and from the instructor's usage journal. The following table presents the use results for the open discussion mode.

Table 3: ODM Results Summary

Date	% Response *	Total Responses	Responses per Person	Responses per Minute	Duration (minutes)
Totals		2528			
Means	89.70		2.99	7.29	7.31

* Percentages of students responding assume 100% attendance

During the Fall 2001 semester, the ODM was used in 20 different class periods for a total of 54 discussion questions. Biology B2 used this mode 6 times with a total of 15 discussion questions. Biology B3 used this mode 5 times with a total of 19 discussion questions. Genetics R2 used this mode in 4 classes for a total of 10 discussions.

Genetics R3 used this mode during 4 classes totaling 10 discussion questions. This averages out to 2.75 discussion questions per instructional class in which they were used. There were a total of 2528 responses with a mean of 89.7% of the students responding overall. This averages out to 2.99 discussion responses per student. On average, each discussion submitted 7.29 responses each minute. This works out to an average discussion length of 7.31 minutes per discussion.

ODM—Techniques Used

In the ODM, the instructor can ask a question or present a topic or question for students to discuss and/or answer. The discussions took place in a synchronous same-place environment with the instructor present to moderate the discussion. In this mode, overall we found that close to 90% of the students participated in these discussions.

The instructor presented a variety of discussion topics from reflection question about a video, ethical issue, content issues, to comprehension-type questions. The comprehension questions are much like the quick questions used in the RAM, but in the ODM all of the students can see what the other students are thinking as well as respond to their peers. On the whole, these topics tended to be more application or analysis type questions compared to the RAM questions.

Students present their ideas and respond to each other. We do not have data to qualify the quality of the responses, nor have we analyzed how an individual student performed and why specific types of comments were made. For future studies, it would be important to document this performance.

Instructor's Role

The use of the Open Discussion Mode in the classroom took many different forms specific to instructional approaches. In this section we present the various types of use as well as themes that describe the outcomes of the instructor using this mode.

<u>Use: Facilitating Online Discussion</u>

The instructor would occasionally enter new questions, as one might in a regular discussion setting, facilitating the discussion.

> "In the next class I repeated the same lesson plan, but I was able to (somewhat) better follow their discussion on my screen…as I followed their discussion I occasionally entered new discussion questions that they then responded to." [Instructor Reflection, Biology Class, October 17, 2001]

<u>Use: Private Feedback to Students</u>

Insightful comments led to teacher use of private feedback via the handheld device.

> "A couple of students would submit such excellent, insightful discussions remarks that I felt the need to praise them for it. But I wanted to do it privately. So I used the comment to student function in which I typed a comment specifically to that particular student." [Instructor Reflection, Genetics Class, November 19, 2001]

<u>Use: Technology Integration</u>

The instructor integrated technology as appropriate, combining the use of the handheld with other instructional media, such as follow-up discussions of movies or using the overhead to address clarification questions.

For example, the instructor used the overhead, along with the handheld, to provide clarification for questions, following lesson review. In another case, the instructor integrated discussion of a newspaper article with a movie regarding cloning of humans. Afterward, the students logged into the computer to discuss aspects of the movie and how it related to cloning in the "real world:"

> The instructor describes: First I showed them Monday's headline article in the Journal & Courier which featured the story. Then I showed them the first 25 minutes of the "The 6th Day"... After the movie I had the kids get out their computers and they discussed various aspects of the movie and how the movie was both like and UNlike the real world of cloning. [Instructor Reflection, Biology Class, November 30, 2001]

<u>Use: "Pro" and "Con" Discussions</u>

In some cases, the instructor would post "for" and "against" types of discussion questions. The following vignette is illustrative of this type of discussion that occurred.

[The question: “Do you think it would be OK to clone humans? What are some reasons FOR and AGAINST?”] Some students are reading, while others are typing in the handheld.
Two students are sitting together and working together. It is very quiet in the classroom; the only sound is the clicking of the keyboard and stylus. Later in the class, the instructor asks another question. He indicates to the researchers that the students appear comfortable, and then he “tests” that assumption by asking the students what they think. They respond positively to the use of the handheld, to the point of not wanting to leave the one question to go on to the next.
Instructor is now moving students to the second question. Instructor: “I want to hear about that question.” [The question: “Should the Federal government fund embryonic stem cell research? What are the reasons FOR and AGAINST?”] Instructor asks the class, “I just wanted to know—if this better than listening to Instructor talk?” The class responds, in unison, “Yes!!” Instructor tries to introduce another question, but they (as a class) want to continue with the current discussion: One student says, “I want to do more on this one.”
Instructor to class: “OK, I’ll tell you what—I’m gonna give you another question.” The students respond, variously,“ OK, hold on.” “Chill out, buddy!” Instructor then activates the third question,” Would you approve of using embryonic stem cells from your embryonic clone to cure your life-threatening disease?” After five minutes, Instructor tries to wrap up the discussion, but students want to continue. “Not yet.” [Observation, Biology class, October 29, 2001]

<u>Use: Inviting Analogies</u>

The instructor also asked for student analogies to enhance the review sessions.

The instructor describes: When we were finished with the review session, we then had a discussion. For this discussion I listed the cell parts on the chalkboard. The discussion question … read something like this: "Now that we have compared the cell to a factory, let's use a different analogy. How are the parts of a cell like the parts of a city?" I told the kids to just start discussing (on the computers) as many examples that they could think of. Some of the students had great examples such as "The lysosomes (which eat up and destroy old worn out cell parts) are like garbage collectors." "The nucleus is like city hall." [Instructor Reflection, Biology Class, November 26, 2001]

<u>Use: Case Studies</u>

In one instance, the instructor followed review sessions by using a case study.

Today both biology classes used the computers in "discussion mode". We have finished our cell unit and I was just introducing our next unit (mitosis & meiosis).
Then I gave them a case study, which told the story of a couple who had difficulty getting pregnant. They produced several early embryos in an in vitro fertilization clinic, and had them placed in frozen storage for later attempts at pregnancy. While the embryos were in storage the couple went through a divorce, so the case study centered around the question of who should have custody of the frozen embryos. I gave them several discussion questions that I had "preloaded" during first hour prep. [Instructor Reflection, Biology Class, December 6, 2001]

In another instance, the instructor used the case study questions for discussion. The instructor participated in the discussion and redirected it as necessary:

The discussion topic was on genetic testing of newborns…To kick off this discussion on the computers, I gave the students a case study…The case study had 5 different discussion questions at the end of it. I had programmed into the server those questions before class. As the discussions progressed, I activated the questions one at a time. I also became a participant in the discussions on the computers, whenever I wanted to redirect the discussions. [Instructor Reflection, Genetics Class, November 19, 2001]

ODM—Discussion

There are several themes that emerged from the data analysis of the ODM: higher level thinking; increased student engagement and participation; and instructor motivation.

Theme: Higher Level Thinking

The instructor noted that, in this case, the students had fun but, again, there was an emphasis on their ability to use higher-level thinking skills

> "Excellent discussions resulted. The kids had a great time but more importantly, they had to do some synthesizing and evaluating (Hey! Those are at the top of Bloom's Taxonomy!!!)" [Instructor Reflection, Biology Class, November 30, 2001]

Theme: Increased Student Engagement and Participation

Increased student engagement and increased participation emerged as a common them. A common occurrence was that the students did not want to stop when it was time to move beyond the discussion: Instructor reflects on discussions for two different classes.

> Both genetics and biology classes have had a great deal of success in using the computers in the past few days for discussions. In both courses, students really got into it. I didn't realize before that this technique may help teachers to not only meet the cognitive needs of students but also their AFFECTIVE needs. They LIKE chatting in this way on the computers (they're social animals!).
>
> We discovered that the kids will respond to one another's comments - just like a real discussion! We also discovered that there was almost 100% participation. There is no way I could get 100% participation in a discussion the "old fashioned way" with nonacademic types. They did not want to end the discussion when I told them it was time to wrap up." [Instructor Reflection, Genetics Class, November 3, 2001]

In addition to observing student engagement in his genetics classes (11th and 12th grade students), instructor also found that there was increased engagement and student participation in his biology classes (primarily 9th and 10th grade students).

> I gave them a discussion question that they responded to using the "discussion mode". They enjoyed it very much and got the hang of it quickly! They just carried on, silently typing as they went. At the end of class they did not want to quit! [Instructor Reflection, Biology Class, October 17, 2001]

Theme: Instructor Motivation

Another theme that emerged, perhaps in conjunction with the higher quality discussions, and student engagement, was the apparent increased motivation on the part of the instructor.

> Today in both genetics classes I lectured while the students took notes in their study guides. At one point I posed a discussion question ("Why do you think older women are more likely to give birth to babies with chromosome disorders?") and I had the students engage in the "discussion mode" on their computers. These kids picked it up almost immediately (as did yesterday's first year biology students), but the discussions today were of higher quality as the students stayed "on task" with the topic. It was exhilarating for me, as an educator, to see them quietly and enthusiastically typing away and forgetting that I was even there! In both classes they expressed a strong desire to keep discussing when I decided to bring closure to the activity! They LIKE this!! [Instructor Reflection, Genetics Class, October 18, 2001]

Perhaps as a result of his increased motivation, the instructor then made motivational comments to the students. In one class session, following a lecture/presentation on Tay-Sachs, the instructor activated a question, "Would you consider prenatal diagnosis and abortion of a fetus diagnosed with Tay-Sachs?" As students entered their responses, the instructor said to the class, "Can't wait to print this discussion out so I can really get into it and see what you're coming up with."

Comparative Analysis Results

This section of the report evaluates the basic capabilities and limitations of the electronic system by comparison with what we designate "conventional instructional systems and tools." Insofar as possible, these comparative capabilities and limitations are classified as either:

- Intrinsic (i.e., arising from characteristics and features which would probably be found in any use of the electronic system) or
- Situation-specific or temporary (i.e., associated primarily with the students, the teacher, the coding that was incorporated in the tools, and the subject matter).

In listing and describing intrinsic features, we endeavor to isolate the impact that the tool by its nature would likely have on a wide spectrum of possible applications, given only that the teacher be reasonably competent and willing to experiment to discover how he or she can best use the tool in a teaching environment. By listing and describing situation-specific capabilities and limitations, we hope to suggest methods of improving or optimizing features that are subject to change and may be improved by further work on the concept.

Ease of Use

Results of the study indicate that virtually anyone who can read and write and is familiar with modern data processing can understand and use the electronic system after only a few minutes of instruction and practice. Given the current level of computer literacy within the population as a whole (at least in the United States and other developed countries), ease of use could be classed as an intrinsic feature of the system. After the first lesson or two, classes of 12 to 20 students were consistently able to take the equipment from storage and set it up in approximately six minutes. If the equipment were set up before the class began (handhelds and keyboards checked out and setup on each student's desk), probably only about three minutes would be required to ensure that the students were ready to begin a session. This includes accessing the correct web page for the class as well as logging in to the server. (This assumes that the hardware is part of the classroom. If students individually owned the device, this time might decrease.) As currently programmed, once the electronic system is physically in place there is a simple path to each of its available modes. If other modes are desired, a simple pop-up menu would still suffice. It appears that, for most foreseeable applications, its ease of use would be assured.

Inasmuch as teachers and perhaps most students would already be familiar with the uses of a conventional system, it is pointless to compare the ease of use of the two systems. The key point is that, for a new system, the electronic system is impressive in terms of ease of use.

Impact on the Classroom – The Changed Environment

The use of the electronic system changes the classroom experience and environment in ways that open many opportunities to teachers and students. Some changes are obvious, but others may be unexpected. This discussion covers some of the quantitative and qualitative ways the use of the electronic system changes the learning environment.

The instructor used the open discussion mode with four classes, designated Bio B1, Bio B2, Gen R2, and Gen R3. Using Bio B3 for 10/17/01 as an example, there were 80 responses from the class over the electronic system. The class size was 20, and each student entered at least one response to the question. This equates to 80/20 or an average of four RESPONSES/PERSON. There was an elapsed time of 10 minutes while the discussion was underway, so the instructor received an average of eight RESPONSES/MINUTE. As mentioned in a footnote to the table, we have assumed that all students were present for the discussion. If any were absent during a discussion, the overall average response rate would be greater than the 89 % appearing at the bottom of the table.

The data in the table helps support the following findings:

- The percentage of students actively and voluntarily participating through relevant questions and answers during discussion periods is much higher when the electronic system is in use. Whereas in the study a typical participation rate was about 25 to 33% (often with the same students participating in each class) when "conventional" teaching methods were used, the active participation rate when the electronic system is in use is around 90 percent and perhaps much higher. In the case of the electronic system, the degree of participation by individual students also varies by topic and from day to day.
- Even though use of the electronic system leads to a great increase in participation, an "electronic discussion" does not necessarily require more classroom time than does a conventional question-and-answer face-to-face discussion. This is because the electronic-based discussion is essentially a parallel discussion whereas a conventional discussion is a "one at a time, please" sequential operation. Thus, the total number of student responses per unit time is much greater when the electronic system is being used. As a rule of thumb, the information transfer rate between teacher and student is increased by a factor of about 2.5 when the electronic system is put in operation.
- In an electronic discussion, the students tend to respond not only to the question posed by the teacher but also to the responses being submitted by other students. The teacher becomes more of a moderator than in the conventional case.
- In the conventional classroom, the question-and-answer sequence tends to be "bang-bang" or rapid response by both teacher and student. Our qualitative evidence appears to confirm that most written responses are more considered and complete than are the verbal responses in a conventional classroom. This has obvious implications where higher-order thinking is desired. This appears to hold true for both teacher and student.

There is similar data for use of the rapid assessment mode. The student participation rate (96.2%) is even higher than in the open discussion case described above.

Assuming that most teachers and educational decision-makers would welcome an environment which increases student participation by a factor of more than three and information-transfer rates by a like factor, we next consider issues that may be of special interest to groups such as teachers, students, administrators, and technicians.

Impact on Instructor Preparation

In preparing their lessons for electronic-equipped classrooms, successful instructors will need to plan for a significantly different experience than before. Because the teacher/student question-and-answer interface is essentially parallel rather than serial, as with the conventional systems, the teacher should have the choice of (a) covering more material per class than before or (b) covering the same amount of material more thoroughly. Because of the greater level of student participation (especially in the rapid assessment mode), they will be able to make real-time changes in the subject matter to meet the emerging needs of individual students. They should anticipate unexpected twists and surprising insights when in the discussion mode, and they will find that they need to consider well in advance how their discussion questions should be phrased, how to expand upon or otherwise clarify important subjects when they discover the need in mid-presentation, and how they can take advantage of a much higher rate of inputs from the students. These seem to be intrinsic features of presentations based in large part on the use of the electronic system. By making good use of the electronic testing mode of the electronic system, they can expect to save time in some after-class activities and gain some guidance on follow-up needs.

Impact on Student Performance and Perceptions

This subject requires more controlled experimentation to help enable us to perform a convincing cost-benefit evaluation of the use of the electronic system. In the present discussion, we attempt to relate the very favorable student responses to the intrinsic features of the system as a guide to further evaluation.

Confidence and Confidentiality

In the current electronic system, responses can be either anonymous or signed in the discussion mode. Our observation was that they were almost always signed, but some students have remarked that they found it much less stressful to enter a response in the system (even if signed) than to express it aloud before the entire class. The impact of the higher participation rate and ratios using the electronic system may be measured directly or indirectly in the quantifiable factors mentioned above: learning rate by type of learning, attendance rate, and student satisfaction with the classroom experience.

"Canned" and Extemporaneous Graphic

Questions and answers in the observed classes were entirely narrative in nature as far as electronic system inputs and outputs were concerned. The teacher always resorted to other tools when graphic presentations were needed. The students never used graphics in their responses, regardless of the tools the teacher used. Given the well-demonstrated advantage of graphics in many learning processes, the potential of using graphics with the electronic system needs to be explored. Various simple graphic programs perhaps could and should be placed at the teacher's and students' disposal using the electronic system. The small size of the screen may be a limiting factor in this respect; however, this perhaps could be dealt with by including a single large screen in the system and enabling the student to zero-in on parts of this screen as needed.

Taking Note of Taking Notes

An infrequent student complaint was that the hand-held computers and screen, small as they were, still took up too much space on the students' desks. The students did not seem to take many notes whatever the tool in use in the classroom, but it perhaps should be made possible to use the hand-held computer to save and index useful comments input by themselves, the teacher, or other students, and to enter and save their own notes as a presentation progresses.

Technology Integration

The section above on Instructor's Role in the section on Creative Interaction—Open Discussion Mode (ODM) contains some speculations about the integration of added hardware and software with the electronic system. A further possibility is the integration of the electronic system with teleconferencing technology so that various classrooms could interact in the lesson presentation. This capability, which might be used for special classroom subjects, might have the advantages of enabling students with more diverse backgrounds and experiences to enrich the discussions. It might also permit the use of subject-matter specialists who could simultaneously share their insights with a large number of students, each in a relatively intimate setting.

We tend to think of technology in terms of tools or as the outputs of physical science. This of course is not an all-inclusive view of technology. Instructional methods will continue to evolve, and the electronic system must be capable of accommodating the findings of instructional science. Additional research will perhaps enable us to predict how the electronic system can keep pace with the evolving needs of the classroom.

Higher-Level Thinking

The section above on Instructor's Role in the section on Creative Interaction—Open Discussion Mode (ODM) also offered some subjective evidence that the electronic system fosters higher-level thinking, especially by those who tend not to participate actively in conventional instructional situations. If this is true, it becomes one of the principal intrinsic advantages offered by the electronic concept. It is widely believed that automation and advancing science in general tend to work against unskilled labor and in favor of those who can think creatively and adapt to rapidly changing situations. The flexibility and power of the electronic system may prove able to improve education in general and stimulate higher-level thinking in particular.

Conclusion

The electronic system creates a new learning environment to which the teacher and at least most students responded favorably. However, there were instances in which the system was not used because of real or perceived physical or software limitations. In most cases, it was easy to identify potential means of removing these limitations.

The electronic system has a number of qualitative advantages over other commonly used instructional methods. This was only demonstrated in a single setting and in two presumably representative high-school courses. The results were almost uniformly favorable. Because the teacher periodically used conventional methods of instruction as well as instruction based on the electronic system, it was possible to make some qualitative comparisons with conventional methods. These were also favorable for the electronic system.

These favorable results appear to more than justify further investigation of the potential inherent in the use of the electronic system. Quantitative evidence of higher-level thinking would be a focal point of such study. Of the numerous paths one could take, that of translating the observed qualitative advantages of the system into quantitative results that could be used by educational decision makers appears to be most logical and potentially useful. The results of the work recommended herein will of course be most easily applied to environments similar to that to be used in the follow-up study, but it should be possible to extrapolate the results and conclusions to numerous other learning environments.

Understanding E-dropouts?

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Abstract

The purpose of this study is to investigate the factors that affect the dropout of adult learners in e-learning through an in-depth literature review on the dropout of adult learners in e-learning. Based on variables identified from the literature review of dropout in e-learning and the models of dropout dealt with above five constructs were categorized: individual background, motivation, academic integration, social integration, and technological environment.

Introduction: Knowledge-Based Economy and E-learning

> Our society is continuously moving towards a knowledge-based economy: an economy in which the application of knowledge replaces capital, raw materials, and labor as the main means of production. The synergy of combining new information and communication technologies with human skills has dramatically altered job content and skills requirements at the workplace. (The Canadian Vocational Association and UNEVOC-Canada, 2002)

The so-called information revolution triggered by advanced communication technologies such as the internet has had a significant influence on our daily lives. The arenas of education and training are no exception. The rapid rate of change demands an ability to learn to adjust quickly and assimilate large amounts of conflicting information. In this environment, an ability to learn continuously is becoming imperative. The learning environment for today's learners is no longer set within the walls of a school, but rather is everywhere, especially the Web and e-mail. These advanced information technologies allow learners to access a variety of learning activities beyond the limitations of time and place. Responding to these potential of anytime, anywhere learning, education and training stakeholders have made considerable technology investments in recent years (The Software & Information Industry Association [TSIIA], 2001). “Most now recognize the power of technology to transform learning into more flexible, personalizes and accountable endeavor required by today’s knowledge-based economy” (TSIIA, 2001). Whiteman (2001) asserts that today's workplace environment necessitates knowledgeable, flexible, efficient, and adaptable workers who are lifelong learners. He continues that “adult learners need to be updated on the latest changes in the structure of the business environment” (p. 1). E-learning has the potential to meet the demand of today’s business environment for skilled workers who are lifelong learners. E-learning provides many potential benefits to both companies and workers (National Alliance of Business [NAB], 2000).

Although e-learning has some advantages as an efficient and effective learning delivery media, the big problem of e-learning is learner dropout. While e-learning seems to answer a lot of learner's needs, drop-out rates are higher than those for face-to-face course campus-based learning (Knowledgenet, 2001). Svetcov (2000) claims, “It is generally agreed that attrition rates from online schools are higher than from traditional schools … the online student dropout rate [is] around 35 percent, [which is] 15 percent higher than traditional schools….The fact is, much of what passes for online education today would put most of us to sleep” (p. 3). More skeptically, Murphy (2001) argues that e-learning courses without face-to-face classroom training have low success rates--only about 10 percent of employees complete online-only courses. The "anytime, anywhere" nature of at-your-laptop learning all too easily becomes "no time, nowhere"; the average dropout rate for online courses can run as high as 50 or 75 percent, depending on the source (Ganzel, 2000). Although many studies related to e-learning have been conducted in the field of adult education or HRD, relatively little concern has been given to why adult learners dropout. In addition, there is not any research-based evidence about how and why the learners in e-learning programs drop out. This study will provide an understanding of the dropout phenomena of adult learners in e-learning by clarifying the dynamic process that results in the dropout of adult learners. The purpose of this study is to investigate the factors that affect the dropout of adult learners in e-learning through an in-depth literature review on the dropout of adult learners in e-learning.

Studies of the Dropout of Adult Learners in E-learning

Although many studies related to e-learning have been conducted in the field of adult education or HRD, relatively little attention has been paid to why adult learners dropout. There is no broad-based quantitative study pointing to evidence of a widespread dropout problem for online training in the corporate world (Zielinski, 2000). In addition, there is not any research-based evidence about how and why adult learners in e-learning programs drop out. Of those studies of dropout of adult learners in e-learning reviewed in this section, only a few provided a comprehensive, theoretically-based, and explanatory framework from which to analyze the problem of dropout. Opinion papers based on the authors' live instructing or managing experiences of e-learning are reviewed and are discussed here as well as several theory-based studies, because of their relevance to the conceptual framework and findings of this research.

A study, the Learning Technology Acceptance Study: "If We Build It, Will They Come?" (2001), by the American Society for Training & Development (ASTD) and The MASIE Center reveals the fact that dropout rates for online training are high when learners are put off by one or more several factors. These factors include poor incentives to learn, lack of accountability for completing classes, problems with technology, and the inability of poorly designed courseware to hold a student's attention. Based on its own experience as an e-learning provider, Frontline Group (2001) also provides five reasons why adult learners drop out in e-learning programs: poor design, failure to understand the new medium, not considering a variety of learning styles, lack of supporting systems, and ignoring the self-selecting content needs of learners.

Based on studies conducted by e-learning providers and the opinions of e-learning experts, Frankola (2001b) argues that adult learners drop out in e-learning courses due to the following reasons: students don't have enough time, lack of management oversight, lack of motivation, problems with technology, lack of student support, individual learning preferences, poorly designed courses, and substandard/inexperienced instructors. Interestingly, NYUonline found that "e-learners who took only the asynchronous course were much less likely to complete it than e-learners who also participated in live sessions" (Frankola, 2001).

On the other hand, crucial interactivity with faculty and among other students can be important for the success of a course. Studies conducted by Sun Microsystems Inc. show that "only 25% of employees finish learning content that's strictly self-paced, but 75% finish when given similar assignments and access to tutors through e-mail, phone or threaded discussions" (Frankola, 2001). Hossein Arsham, a Wright Distinguished Research Professor of Statistics and Management Science at University of Baltimore, also points out that interactivity with students is a key factor in explaining students' retention, based on the experience of teaching two courses of the first all-online accredited Web MBA program (Elearningpost, 2001).

This fact is also supported by a study (Towles et al., 1993) conducted in the field of distance education. This study sought to evaluate the effect of faculty initiated contacts on student's persistence within a large video-based distance learning program, and showed that faculty-initiated efforts seem to have the greatest effect on improving course persistence among freshmen students. Vrasidas and McIsaac (1999) examined the nature of interaction in an online course from both teacher and student perspectives. They find that the structure of the course, class size, feedback, and prior experience with computer-mediated communication (CMC) all influenced interaction. In particular, findings showed that some elements of structure, such as required activities, led to more interaction, and students who were new to CMC were not comfortable participating in the online discussion. In addition, "when students do not receive feedback, they do not continue to post messages. Unless receive immediately feedback, they feel they are posting to the network without any response" (Vrasidas & McIsaac, 1999, p. 33).

According to Gilroy (2001), the CEO of the Otter Group, low enrollments and high attrition rates stem from user dissatisfaction and the cause of this problem is the separation of people in time and space; but it can be overcome by building environments where people talk to one another, build relationships, and teach one another. She continues, "While there is no simple answer, there is one key idea that has been overlooked in the design and implementation of many of the e-learning programs on the market today". That is, "learning is fundamentally both social and experiential. It is the context of the learning-all of the elements that comprise the experience around the content-that is most important". Based on the Otter Group's model of how best to teach and learn online, she presents many elements that must be managed to create e-learning programs; Not too much content and too little context, valued learning experience, course as learning communities, personalization, and an open technology source.

A study, "Student support services and success factors for adult on-line learners," conducted by Greer, Hudson, and Paugh (1998) examined a variety of student support services and four areas for student success from the viewpoint of World Wide Web-based learners in the University of Central Florida College of Education, Vocational Education area. They point out that the most common theme in terms of students' perceptions of success factors were budgeting time, being self-motivated, and having supportive friends and family.

Shepherd (2001) argues that the reason why learners dropout is a simple one of motivation. In addition, motivation has two determining factors: the first factor is a desirable outcome, whether this is the achievement of a personal goal, recognition from others or some form of tangible reward such as money or promotion. There is a flip side to this, in that the learner may be seeking to avoid some penalty, such as a reprimand, disapproval or some financial disincentive. The second factor in motivation is the learner's perception of the likelihood, given that learners put in sufficient effort, of the learner obtaining their reward or avoiding the penalty. If the means to the end is too tortuous, the motivation will drop regardless of how desirable the outcome may be. He maintains that "even if the incentives are sufficient to get learners started, e-learning can place many obstacles in the way of successful completion. "Removing, or reducing the effect of these obstacles is essential to curing the drop-out problem" (Shepherd, 2001). These obstacles are inappropriate or inadequate content, lack of time and/or inadequate time to learn, no support for their learning by peers and training mangers, and the assessment of the learner's learning process by tutors or managers.

Based on a case study, Chyung (2000, 2001a, 2001b) finds some reasons for dropout in online distance education. These reasons are discussed under the Foundation Section (p. 14). Chyung, Winiecki, and Fenner (1998) found that the satisfaction of adult learners in an on-line course during the first or second courses was the major factor, which determined learners' decisions about whether or not to continue in the program. Forty-two percent of the students who dropped out expressed dissatisfaction with the learning environment as the reason; Another reason given was a discrepancy between professional or personal interests and course structure. In a study by Lim (2001) to develop a predictive model of satisfaction of adult learners in a Web-based distance education course and their intent to participate in the future, she found that computer self-efficacy was the only predictor variable that was statistically significant out of variables included in the predictive model. The variables included in the model were computer self-efficacy, academic self-concept, age, gender, academic status, years of computer use, frequency of computer use, computer training, Internet in a class, and participation in a workshop for Web-based courses.

Some e-learning experts present many strategies or tips for the success of e-learning. Interestingly, Augusto Failde, senior vice president of global development at NYUonline, proposes 11 strategies that companies can use to help ensure high course completion rate (Frankola, 2001a). These strategies are as follows: (1) develop a culture that takes online learning just as seriously as classroom training, (2) do individual comparisons, (3) hold managers accountable for the success of their employees, (4) use managers as role models, (5) create a social dimension to e-learning, (6) make expectations clear up front, (7) provide formal rewards, (8) track performance, (9) get personal, (10) hold a team competition, and (11) launch a communications campaign. He articulates, "Good companies that recognize the importance of human capital must motivate and support employees as they develop a commitment to life-long learning" (Frankola, 2001). Broadbent (2001) also gives e-learning engagers some tips for e-learning success. These tips include; (1) focusing on a clear business objective, (2) don't set very high expectations, (3) hire consultants or some sort of service provider to handle all of e-learning needs, (4) don't force e-learning on resisters, (5) don't evaluate. Black (1998) emphasizes the following; (1) offer short classes, (2) make graphics simple and easy to read, (3) foster collegiality by asking students to contribute information about themselves and their interests, (4) vary the way you interact with learners, (5) avoid superfluous media, and (6) use a combination of synchronous and asynchronous instruction to reinforce new material, design assignments, and improve learner retention. Horton (2000) contends, "Successful virtual classroom courses usually depend more on human interaction than on technological infrastructure" (p. 398). Hence, he points out that selecting a qualified instructor, keeping the class small, and responding promptly and reliably are important in planning a Web-Base Training (WBT) course. In addition to this, he suggests holding a pre-class get-together to overcome initial hurdles; publishing a comprehensive syllabus; preparing learners to participate (e.g., the etiquette for online meetings); managing collaborative activities; teaching the class-rather than just letting it happen (e.g., contact participants individually, help classmates get to know one another, stay on the published schedule, keep office hours, pace learners, do not spend too much time teaching the course software); conducting live events; making participants visible; and staying in touch after the class. Khan and Vega (1997) contend that the Web design should be "logical, user-friendly, and meaningful" (p. 378).

As many researchers point out, motivating learners is a very important factor to retaining them in e-learning courses. "Successful WBT courses rely on the self-discipline and focus of motivated learners" (Horton, 2000, p. 418). He suggests some techniques that designers and instructors can use to keep learners interested, energized, and enthusiastic. These techniques are: (1) set clear expectations, (2) require commitment, (3) feature the WIIFM (what's in it for me?), (4) make WBT fun and interesting, (5) offer bribes, (6) pace and prompt learners, (7) provide encouraging feedback, (8) build a learning community, (9) intervene with unmotivated learners, and (10) redeem troublemakers.

Driscoll (1998) contends, "Designing effective WBT requires knowledge of the unique characteristics of adult learners and an understanding of the facilitator's role" (p.13). He outlines the characteristics of adult learners as: real-life experience, problem centered learning, continuous learners, varied learning styles, responsibilities beyond the training situation, and meaningful learning.

Like Tinto's model (1975), the two dimensions of integration, academic and social, form the core of Kemper's open learning model (1995). This model was developed through the process of validation of the model, utilizing both quantitative and qualitative data from a diversity of sources. This model consists of several constructs that affect outcome of students in open learning courses. The construct of entry characteristics that influences integration variables consists of demographic status, educational qualifications, family status, and employment. Kemper (1995) articulates that entry characteristic are not good predictors of final outcomes, because they are just a starting point in determining how much difficulty a student is likely to face in coping with a course. He continues, "Many students with apparently adverse circumstances do succeed" (p. 77). The social integration construct consists of enrollment encouragement, study encouragement, and family environment and examines the degree to which students are able to integrate their academic with the often conflicting employment, family and social requirements. Kemper (1995) asserts that "social integration can be achieved, even in the face of an inhospitable social environment, if a time and space for study are negotiated" (p. 88). The external attribution construct consists of insufficient time, unexpected events, and distractions. The lower levels of social integration affect the negative academic integration of students. In the model, academic integration is spilt into the positive (academic integration) and negative (academic incompatibility) tracks. Each construct consists of four indicators such as study approach, motivation, course evaluation, and language ability. Academic integration is understood as "encompassing all facets of a course and all elements of contact between an institution and the students whether these are of an academic, administrative or social nature" (Kemper, 1995, p. 99). In addition, GPA functions to some extent as an intervening variable between academic incompatibility and dropout. At the final step of the model, a cost/benefit analysis, the student has to make a decision about either dropping-out or completing study. This final step includes a recycling loop that provides a mechanism for switching from one track to the other.

Factors Identified from the Literature Review of Dropout in E-learning

Based on variables (see Table 1) identified from the literature review of dropout in e-learning and the models of dropout dealt with above five constructs were categorized: individual background, motivation, academic integration, social integration, and technological environment.

Table 1 Factors Identified from the Literature Review of Dropout in E-learning

Constructs / Studies	Individual Background	Motivation	Academic Integration	Social Integration	Technological Environment
ASTD & MASIE Center (2001)		• Incentives • Lack of accountability for completing classes • Poorly designed courseware			• Problems with technology
Augusto Failde (as cited in Frankola, 2001a)		• Extrinsic motivation-formal reward, team competition, clear expectations, etc.		• Social dimension	
Broadbent (2001)		• Clear expectations • Need satisfaction			
Black (1998)		• No evaluation • Challengeable expectations • Clear business objective • Short classes	• Interaction with learner		• Superfluous media
Brown (1996)			• Support from tutor		
Chyung (2000, 2001a, 2001b)		• Attraction • Confidence • Relevance • Satisfaction			
Chyung et al. (1998)		• Satisfaction			

Driscoll (1998)	• Characteristics of adult learners				
Frankola (2001b)	• Individual learning preferences	• Lack of learner control of content • Poorly designed course	• Lack of management/ support • Inexperienced instructor	• Lack of time	• Technical hurdles
Frontline Group (2001)	• Learning styles	• Poorly designed course	• Supporting systems		
Greer et al. (1998)		• Self-motivated		• Budgeting time • Supportive friends and family	
Gilroy (2001)		• Satisfaction • Poorly designed course • **Personalization**	• Learning community		
Horton (2000)		• Live event • Incentive • Pre-class meeting • Staying on the published schedule • Pacing learners • Making participants visible	• Qualified instructors • Interaction individual contact • Prompt feedback		• Technical hurdles
Hossein Arsham (as cited in Elearningpost, 2001)			• Interactivity with student		
Kemper (1995)	• Entry charateristics	• Intrinsic/extrinsic motivation • Positive/negative course evaluation	• Poor/good language skills • Deep/surface approach	• Family environment • Enrollment encouragement • Study encouragement • Insufficient time • Unexpected events • Distractions	
Khan & Vega (1997)		• Poorly designed course			
Lim (2001)		• Self-efficacy			
NYUonline (Cited in Frankola, 2001b)		• Live session			
Osborn (2001)	• Educational level • Number of credit hours taken in the current semester, and number of previous distance learning courses.	• Computer confidence • Lower motivation		• Less-stable study environments	
Shepherd (2001)		• Incentive • Learner’s perception of the likelihood of the learner obtaining their reward or avoiding the penalty • Inadequate contents	• No support of peer & training managers	• Lack of time	

		• Assessment of learner's learning process by trainers			
Sun Microsystems Inc (as cited in Frankola, 2001b)			• Crucial interactivity; faculty and learners		
Towles et al (1993)			• Faculty-initiated interaction		
Vrasidas and McIsaac (1999)	• Prior experience with CMC	• The structure of the course	• Interaction • Class size • Feedback		

Some Implications for the Study of Dropout of Adult Learners in E-learning

Year after year, e-learning is becoming more popular because it allows training to be available on demand, to be delivered remotely, and to keep up with the rapid pace of economic change. The flexibility of time, place, low delivery cost, and program contents provided via e-learning is very appealing to workers who are trying to improve their careers related to job performance or individual development as well as to training mangers. Undoubtedly, e-learning based on the today's advanced technologies has been considered as the best learning delivery media for this purpose. At this point, it needs to understand the dropout of adult learners in e-learning for more effective and efficient e-learning operation.

The literature review has at least two significant implications for the study of dropout of adult learners in e-learning. First, it needs to build a holistic model that accounts for the phenomena of adult learners' dropout in e-learning. Whatever the setting, it is difficult to comprehend the reason for the learner's dropout in adult education and training programs because the reasons for dropout among learners are numerous and complex. Theory in the area of learner dropout supports a multivariate framework to account for the complexity inherent in analyzing the learner's participation in multiple spheres of activity (Osbom, 2001). Second, in addition, there is a need for practical contributions of the new model of dropout in the field of adult education, especially, e-learning. This means that any new model based on or including a variety of perspectives should have the power to provide practical contributions to the field of adult education. For instance, if adult learners drop out of a course due to motivational factors, some prescriptive strategies developed in terms of a motivational aspect could be provided for adult education practitioners of e-learning programs. Also, e-learning program designers and instructors could use it to prevent or decrease the dropout rate in e-learning practice.

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Power Relationships Among Adult Learners In Online Discussions

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Abstract

The purpose of this paper is to present preliminary findings of a study dealing with the nature of power relationships in a specific online learning setting, based on critical discourse analysis. The findings are that (1) There were no differences of power inequality in gender, race, and social position among adult students in terms of discussion initiatives, (2) There was much evidence that women used more powerless words than man did, and (3) There were no differences in the use of powerful language between those who have relatively high social position and those who do not.

Introduction

Power is a key element in all human interactions. Tisdell (1993) points to the structural inequality that exist in society, the "power disparity between racial minorities and the white majority, between the poor and the wealthy, the undereducated and the educated, and women and men" and how "these power relations are reproduced and maintained through the educational process" (p. 203).

Critical discourse analysis can be used identify and map power relationships in educational settings. Pratt and Nesbit (2000) argue that discourses are systems of thought based on language in the social sciences; hence, "attention is drawn not only to vocabularies of speech or writing but also to how they imply a whole network of social relationships and regularities" (p. 118). In addition, they point out that the sociocultural discourse, which posits that learning is inescapably based on contextualized social relations, precipitates questions about patterns of social relations, power, and particularities of circumstance and settings" (p. 122). Cunningham (2000) suggests that much of the field of adult education's "rhetoric centers on the learners, as if the learners are disembodied creatures and as if the social context, the social structures, the social class in which we all exist do not affect the process of education" (p. 573). Wilson and Cervero (2001), in citing Livingston (1983), contend that to practically confront the world of inequity, we need to understand the way it is, have a vision for what it should be, and have strategies for achieving our vision. They depict adult education as a site for the struggle for knowledge and power:

The social, economic, political, cultural, racial, and gendered power relations which structure all action in the world are played out in adult education. These systems of power are an inescapable facet of social reality and almost always asymmetrical in that they privilege some people and disadvantage others. Regardless of its institutional and social location or the ideological character of its content, any policy, program, or practice of adult education represents this embeddedness in a structuring (but not pre-determined) social reality. In a real sense, the power relations that structure our lives together do not stop at the doors of our classrooms or institutions that provide adult education. (¶ 6)

Although there is a body of literature that discusses the types of interaction or the factors influencing interaction in online discussions for adult learners, there has been a lack of research that specifically examines the nature of power relations among adult learners in online discussions. The present study employed critical discourse analysis in an attempt to understand the nature of power relationships that occurred in the written discourse of two online graduate courses.

The purpose of this paper is to present preliminary findings of a study dealing with the nature of power relationships in a specific online learning setting. This purpose is guided by the following research questions: (1) What is the nature of power relationships in the online discussions of online learning courses? (2) In what ways are power and privilege expressed?

Literature Review

There are a considerable number of studies describing online discussions or comparing online and face-to-face discussions in adult and higher education. These studies have mostly focused on such subjects as (1) how adult students participate in online discussions, (2) the comparative advantages and disadvantages of online and face-to-face discussions, and (3) the relative merits of various instructional strategies for online discussions. However, most of these studies have been given little attention to the nature of power relationships and the ways in which power and privilege are manifested in the online discussions.

Jeris (2001) explored how time and space, significantly altered through electronic mediation, affect the power relations among adult graduate students who participated in an online course, providing the comparison of power relations within online and face-to-face classroom discussion through a case study. The author pointed out the power disparity that existed between women and men participating in online discussions, illustrating with the following example:

…In relation to this comment, another student remarked, "I was so embarrassed by something stupid I said during my first MBA class that I made up my mind right then, I was not going to say another word. If it hadn't been for this class, I would have kept that promise." Several students wanted to know why this student decided what she said was stupid. She revealed that her comment was pronounced "utterly ignorant" by a male classmate who was also a professional colleague in a more senior position.

Tisdell (1993) examined how power relationships predominantly based on gender but including race, class, and age were manifested in higher educational classroom of adult students through observations of classes taught by a male and a female professor, interviews, and document analysis. She observed several significant facts in terms of power relations: (1) the students who benefited from more interlocking systems of structural privilege tended to have more power in the classroom from the perspective of their peers than the students who had less interlocking privilege and they played the dominant role in the class, (2) the students contributed to reproducing structured power relations in their reification of patriarchal values, (3) the male professor tended to exert more control than the female professor, and (4) the middle-aged women with more education tend to be more participatory, at least in classes where affective forms of knowledge are valued.

Grob, Meyers, and Schuh (1997) examined sex differences in power/powerless language such as interruptions, disclaimers, hedges, and tag questions in the small group context of a higher education classroom by juxtaposing two competing theoretical frameworks: “dual cultures” and “gender similarities.” Their findings revealed that there were no significant differences between women and men in their use of interruptions, hedges, and tag questions, which supports "gender similarities" approach to understanding sex differences and not the dominant "dual cultures" approach for investigating sex differences. In other word, there was no evidence that men use more powerful language while women use powerless language.

McAllister and Ting (2001) explored gender differences in computer-mediated communication in web-based college courses, analyzing the 456 discussion postings of 34 students in 2 online college courses. Each discussion posting was analyzed for seven variables: frequency, length, readability, audience, purpose, reference, and format. The findings of the study suggested that male and female discussion items differed significantly in length, use of indicators to specify a particular reader, purpose, and use of formal signature. However, male and female discussion items did not differ in frequency, readability, intended audience, or references to personal experience or outside sources.

Although all of this literature contributes to our understanding of power in online learning, it is clear that additional work is needed if we are to understand power dynamics in this rapidly growing educational format. This study explored the ways in which power and privilege are expressed in the online discussions in higher education.

Methodology

This study explored the extent to which the structural power inequities that exist in society are reproduced in an online classroom of adult graduate students; the study focuses primarily on power relationships based on gender, but also explores potential power inequality related to race, social position. In this study, the researchers used critical discourse analysis (CDA) as a research methodology.

CDA is “a type of discourse analytical research that primarily studies the way social power abuse, dominance and inequality are enacted, reproduced and resisted by text and talk in the social and political context” (van Dijk, 1998, ¶ 1). Furthermore, van Dijk asserts that effective research using CDA has four key characteristics: (1) It focuses primarily on social problems and political issues, rather than on current paradigms and fashions, (2) it is employs a multidisciplinary approach to understanding social problems, (3) rather than merely describe discourse structures, it tries to explain them in terms of properties of social interaction and especially social structure, and (4) it focuses on the ways discourse structures enact, confirm, legitimate, reproduce or challenge relations of power and dominance in society.

Fairclough and Wodak (1997, pp. 271-280) summarize the primary tenets of CDA: (1) CDA addresses social problems, (2) Power relations are discursive, (3) Discourse constitutes society and culture, (4) Discourse does ideological work, (5) Discourse is historical, (6) The link between text and society is mediated, (7) Discourse analysis is interpretative and explanatory, and (8) Discourse is a form of social action. CDA focuses on the role of discursive activity in constituting and sustaining unequal power relations (Fairclough & Wodak, 1997). In a similar vein, van Dijk (1996) articulates the elucidation of the relationships between discourse and social power as one of the crucial tasks of CDA. In short, he maintains that CDA "should describe and explain how power abuse is enacted, reproduced or legitimised by the text and talk of dominant groups or institutions" (p. 84).

Dellinger (1995) says that socially situated speakers and writers produce texts and the relations of participants in producing texts are not always equal; there will be a range from complete solidarity to complete inequality. He stresses that meanings arise through interaction between readers and receivers, and in most interactions, users of language bring with them different dispositions toward language, which are closely related to social positionings. In a similar vein, Fairclough (1995) underscores that "analysis of texts should not be artificially isolated from analysis of institutions and discoursal practices within which texts are embedded" (p. 9). As Kaplan (cited in Dellinger, 1995) expresses, the text is multi-dimensionally structured and layered like a sheet of thick plywood consisting of many thin sheets lying at different angles to each other.

Research Participants and Data Collection

The two online classes, "G" and "O", selected for this study were Master's level research classes at a large state university in the southeastern United States. The same instructor taught the two online classes. In addition, the contents and teaching strategies of the two courses the instructor adopted were the totally same. The graduate students enrolled in the two classes consisted of 10 males and 31 females between the ages of twenty-three and fifty-eight. All but two of the students were part-time students who had full-time jobs except 2 persons. Thirty-one of the students were white and the others were of African descent. All of the students were adults (aged 24 or older), though age data were not formally obtained.

The online course contained 10 units related to the concepts of educational research. Each class employed 3 small group discussions in each of the 10 learning units. More specifically, for each learning unit, the instructor gave discussion questions or set a discussion task. Each member of the group was required to make at least two "substantive contributions" to the discussion of each unit. The instructor didn't participate in the small group discussions, because the intervention of the instructor could affect the small group discussion. However, in the unit 9 and 10 discussions of total group, two educational methodology experts facilitated their discussions.

Substantive contributions were defined as having three major characteristics: (a) The contribution must relates either to the discussion task the instructor set or to the comments made by other group members, (b) it must be well thought-out and well crafted, and (c) it must be at least a two sentences in length. Each discussion was time-bound; there was a tightly controlled time period during which students must make their contributions. The total span of the discussion activity in the first to eighth unit was 1 week and that of the remaining were 2 weeks. Ultimately, there were a total of 1354 postings made in the two classes over the span of the semester.

Data Analysis

In this study, discussion postings were analyzed based on techniques of critical discourse analysis, closely keeping in mind the primary tenets of CDA. As Fairclough (as cited in Joyce, 2001) notes that "there is no set procedure for doing discourse analysis; people approach it in different ways according to the specific nature of the project, as well as their own views of discourse" (¶ 17). Van Dijk (1993) also points, "Critical discourse analysis is far from easy. . . . it requires true multidisciplinarity, and an account of intricate relationships between text, talk, social cognition, power, society and culture" (p. 253). Joyce (2001) stresses, by taking a position, researchers must be self-reflexive in terms of their interpretations and analyses and maintain some distance in order to avoid producing analyses that map directly onto their own personal beliefs.

In this study, our analysis was based on indicators of power/powerlessness drawn from studies by Grob, Meyers, and Schuh (1997), McAllister and Ting (2001), and Tisdell (1993) to identify and analysis power relations among participants. These indicators included: discussion initiatives, disclaimers, hedges, and tag questions. In our analysis, we assumed the following:

a) A person who has more discussion initiatives is more powerful than those who have less discussion initiatives.
b) The use of disclaimers, which are expressions of uncertainty (e.g. "I guess," "I suppose," "I don't know much but," "I'm not an expert but"), indicate a lack of power.
c) The use of hedges, which include adverbs or adverbial phrases that convey either moderation or no particular meaning at all ("kind of," "sort of," "probably," "perhaps," etc.) indicate a lack of power.
d) The use of tag-questions (i.e., short questions added to the end of a declarative sentence, such as "doesn't it?", "don't you agree?", "you know what I mean?", etc.) indicate a lack of power.

Our analysis consisted of examining the 1354 postings—all of which were printed and collected into a notebook—and coding them for these and other indicators of power/powerlessness.

Findings

Finding # 1: There were no differences of power inequality in gender, race, and social position among adult students in terms of discussion initiatives.

Initial analysis shows that there were no differences of power inequality in race, gender, and social position among adult learners in terms of discussion initiatives. Table 1and 2 represent the number of discussion initiatives by participants for each class. For Class G and O, the discussions seem to be dominated by a few learners who have more discussion initiatives. However, we need to consider the context of learning activities. Specifically, in the cases of NP, MM, JH and CD (one black woman, one black man, and two white women) of Class G, although they have much more discussion initiatives than others, we have to consider the number of non-replied discussion inactivates. This is because the number of non-replied discussion initiatives accounts for the big part of the total number and most non-replied discussion initiatives deviate from the discussion context. For instance, in most cases, non-replied discussion initiatives were posted at the last minute because they were part of compulsory discussion assignments. Included were such postings as greetings that didn't need to be replied by others. In replied discussion initiatives, as seen in Table 1and Table 2, VL and MM of Class G and MR and DS of Class O have more discussion initiatives than others. They are all women who did not have high social positions except for VL who has the relatively high social position of a vice president for a company.

Table 1 The Number of Discussion Initiatives of Adult Learners for Class G

Learner / Initiative	EA	BB	CD	TE	JF	LG	EG	KG	JH	DJ	RJ	LJ	NK	VL	BL	MM	EO	*<u>NP</u>*	*<u>KS</u>*	AS	RW	JW
Replied	0	4	4	1	6	4	2	4	6	1	5	6	5	10	6	10	2	6	2	5	3	7
Non-Replied	3	1	11	0	0	1	0	1	8	1	1	1	1	1	5	8	0	16	10	5	3	2
Sum	3	5	15	1	6	5	2	5	14	2	6	7	6	11	11	18	2	22	12	10	3	9

Table 2 The Number of Discussion Initiatives of Adult Learners for Class O

Learner / Initiative	SA	LA	DC	SC	KE	CH	KJ	GJ	SJ	PL	JM	VN	TR	MR	JR	ER	DS	*<u>SS</u>*	*<u>DY</u>*
Replied	5	1	5	4	11	3	4	2	7	3	5	3	4	10	6	4	12	6	6
Non-Replied	6	6	1	3	3	3	1	6	3	4	4	1	4	1	1	1	1	6	5
Sum	11	7	6	7	14	6	5	8	10	7	9	4	8	11	7	5	13	12	11

Even though there were no differences of power inequality in race, gender, and social position among adult learners in terms of the discussion initiative, there were two types of replied discussion initiatives.

The first type is to raise questions to induce the following responses. However, this type was likely to use powerless language such as disclaimers, hedges, and tag questions. Here are data to support this finding:

…I suppose the next logical question is can it be possible to have research generated under these ideal ethical conditions? Any thoughts? (RW, WW, Unit 1, GC)

[Note: The first two capital letters indicate student's name. The followings indicate race and gender (e.g., BW= black woman, BM= black man WW=white woman, WM = white man). Finally, the last letters points the class (e.g., GC = Q class and OC=O class)]

…While I think that common knowledge and research are equally important, I must ask... Can knowledge be produced and imparted? (DS, WW, Unit 1, OC)

…Maybe it just seems too complicated to her? I know lots of people who are working in various areas of adult ed who are essentially limiting themselves because they don't or won't use technology to access information on topics that would help them with their work. Does that make sense? (BB, WW, Unit 3, GC)

…I can't think of any major decision in life that should not be researched first. Can anyone else? (LG, WW, Unit 3, GC)

…Unfortunately, I can't think of a good example of a variable that shouldn't be studied right now - can anyone else? (SS, WW, Unit 4, OC)

…Yet, I think it safe to say that it would be highly offensive and presumably unethical to research driving habits based on ethnicity. any thoughts on that? (DJ, WM, Unit 4, GC)

…What if the first 100 students they meet are just exiting a class or seminar, therefore they could all be the same year or major/interest which might affect the results? And wouldn't they be excluding students who didn't have a class or reason to be at that spot on campus that day? What if the group all happened to be either frequent users of the union, or else non-users? More ideas, anybody? (MR, WW, Unit 5, OC)

Wish I could post a graphic rather than explaining this. Hope you see what I trying to explain. Is this what the rest of you understand with regard to Question 7? (NP, BW, Unit 7, GC)

…I think we could add a lot more to this question, it seemed hard for me to answer it, so I wanted to try and tackle it first. Anyone have any other ideas?? Hard for me to grasp everything in this chapter, but I'm trying! :O) (JR, WW, Unit 7, OC)

…Also, page 448 lists four main threats to internal validity: mortality, location, instrumentation, and instrumentation decay. Have you seen this condition occur in your own experience? (JW, WM, Unit 9, GC)

The second type of discussion initiatives is revealed by student's suggestions of their own opinions. In this type, they did not use powerless language. Below are data to support this finding:

…Is research knowledge better than everyday knowledge? I'm not sure if one is better than the other generally speaking. I believe that one is based on the other. Research is based on everyday knowledge, behaviors, events etc.. I see research as a tool to examine, discover and validate those truths about everyday knowledge. (AS, BW, Unit 1, GC)

…however, my point here is that if the information will be tainted then the educational research is not important enough to justify the inconvenience and time loss it causes participants. (PL, WW, Unit 2, OC)

…There are limitations but the importance of descriptive statistics in educations or just in our daily lives cannot be denied. (RJ, WM, Unit 7, GC)

…Usually, researchers of this type gather information through naturally occurring situations because they want to see how and why things happen. This is my understanding of qualitative research. (SJ, WW, Unit 10, OC)

…I am more interested in qualitative research because it is more "hands on" as the researcher; involves more detail and description which I tend to do more of in my line of work. One tends to get a "better picture" of the results I think with qualitative research. (DB, BW, Unit 10, OC)

Finding # 2: There was much evidence that women used more powerless words than men.

According to Grob, Meyers, and Schuh (1997), "typically, research on powerful/powerless language use and gender has linked power language with men and powerless language with women" (p. 283). The finding of this study is also consistent with this. While women participants used relatively powerless language, men participants did not. The followings are the examples of the use of language by men:

Thanks BL for agreeing with me. The bottom line is how the knowledge is applied. Whether it is through everyday practical means or by controlled experimentation, the true variable is application. (CD, BM, Unit 1, GC)

I do hate to straddle the fence on an issue, but I'm really at a loss to describe either scientific research or common knowledge as "better." I'll keep thinking.... (DJ, WM, Unit 1, GC)

…As one of the posts pointed out (I have a hard time keeping track when I'm reading through them), the answer in part depends on how you define terms such as "educational research" and "inconvenience." Take for example the article in today's AJC regarding the charter school in Lithonia (available at http://www.accessatlanta.com/ajc/epaper /editions/friday/metro_c3a5f3b1e1a551070058.html). (TR, WM, Unit 2, OC)

…Sometimes the "best" decision just has to rely on an ounce of available research and a ton of personal expertise. (DJ, WM, Unit 3, GC)

Hey guys, I think that question 1 b. would not be a cluster sample, it would be a two stage random. On p 111, this is illustrated where a sample of clusters is randomly chosen, then a sample of individuals from within these clusters is then randomly chosen. Hence the two stages. (GJ, WM, Unit 5, OC)

That being said, I do believe that personal privacy is one consideration that may reasonably limit the use of variables, but since this relates to the individual, it should not necessarily limit inquiries that seek to understand phenomena related to populations at large. (LJ, WM, Unit 5, GC)

…so the bottom line is that any quantitative study is out of the question…. (GJ, WM, Unit 10, OC)

In contrast, women used more powerless language such as disclaimers, hedges, and tag questions:

We cannot assume everything researched is factual information. This is another thing to think about when debating the benefits of knowledge gained through researchers and everyday research, isn't it? ...(VL, WW, Unit 1, GC)

…From my novice's perspective, I think that to obtain value from knowledge produced by research, especially better value than from everyday knowledge, the research has to have been conducted and presented in an ethical manner. (RW, WW, Unit 1, GC)

I think both types of knowledge is not so much better than the other but actually "go hand in hand"; dependent of the other. (MR, WW, Unit 1, OC)

While pure academic research does have a lofty aspiration for seeking truths, we have to remember that so little (if anything) in this world is value-neutral. Although the basic facts revealed by research may be unbiased, how they are used most assuredly are not. ...in my own humble opinion, of course! :) (DJ, WM, Unit 1, GC)

I'm not sure why this is the only group for this unit… (DL, WW, Unit 4, OC)

Hi PL, I'm not totally sure about this, but I think the quantitative ones are a matter of degree. Yes, I know a person can have blue eyes or VERY blue eyes, but in general, they'd just go in that category. But you're right, there's still room for deciding how you want to classify something, I guess it depends on the research and its purpose. (MR, WW, Unit 4, OC)

…Are those part of the population or the ecological (setting)? Sorry to have questions instead of answers but I want to make sure that I understand this. (VN, WW, Unit 5, OC)

…I guess then, that for 7, the larger the standard deviation, the more heterogeneous the scores, is true, because they are spread out more, or vary more. Is that right? Help! :-) (MR, WW, Unit 7, OC)

I think that rather than being negative (or positive) the score would be very low, close to 0.0 -- meaning no correlation. I understand negative correlation to be as one increases, the other decreases (a pattern if plotted would slant from top left to bottom right) -- in other words, a negative relationship (but a relationship none-the-less.) …Am I completely off base? (KJ, BW, Unit 7, OC)

…I am not sure an outsider doing a personal interview would work all that well, but trust might be established. (DS, WW, Unit 9, OC)

…To me qualitative research seems like it would be more interesting to conduct rather than quantitative. (SA, BW, Unit 10, OC)

Finding # 3: There were no differences in the use of powerful language between those who have relatively high social position and those who do not.

Some participants in the two classes have relatively higher social positions than others. For Class G, DJ (white man, director for an university institution), NP (black woman, administrator for K county public schools), RJ (white man, chief operating officer of the company's sponsored M SC Union), and VL (white woman, vice president for a company) have relatively higher social positions than others. For Class O, SC (white man, director of field operations and training for an university institution), CH (white man, program manager for an airline), TR (white man, circuit juvenile court judge), and DY (white woman, program director for a 4-H Center's environmental education program) have relatively high social positions.

Like the first finding above, there were no differences in the use of powerful language between those who have relatively high social positions and those who do not. In fact, they often used powerless language similar to the other students. Some evidence for this finding are:

…But it's not valuable just because it's research-based; it's valuable because it's relevant. That make sense? (TR, WM, Unit 1, OC)

…I wonder if it is ever common for researchers to state a hypothesis they are biased to believe is false? In other words, just doing to research to prove it incorrect? (DJ, WM, Unit 4, GC)

He or she does not feel strongly about an issue to respond directionally, so a nondirectional hypothesis is formed. By stating things as "either" "or", the results will lead one way or another. This would "save face" when the hypothesis is tested and conclusions made. Just my thoughts... (VL, WW, Unit 4, GC)

…I want to make sure I understand this properly, so give me your thoughts?????? ... (NP, BW, Unit 7, GC)

I am not sure an outsider doing a personal interview would work all that well, but trust might be established. (DY, WW, Unit 9, OC)

Am I being narrow minded or limited in my thinking? What should a researcher do in the case of witnessing "harmful, illegal, or wrongful behavior?" (RJ, WM, Unit 10, GC)

Conclusion

Discussions in online learning settings are very different from those in the face-to-face environment. Specifically, “group interactions are difficult and complex in an online environment where a clear sense of personal presence is difficult to maintain” (Williams, Watkins, Daley, Courtenay, Davis, & Dymock, 2001, p. 2). Accordingly, we can assume that power relations among participants in an online learning environment reveal very different aspects from face-to-face classroom discussions. That is because social cues such as eye contact, body language, facial expression, and voice tones are totally absent in the online discussion environment. More often than not, power relations among people are likely to appear with those cues in the face-to-face classroom discussions. However, in online discussions, written language alone is the most important factor that can uncover the power relations among people.

The findings of this study reveal that (1) there were no differences of power inequality in race, gender, and social position among adult students in terms of the discussion initiative, (2) there is much evidence that women used more powerless words than men, and (3) there were no differences in the use of powerful language between those who have relatively high social positions and those who do not. Interesting enough, male participants used more powerful language than female participants in online discussion learning settings did. This finding is consistent with the fact that powerful/powerless language use and gender has linked powerful language with men and powerless language with women (Grob, Meyers, & Schuh, 1997).

At this point, we may be able to conclude that the online discussion environment attenuates the power of the privileged people established by a tacit consent in terms of the last two findings, (2) and (3). However, before coming to any definite conclusions we need to conduct comparative studies on power relations among learners that occur in both online discussion and face-to-face classroom discussion environments.

As Wilson and Cervero (2001) point out, the systems of power that structure all action in the world are an inescapable facet of social reality and usually asymmetrical in that they privilege some people and disadvantage others. The burning problem is to disclose the unequal power relations between people who have the privilege and those who do not.

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Technology-Literate Students? Results From a Survey of Freshman Students at Colorado State University

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Abstract

There are contradicting beliefs about student information technology skills. The first is that high school students know more than faculty about computers and information technology. The second is that incoming freshman do not have the information technology skills needed and faculty do not have the time to teach these skills in addition to their course content. This was a topic of discussion on the Colorado State University campus. Questions included: Who is responsible for teaching the students the skills they need? and What skills need to be addressed? A committee, including representatives from faculty, library, academic computing, and college IT support staff, was formed to investigate these issues. They designed a survey to support or reject the hypothesis that a digital divide in IT-based knowledge and experience did exist in the freshman newly arrived on campus. This paper presents the need, methodology, and results from this survey.

Information Technology Literacy

Institutions in higher education have anecdotal evidence from faculty and support centers that define a fundamental "digital divide" in computer-based skills that students bring to post secondary education. Although Edminston and McClellend (2001) remind us that predictions were made in the early 90's that computer literacy courses would no longer exist by the year 2000 observations suggest a remarkable range in students' knowledge about information technology (IT) concepts and software skills. In fact, in a recent study conducted by Hackbarth (2000), elementary school students were reported to have only 10-60 minutes of access to information technology each week. Due to the lack of access time at school, it is presumed that K-12 students are gaining their technology literacy at home. The National Assessment of Educational Progress found that 41% of eighth-graders in free and reduced lunch programs have home Internet access compared to 72% of their financially better off peers. Sax, Ceja, & Teranishi (2001) suggest that these disparities in pre-college use of information technology, if not attended to, may seriously compromise some students' ability to succeed to the fullest extent in college. In such an inconsistent environment, instructors cannot assume prior knowledge of even the most basic of IT skills. Faculty are under increasing pressure to incorporate technology into their teaching and learning activities, and develop technology literate students upon graduation. Unfortunately, the inconsistency in student skills makes it difficult to design effective technology enhanced instruction.

This dilemma is not a new phenomenon on campuses, but the search for possible solutions has taken on an increasing urgency in the past decade. The ability to effectively use computers in the workplace is now important in almost every profession. The U.S. Department of Education's report to the Nation on Technology and Education (1996) recognized that technology literacy "has become as fundamental to a person's ablity to navigate through society as traditional skills like reading, writing, and arithmetic." Information Literacy is defined in this report as "computer skills and the ability to use computers and other technology to improve learning, productivity, and performance." (p. 1). The increasing use of technology in higher education reflects this ubiquity. If the basic knowledge of information technology is so central to the education of all citizens, it begs the question of how educators should address the curricular issues involved. In 1999 the Computer Science and Telecommunications Board (CSTB) of the National Research Council published their seminal report, *Being Fluent with Information Technology*. The book was the culmination of a two-year national study by the Board's committee on Information Technology Literacy (CSTB, 1999). The report addressed the centrality of information technology in modern life in the United States and the related implications for higher education. It sought to answer the question "what should everyone know about information technology in order to use it more effectively now and in the future?" It made a significant distinction between information literacy and information fluency. The report argued that, since digital technology is evolving at such a rapid rate, superficial attempts to promote simply literacy by stressing the acquisition of basic skills such as word processing would be too modest a goal (CSTB, 1999). The acquisition of information fluency implied a broadening of the learner's knowledge base to include fundamental IT concepts and capabilities that would enhance the learning of knew digital skills.

This holistic approach is important in higher education where a narrow focus on digital skills acquisition is often perceived as a simplistic solution that is dismissed with the epithet "too vocational." The CSTB report stresses that the development of IT concepts and capabilities must be linked with skills acquisition to transform literacy into fluency in a process it labeled as "FITness". The repost succinctly outlined three significant components of FITness:

- contemporary skills, the ability to use today's computer applications
- foundational concepts, the basic principles and ideas of computers, networks and information, the how and why, and
- intellectual capabilities, the ability to apply information technology in complex and sustained situations.

These are further broken out into ten components of fluency for each focus area.

While the traditional approach to improving computer literacy is focused on skills, the FIT model is valuable in its balanced approach. One can argue that the enhanced study of information technology should not be pursued as something to be grafted to the higher education core curriculum but should rather be an integral element of it. This was a topic of discussion on the Colorado State University campus. Two primary questions evolved:

1. Who is responsible for teaching the students the skills they need?
2. What do we need to teach the students?

A committee was formed to investigate the issue. This committee was facilitated by the Assistant Director in the Office of Instructional Services, members included representatives from faculty, library, academic computing, and college IT support staff. Review the Website at http://www.colosate.edu/webct/computer_literacy_survey/ for a list of committee members, the survey questions, and the full results.

How CSU Addressed the Questions

The committee examined the information technology literacy issue from numerous angles. In agreement with Hirt et. al. (1999) who completed an assessment of computer skills on the Virginia Tech campus, we determined that we needed to examine which groups on campus were using which types of technology and how skilled they are in using that technology. Although in 1999 the study was unable to find studies related to information literacy, we were able to find a handful (Edmiston & McClelland, 2001; Hackbarth, 2001; Olsen, 2000; Sax, Ceja, & Teranishi. 2001) which led us to believe that we needed to assess the status specifically at CSU. We first determined what support systems were already in place. The only centralized student support for information technology is the Help Desk which is staffed by the Computer Training and Support Services. While this desk provides answers to questions such as how to connect to the Internet, set up dial-up accounts, set up an eIdentity, and forgotten passwords, they do not provide any formal training for students. Additional student support is based on student technology fees. Each college sets its own technology fees which need to be approved by the students in that college. This varies between colleges and impacts the levels of support they provide for their students. For example, the College of Business requires all incoming freshman to attend a one-week boot camp before the start of the fall semester. During this time the students receive instruction in the basic technology skills they will need for initial course work. This includes setting up email accounts and learning how to access the college's networked software and drives. The College of Agriculture offers one-credit elective courses that cover use of software such as Microsoft Word and Excel. Other colleges do not provide structured technology training. The existing training programs were based on a perceived student need. We determined that, if we hoped to make effective recommendations for student support in information technology literacy and faculty support for enhancing student information technology fluency, we would need to collect data on students' current literacy levels. We examined potential methods for collecting information from the students.

Methodology

The committee determined that a survey would be the least invasive way to collect the information. An electronic survey would be the easiest and least expensive on the front end but if we wanted full representation, including those students who did not possess strong technology skills, an electronic survey would certainly eliminate a significant part of the target population. Therefore we decided a paper-based survey would illicit the most significant results. CSU had recently initiated a one-credit Freshmen Seminar course which is required for all freshman and transfer students. This would give us access to all freshman enrolled in the fall of 2001 without concern of anyone completing the survey twice. Once we had determined the method and population, each member of the committee submitted a list of questions they felt would be appropriate for the survey. The facilitator compiled a list of all the questions, eliminated duplicates and grouped the questions into categories. At this point, we had many varied questions and the survey would take too long to complete. The list of questions was refined based on hoe we believed we could apply the responses. Some of the questions would provide interesting information but were not applicable to the actual intent of the survey. We narrowed the list down to 71 questions and the response format was designed to allow us use a scantron form to collect the information.

Drs. Kaminski and Seel met with the Vice Provost to discuss the survey and obtain support. The survey and intent was presented to the Council of Deans who made a couple of recommendations that were incorporated into the survey. The Vice Provost then sent a message to all Freshman Seminar faculty/instructors stating her support for and the importance of the survey. She also requested they allow for time in their classes for student to complete the survey. Her office provided us with a list of all freshman seminar courses, the instructor, the days, times, and locations of the classes.

Once the survey method and questions were approved and submitted to the IRB for exempt status, we field tested the survey with one freshman seminar. The students not only completed the survey but were asked for feedback on the clarity of the questions and additional comments. We made a few grammatical modifications from this field test. We also ran the data so we could examine the output from the scantron system and ensure we would be able to analyze it. Once this phase was completed the process became the mechanics of implementing the survey and disseminating the results. Enrollment in each freshman seminar is limited to 19 students. There were 214 seminars with a total enrollment of 3,898 students. To distribute the survey, the committee made 4,000 copies of the survey, grouped them in stacks of 20 with 20 scantron forms and a copy of the letter from the Vice Provost and placed them in an envelope which was labeled with the course information. For distribution purposes we enlisted assistance from the University Instructional Technology Committee (UITC). Each of the nine colleges has a representative on this committee. The UITC member contacted faculty and set up a time within a three-week period to complete the survey. They visited the classroom, distributed the survey, collected it, and returned them to the Office of Instructional Services. Once all the surveys were returned, the scantron forms were compiled, incomplete forms were culled and the surveys were delivered to be run through our scantron system.

The results were returned in a text file that contained the information on each form. We elicited the help of a statistics instructor for data analysis. He imported the information into SPSS for analysis and tabulated all results for overall freshman class response frequency as well as frequency of response by college. He then completed additional analysis based on sets of questions and skills.

Findings

Our design worked well. We received surveys from 155 course sections for a return rate of 72%. Of 3898 students, we received 2102 correctly-completed surveys for a response rate of 54%. There were some faculty who refused to allow for time in their class to participate in the survey.

Demographics

Of the responses, 1933 were freshmen, 118 sophomores, 28 juniors, and 7 transfer students. The majority of the respondents were 18 years old (1313), 660 were 19 years, and 22 under 18 years. There were 793 male respondents and 1268 female respondents. Although we decided not to include detailed questions about the students high school experience, we did feel that information regarding the size of their graduating class and if it was a Colorado school would provide us with important demographic data. Of the respondents, 1587 or 75.5% indicated they did graduate from a high school in Colorado.

Table 1 Graduating Class Size

N	Number of Students
129	less than 50 students
179	51-100 students
276	101-299 students
458	201 – 300 students
1049	more than 300 students

We included two questions regarding information technology presence in high school. Only 500 students indicated they had taken a programming course in high school and 291 indicated they had taken a Web development class in high school.

Hardware Information

Some of the more interesting data included information on computer ownership. Only 7% or 150 of the students indicated they did not own either a laptop of a desktop computer. Of these, 1286 or 61% indicated that their computer was less than one year old.

Table 2 Hardware Ownership

Hardware	N	%
Desktop	1136	54.%
Laptop	569	27.%
Both	230	11%
Printer	1722	82%
Scanner	445	21%
CDROM	1823	87%
RD-recordable	1083	52%
DVD	989	47%
Network Interface	1091	52%
PDA	250	12%

Email

As communications over the Internet is one of the most common uses of information technology, we asked the students specific information regarding their use of electronic mail. The majority of the students, 98%, indicated that they do have an email account and 81% of them indicated they knew how to attach a file when sending email. While 49% indicated they use an email account provided by their department or the campus, 41% indicated they use a commercial email account. Only 3% indicated that they did not know that they could receive a free email account from CSU. 80% of the students indicated they check their email on a daily basis.

World Wide Web

The Web has become another common form of communication as well as its use for information and fact finding. When asked about their experience using the Web, the majority of the students, 87% indicated they had been using it for 2 or more years with another 9% for the past year. When connecting to the Web, 68% indicate they use the campus network, 12% use DSL or a cable modem, and 10% use a regular modem and phone line. An interesting finding was that 8% indicated they did not know how they connected to the Web.

Table 3 Use of the World Wide Web

Use	N	%
Games	1009	48%
Newsgroups	776	37%
Email	2006	95%
Videos	888	42%
Music	1847	88%
Library- research	2019	96%
Info on CSU	1915	91%

Software

We asked the students to indicate their proficiency in the use of different software packages. We not only included the frequency of responded but analyzed the responses based on three types of software including using Microsoft Office type software, Web and multimedia development type software, and programming software. The maximum sum in the Office and Development categories is 15. Males scored an average of 10 and 5 respectively while females scored an average of 9 and 3 respectively. The maximum score for programming was 9. Males scored an average of 3 while females scored an average of 2. The difference in skills between males and females was not significant. This information was also broken out by college.

Table 4 Software Skills by College

College	Office Score	Development Score	Programming Score
Agriculture	9.8	4.8	2.9
Applied Human Sciences	9.3	4.2	2.4
Business 10.4	4.8	2.7	
Engineering	9.5	4.8	2.8
Liberal Arts	9.1	4.3	2.1
Natural Resources	9.3	3.6	2.1
Natural Sciences	9.6	4.1	2.5
Vet Med & Bio Sci	9.8	4.0	2.2
Undecided	9.3	4.2	2.3

Skills

Under the skills category we included questions that intended to ascertain if the students have basic skills in setting up a computer and using some of the tools needed outside of a software package (information fluency). This included the ability to download and install software where 82% responded yes, the ability to download and install plug-ins where 46% responded yes, and the ability to download and read pdf files where 41% responded yes.

We also included some questions about basic skills on information gathering. Specifically, 52% indicated they had received training in high school on information gathering. If asked to write a research paper, 58% indicated they would first use Yahoo or Google for a search while only 23% indicated they would use a database of index of abstracts and citations. Only 13% indicated they would go to the library first. Surprisingly when asked what information they could find in a library catalog, 19% indicated books and journals, 2% indicated citations to journal articles, and 71% indicated both, while 7% indicated they don't know.

Support

We decided if we hope to provided effective solutions to the information technology fluency puzzle, we should determine the method in which students prefer to receive this information. In addition, we determined this information would inform us on how much students are using technology based solutions when faced with technology use challenges. When asked about how they prefer to learn most of the students indicated that they would rather receive one-on-one training while online training was not highly rated.

Table 5 Preferred Instructional Style

Style	N	%
One-to-one help	1089	52%
CD Computer-based	186	9%
Videotape	33	2%
Online training	63	3%
Classroom	584	28%

Discussion

Perhaps most important, when a society is fluent in information technology, is that people have a better understanding of such issues as data mining, privacy, free speech, intellectual property, and even issues of "photographic truth". There is no one right answer for resolving these issues. It requires a shift in thinking across many areas of higher education. Increased awareness of the state of the divide will guide us on where to concentrate our initial efforts.

Events have taken place at Colorado State Univeristy that may have effected our survey data. During the semester which we implemented the survey, the institution implemented an eIdentity or a common username and password for access to all electronic information. This required all students, faculty, and staff to visit a Website, establish their campus wide username and password, and indicate a preferred email account. Students who did not already have an email account set up a campus account at this time. The following semester, students were required to have an eIdentity to register for classes which had a strong influence on accessing information online. This may explain why such a large percentage of students responding to the survey indicated they did have and use email. It may also have influenced the results indicating that the most frequent use of the Web was for email, library research, and obtaining information about CSU. The fact that music and games followed in use supports similar findings in prior research. Also not surprising was the highest level of technology literacy in software use was knowledge of the office products, with the lowest familiarity with programming.

We were surprised by the number of students who reported that they own a new computer. Frequently lack of skills are attributed to lack of access (Hackbarth, 2001, Poftak, 2002; Sax, et. al., 2001). In agreement with prior studies (Hirt, et. al), we recognized the need to identify additional ways to teach students, not only designing programs to teach the basic skills, but also to increase technology integration and teach the importance of information fluency. While the majority of students have the tools at hand to increase their information technology FITness, they still prefer classroom and one-to-one instruction for learning new skills. This information is in agreement with experiences at other institutions. An article on freshman computer lifestyles at five institutions (Olsen, 2000) indicates that the majority of freshman students do not attend computer training sessions or use help services. This information will be taken into account as we discuss what types of skills students need to learn, and how these can be integrated into the core curriculum. Continued monitoring of the issues will provide current needs and strategies and technology advances.

The overall materials cost of implementing the print-based survey was minimal at $980 and valuable information was gained. Incorporation of information literacy into the core curriculum will take time and patience as faculty become more technology savvy themselves. When discussing obstacles to technology integration, Walbert (2000) indicates that lack of use is mainly due to lack of access, lack of time, and lack of experience on what to do. "…the rapidly spreading use of personal computers and related telecommunications networks explain the accerlerating pace at which new technology-based options for teaching and learning emerge." (Moore's law, as discussed by Steven W. Gilbert, 2001, p 22). These new options provide the tools to enhance information technology fluency through the classroom. Implementation of additional student support and training may ease faculty concern about the time involved in supporting non-literate students and encourage them to incorporate additional technology into their teaching and learning activities. Increased awareness of the actual levels of technology literacy may help faculty in the design of these activities. Gilbert (2001) indicates that we need 'deep learning' among faculty, support professionals, and administrators, the process of changing education is itself an educational process. Faculty need a framework, taxonomy, and introduction to relevant models. They need guided practice and support. Thanks to the research done by Rickman and Grudzinski (2000) on information technology use in the classroom we have input from over 2300 students on their perceptions. They report that the average time students thought IT should be utilized only 40 percent of the classroom time. This would coincide with instructional design beliefs that a mix of delivery modes provides the most effective learning experiences.

Each college has looked at their results and has begun discussions on how to address their specific needs. While recent changes at the Provost's level have hindered overall campus considerations. The advisory board for the newly created Interdisciplinary Studies Program in Information Systems and Technology has taken the information and the idea of "FITness" seriously. They are recommending repeating the survey with freshman over the next three years, and completing a follow-up survey of the 1999 class the spring before graduation. We may find more institutions implementing a similar program to South Dakota State University (SDSU, 2002). They now require students to complete a proficiency examination and an information technology literacy exam approximately mid-way through their program of study. In addition, the students participate in a department-based information technology literacy assessment based on their particular program. Students must pass the exam for graduation. If they do not pass the exams with at least 70%, they are required to remediate and retake it.

With that said, additional research is needed to help faculty and administrators determine the best methods for integrating information technology literacy and increasing students' information technology fluency in the teaching and learning process. Educators need to not only address the issue of skills, but the need for lifelong learning in a technology-prolific society. This requires a change in administrative attitude toward recognition of faculty time invested in information technology. When we repeat this study, we will obtain additional information regarding the amount of exposure students had to information technology both in their school and home environments. We may also focus more on obtaining information regarding the skills students feel as though they are lacking vs. the skills they report to have.

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The Medium is the Message Revisited

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Abstract

Much like Marshall McLuhan predicted, we 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. Researchers have shown that viewers automatically learn to cope with symbolic presentation methods through repeated exposure to these television and visual patterns. Furthermore, the widespread availability of production techniques provides easy access to capabilities that allow people to use video media to easily create their own content. As a result of reviewing these findings, one might be able to surmise that perhaps educators need to look differently at how to motivate and educate today's media-centric youth. Implications for teaching students in this environment are discussed.

Background

We 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 these 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 might be able to comprehend these messages much more easily and comprehensibly than can their adult counterparts. One can no longer assume that exposure to television or digital video is simply a passive viewing activity. Advancements in technology are changing the way viewers are forced to look at and interpret video media. Furthermore, the widespread availability of production techniques provides easy access to capabilities that allow people to use video media to easily create their own content. It has been widely shown that these acquisition (i.e., production) opportunities also increase exponentially one's ability to comprehend content delivered in like form (Tyner, 1998).

Corcoran (1981) defined *intelligence* as a skill in a particular medium and suggested that the symbolic codes used in that medium that serve communication purposes and are internalized by a receiver become an authentic tool of thought. This idea may be at the root of how to dispel errant notions about perceived intellectual weaknesses in today's youth. Current failures in reading may be really the result of generational differences in communication skills based on an over-dependence on the right brain activities during early childhood and teenage years. Just because students do not know the words to communicate their ideas does not necessarily mean that they are not having ANY intelligent thoughts. Perhaps, they are simply coming to these individuals in different ways. In short, educators need to look differently at how to motivate and educate today's media-centric youth. If one follows John Keller's ARCS educational motivational model (1983), it shouldn't be too hard to see how making things relevant and providing successful outcomes using new media may be translated into making positive connections with today's media-centric youth.

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.

Researchers and educators looking into the intrinsic instructional value of video media have traditionally presented conflicting views on the role visual perception plays in attention, motivation, and recall. There have been several studies that have looked into the potential affect mediated coding systems have on cognition (Davis, Scott, Pair, Hodges, & Oliverio, 1999; Nugent, 1982; Seidman, 1981; Walma van der Molen & Van der Voort, 2000). While many theorists have looked into the use of video, most of them had little good to say about its ability to bring anything new to the table with regards to using it as a communicative medium (Berlo, 1960; Calvert & Scott, 1989; Ide, 1974; Kozma, 1986). This may have been due to the limitations imposed by the technology in use at the time. Recent technological advances in commercial television production techniques allow today's producers to readily integrate fast-cuts and montage and provide new tools to more easily communicate complex thought using a pictorial narrative structure. A correctly constructed rapid-cut montage passage has been found to add clarity because of the phenomenon that the interpretive whole of a montage segment literally communicates more than the sum of its parts (Hitchon, Druckler, & Thorson, 1994; Stephens, 1996). In other words, it is the composite whole of all the visual images in a passage or segment when considered all at once that gives it extended meaning. In addition, newer editing techniques have evolved that emphasize the *perceptual* continuity of a rapidly presented image-based narrative structure, rather than the classical point of view of editing that stressed the importance of applying strict rules in order to obtain slow and smooth transitions between successive shots (d'Ydewalle & Vanderbeeken, 1990).

Need for the study

Perhaps it is time to update the thinking with regards to using video as an instructional medium in light of new technological developments. A review of the literature of the past twenty years has already yielded some studies into the impact of rapid video editing in an educational setting (Stephens, 1996; Wetzel, Radtke, & Stern, 1994). However, more recent advances in technology that have superceded those studies and an increased usage of rapid-cuts and montage production techniques in commercial television programming have created the need to update any earlier research that does exist. Lang has conducted more recent studies that have looked into the effectiveness of fast-cuts (Lang, 1994; Lang, 1996; Lang & Basil, 1998; Lang, Bolls, Potter, & Kawahara, 1999; Lang, Zhou, Schwartz, Bolis, & Potter, 2000), but hers deal with television in a casual viewing environment.

Description of the study

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 & Nass, 1996), rather than school-aged students viewed in their original educational environments.

The current study was designed to look at the effect of these rapidly-presented visual passages in an educational setting. It is hoped that a new look at rapid visual processing brought on by this study might lay the groundwork for educational media producers to update their thinking about rapidly-presented video montage by providing a research basis that appears to be lacking currently. Specifically, the questions that were reviewed were:

1) Is it possible to remember content solely from rapidly paced visual montage that is not supplemented with some form of verbal narrative?

2) Is there a difference between gist and verbatim memories for rapidly presented videos?

3) How do individual characteristics such as gender and learning/cognitive styles affect a student's ability to process fast-cuts/montage video presentations in a classroom setting?

This study was designed to determine if there are differences in the way visual montage messages that vary only in their presentation speed (i.e., fast, medium, or slow) are perceived and immediately remembered in an educational setting. Recent reports found in the literature, (Brainerd & Reyna, 1990; Brainerd & Gordon, 1994; Reyna & Kiernan, 1994) have suggested that researchers have been able to successfully parse memory into *verbatim* (i.e., precise/literal) memory for specific details and *gist* memory (i.e., contextual or contextual remembrances similar to that which is assessed in reading comprehension tests). This study looked at immediate memory as a whole and separately, using these same categorizations. The educational setting was determined to be several ninth grade classrooms that were categorized by gender and also further delineated by the subjects' individual cognitive/learning style. The overall sample set for this study came from that population group. For purposes of this study the identification of cognitive style was limited to the reflective-impulsive scale, as originally developed by Jerome Kagan (1965; 1966), and later refined and re-catalogued by Cairns and Cammock (1984). Identical videos that varied only in their speed of message delivery were presented to three randomly assigned groups of students. The procedural requirements for implementing the cognitive style test instrument indicated that the analysis was to be performed on a smaller subset of the sample base to see if the variance in delivery speed also affects gist and verbatim memory, and if there might be any interaction with their prospective cognitive styles.

The current study integrated a commercially-made video montage (*American Time Capsule* by Chuck Braverman), for which permission was granted by the current copyright holder, Pyramid Media, to use in this study (R. Wright, personal communication, March 21, 2001).

This study had four overall purposes. The first was to determine whether differences in presentation speed of a video montage would have an effect on a memory. Second, this study attempted to determine whether the presentation speed affect males and females differently. A two-way analysis of variance was used in these two portions of the study. Third, the study attempted to determine whether there would be differences between immediate verbatim and gist memory for the content of the video caused by changes in presentation speed. The design of this portion of the study was a multivariate analysis of variance. Last, an investigation was made to determine whether the immediate memories for subjects classified as either impulsive or reflective would be influenced by changes in presentation speed. The design of this portion of the study was a 2 x 3 factorial design ANOVA.

Results

The data were analyzed with analyses of variance and a multivariate ANOVA. The relevant statistics are presented in ANOVA summary tables. In addition, descriptive statistics are included for means and standard deviations.

Hypothesis 1. There are no significant differences in overall test scores (in which verbatim and gist scores are pooled together), for the overall sample set based on presentation speed of the video.

The analysis resulted in an F (2, 201) of .317 (see Table 4). An F ratio of .317 is not significant at ($p < .05$), therefore, this null hypothesis was not rejected.

Table 1 Source Table of Analysis of Score Variance by Presentation Speed

Source	SS (Type III)	df	MS	F	Sig.
Between Groups					
SPEED	6.377	2	3.189	.317	.729
Error	2022.329	201	10.061		
Total	2028.706	203			

The means and standard deviations for presentation speed are presented in Table 2. In Table 2, 'Fast' represents the results for those who watched the video presented at its original speed (averaging 300-400 milliseconds per picture), 'Medium' at 1/3 of the original (approximately 500-700 milliseconds), and 'Slow' (at approximately 1/2 the original speed (each picture was presented at approximately 1 second each).

Table 2 Score Means and Standard Deviation for Presentation Speed

SPEED	Mean	SD	N
Fast	12.99	3.18	75
Medium	12.70	3.05	69
Slow	12.57	3.30	60
Total	12.76	3.16	204

Hypothesis 2. There are no significant differences in overall test scores between male and female subjects in the overall sample set.

The analysis resulted in a between subjects effect F (1, 202) of 1.542 (see Table 3. Because an F ratio of 1.566 for this main effect is not significant at ($p < .05$), this null hypothesis could not be rejected. The means and standard deviations are presented in Table 4. The mean scores and standard deviations are shown by gender (i.e., males and females). The table shows a difference in scores and standard deviations between males and females, with males obtaining a higher average score. However, as the differences are not significant, they are considered statistically as random variations.

Table 3 Source Table of Analysis of Variance for Gender

Source	SS (Type III)	df	MS	F	Sig.
Between Groups					
GENDER	15.604	1	15.604	1.566	.212
Error	2013.101	202	9.966		
Total	2028.706	203			

Table 4 Score Means and Standard Deviation for Gender

GENDER	Mean	N	SD
Male	13.03	107	3.34
Female	12.47	97	2.94
Total	12.76	204	3.16

Hypothesis 3. There is no significant interaction between presentation speed and gender for overall test scores.

Table 5 Source Table of Analysis of Variance of Speed versus Gender

Source	SS (Type III)	df	MS	F	Sig.
Between Groups					
SPEED	8.437	2	4.219	.419	.659
GENDER	15.540	1	15.540	1.542	.216
SPEED * GENDER	8.766	2	4.383	.435	.648
Error	1995.428	198	10.078		
Total	35268.000	204			

Table 5 shows the interaction effect for between subjects of SPEED * GENDER resulted in an F ratio of .435. This F ratio is not significant at ($p<.05$). Therefore, this null hypothesis was not rejected. Table 6 shows the means and standard deviations comparing presentation speed with gender. Males had higher memory scores than females but, these differences are shown to be not significant. As such, they are considered random fluctuations.

Table 6 Score Means and Standard Deviation for Speed versus Gender

SPEED	GENDER	Mean	SD	N
Fast	Male	13.56	3.10	34
	Female	12.51	3.20	41
	Total	12.99	3.18	75
Medium	Male	12.97	3.46	38
	Female	12.35	2.48	31
	Total	12.70	3.05	69
Slow	Male	12.57	3.46	35
	Female	12.56	3.12	25
	Total	12.57	3.30	60
Total	Male	13.03	3.34	107
	Female	12.47	2.94	97
	Total	12.76	3.16	204

Hypothesis 4. There are no significant differences in verbatim test scores, for the overall sample set, based on presentation speed of the video.

The analysis of verbatim scores resulted in an F (2, 201) of 1.082 (see Table 7).

Table 7 Source Table of Analysis of Variance for Verbatim Scores for Speed

	SS (Type III)	df	MS	F	Sig.
Between Groups	12.035	2	6.018	1.082	.341
Error	1117.592	201	5.560		
Total	1129.627	203			

Because the F ratio for verbatim recall was not significant at ($p<.05$), this null hypothesis could not be rejected. The means and standard deviation are presented in Table 11.

Hypothesis 5. There are no significant differences in gist test scores for the overall sample set, based on presentation speed of the video.

The analysis of gist scores resulted in an F (2,201) of 5.491 (see Table 8). Because the F ratio for verbatim recall was significant at ($p<.05$), this null hypothesis was rejected.

Table 8 Source Table of Analysis of Variance for Gist Scores for Speed

Source	SS (Type III)	df	MS	F	Sig.
Between Groups	32.462	2	16.231	5.491	.005*
Error	594.127	201	2.956		
Total	626.588	203			

* Significant at ($p<.05$)

Because the results were found to be significant, and because there were more than two groups to be compared, a Bonferroni test was run to compare individual pairings of gist scores to each of the individual presentation speeds. Table 9 shows that the pair-wise comparisons are significant for gist scores when comparing ‘Slow’ and ‘Fast’ speeds, but not significant between ‘Medium’ and ‘Slow’ or ‘Medium’ and ‘Fast’.

In order to further compare verbatim and gist scores, a means and standard deviation table (Table 10) is presented. Table 10 shows a mean score for fast speeds of 6.01 out of 10 possible gist responses for those viewing the video at the fast speed and 5.05 (out of 10) mean score for those viewing it at the slow speed. Table 10 shows that, as a percentage, those subjects who watched the video at the two faster speeds also tended to get more gist questions correct than those watching at the slow speed. For the verbatim questions, there were no significant differences based on changes in speed.

Table 9 Multiple Comparisons Between Speed and Gist Scores

		Mean Difference	Std. Error	Sig.	95% Confidence Interval	
SPEED	SPEED				Lower Bound	Upper Bound
Fast	Medium	.25	.287	1.000	-.45	.94
	Slow	.96*	.298	.004	.24	1.68
Medium	Fast	-.25	.287	1.000	-.94	.45
	Slow	.72	.303	.057	-.01	1.45
Slow	Fast	-.96*	.298	.004	-1.68	-.24
	Medium	-.72	.303	.057	-1.45	.01

* Significant at ($p<.05$)

Table 10 Score Means and Standard Deviation for Gist versus Verbatim Test Items

	SPEED	Mean	Std. Deviation	N
VERBATIM	Fast	6.93	2.47	75
(15 questions)	Medium	6.97	2.26	69
	Slow	7.48	2.33	60
	Total	7.11	2.36	204
GIST	Fast	6.01	1.79	75
(10 questions)	Medium	5.77	1.64	69
	Slow	5.05	1.72	60
	Total	5.65	1.76	204

> Hypothesis 6. There are no significant differences in overall test scores for those subjects from the overall sample set who are determined to possess impulsive or reflective tendencies.

As seen in Tables 11 and 12, the sample size is smaller (n=129 versus n=204) due to the procedures involved in determining impulsive and reflective tendencies. A portion of the sample was systematically excluded due to these subjects being cast as either fast-accurate or slow-inaccurate, which placed them outside the parameters set forth by the administrative instructions that accompanied the MFFT-20. An analysis of variance was performed and obtained an $F_{(2,123)}$ of 6.560 for the main effect for cognitive style. The F ratio for between subjects was significant at ($p<.05$), therefore, the null hypothesis was rejected. The means and standard deviations are presented in Table 12. This table shows that impulsive subjects had significantly lower correct scores than reflective subjects, regardless of presentation speed.

Table 11 Source Table of Analysis of Score Variance by Presentation Speed and Cognitive Style

Source	SS (Type III)	df	MS	F	Sig.
SPEED	2.968	2	1.484	.160	.852
STYLE	60.870	1	60.870	6.560	.012*
SPEED * STYLE	7.380	2	3.690	.398	.673
Error	1141.340	123	9.279		
Total	21733.000	129			

* Significant at (p<.05)

Table 12 Means and Standard Deviation for Overall Scores for Style

SPEED	STYLE	Mean	Std. Deviation	N
Fast	Impulsive	11.50	2.09	22
	Reflective	13.50	3.31	24
	Total	12.54	2.94	46
Medium	Impulsive	12.36	3.86	25
	Reflective	13.24	2.14	21
	Total	12.76	3.19	46
Slow	Impulsive	11.82	3.30	17
	Reflective	13.10	3.02	20
	Total	12.51	3.18	37
Total	Impulsive	11.92	3.17	64
	Reflective	13.29	2.85	65
	Total	12.61	3.08	129

Hypothesis 7. There are no significant differences in verbatim test scores for those subjects who are determined to possess impulsive or reflective tendencies.

In order to further investigate the differences in scores obtained for impulsive or reflective styles, a one-way analysis variance was developed (Table 13). An analysis was performed and obtained an F (1, 127)of 2.925 for verbatim scores. The F ratio for between subjects was not significant at ($p<.05$), therefore, the null hypothesis was not rejected.

Table 13 Source Table of Analysis of Score Variance for Verbatim and Gist and Cognitive Style

		SS (Type III)	df	MS	F	Sig.
GIST	Between Groups	12.089	1	12.089	4.410	.038*
	Within Groups	348.144	127	2.741		
	Total	360.233	128			
VERBATIM	Between Groups	14.267	1	14.267	2.925	.090
	Within Groups	619.423	127	4.877		
	Total	633.690	128			

* Significant at ($p<.05$)

Hypothesis 8. There are no significant differences in gist test scores for those subjects who are determined to possess impulsive or reflective tendencies.

The same analysis of variance used for Hypothesis 7 was used to show both verbatim and gist scores (Table 13). The analysis obtained an F (1, 127) of 4.410 for verbatim scores. The F ratio for between subjects was significant at ($p<.05$), therefore, the null hypothesis was rejected.

A means and standard deviation table (Table 14) was developed to further investigate these differences. Table 14 shows that the significant differences in test scores found in Hypothesis 6 were derived from the gist portion of the memory test, which is consistent with previous findings regarding the significance of gist versus verbatim memory from the overall combined test scores.

Table 14 Means and Standard Deviation for Gist and Verbatim Scores for Style

	STYLE	Mean	Std. Deviation	N
GIST	Impulsive	5.20	1.77	64
	Reflective	5.82	1.54	65
	Total	5.51	1.68	129
VERBATIM	Impulsive	6.77	2.14	64
	Reflective	7.43	2.27	65
	Total	7.10	2.23	129

Hypothesis 9. There is no significant interaction between cognitive style and presentation speed of the video.

The interaction effect for between subjects of cognitive style (STYLE) and presentation speed (SPEED) resulted in an F (2, 123) of .398 (see Table 11). This F ratio is not significant at ($p<.05$). Therefore, this null hypothesis was not rejected.

Summary

The results of this study indicate that students tend to remember gist information from rapidly presented videos better than those presented at slower speeds. These results appear to contradict earlier research that indicated that the viewers would be able to remember more information from pictures if they are presented at slower speeds. One of the reasons might have been because the earlier studies measured memory on a combined basis, concentrating solely on measuring immediate verbatim memory. The parsing of gist and verbatim scores in the current study has uncovered a potential new approach to investigate differences in pictorial cognition. The fact that the significant differences in gist memory was masked when the verbatim and gist memory scores were considered together reveals that researchers may need to identify new paradigms that take into consideration the goals and intended outcomes of the instructional activities they are investigating. Not all classroom experiences need to have rote memory as a sole learning outcome. Stimulating gist memories, like teaching reading comprehension, may have its own place in overall instructional schemes.

To a degree, the results of the cognitive style instrument used in this study to categorize subjects indicate that some things about learning styles have changed since the original instrument was analyzed and developed. When one compares the results of MFFT-20 cognitive style in the current study to the norms provided by earlier research by Cairns and Cammock in 1984, not only has the median total number of errors decreased (from 28-30 in the Cairns and Commock studies to eight in the current study), but also so has the median latency to first response (from 18 to 9.12). These reductions seem to indicate that latencies to first response for visual activities are growing shorter, and that the quicker responses do not always translate to higher error ratios. Students appear to be developing a propensity for remembering things from rapid visual presentations.

Another change that took place is the shrinking of the differences in visual cognition between males and females. With Cairns and Cammock (1984), responses were considered to lie so dramatically outside of the norms that they were systematically eliminated from their studies. In the current study, any differences between males and females that did exist were found to be non significant. While females still may be found to be more reflective than their male counter-parts, these differences may be growing smaller.

The results of this study als o indicate that using the impulsive-reflective cognitive style instrumentation may be still a valid measuring tool. While both verbatim and gist memories were both negatively affected by cognitive style, it was only gist memory for the rapidly presented videos that was affected significantly. When considering the entire sample without regard to style, the analysis of variance did not yield any significant differences. The cognitive style portion of this study uncovered some discrepancies (i.e. learning difficulties) that might have otherwise gone unnoticed.

Whether the changes found here are the result of differences in casual television viewing habits or computer usage (or both in combination) was outside the purview of the current study. However, many of the results indicate that something is different about the way today’s youthful learners perceive visual inputs, creating several interesting scenarios for future studies.

It is noteworthy that the total correct number of responses for all groups was quite low (around 50%). The relatively low numbers of correct to total possible responses serves to reinforce that the purpose for integrating video presentations into teaching and learning situations has not changed. While a change in presentation style may provide an essential pre-condition for increasing knowledge, it still needs to be coupled with sound instructional strategies for any learning to take place.

Revisiting McLuhan

New media tends to attract right-brain cognition, whereas text-based cognition is left-brain. An over-dependence on one side or the other appears to prevent full development of one's potential and can leave a child ill equipped to fully function in the world. Researchers (Doman, 1984; Shichida , 1994) have presented considerable evidence that children are born with right-brained proclivities. Some of them never quite grow out of that stage. The cause for this delay might be due to outside influences, like extended viewing of television. Some of this might also be due to misguided attempts to force-feed text-based activities. Doman, Jr. (1984) very often preaches that one should teach to one's strengths and remediate any weaknesses. If it is true that many of today’s youth are right-brain dominated, then perhaps using right brained activities is a way to help them develop their left brain capabilities (i.e. text-based or left-brain cognition). In other words, there might be considerable success in using visual skills to get at and develop textual. Whether the changes found here are the result of differences in casual television viewing habits or computer usage (or both in combination) was outside the purview of the current study. However, many of the results indicate that something is different about the way today’s youthful learners perceive visual inputs, creating several interesting scenarios for future studies.

The findings of this study also appear to re-confirm McLuhan’s concept of *the medium* is the message paradigm. The study Perhaps it is true that the media people utilize most often not only help to define the messages they receive, but they also help to re-define the people who use that media.

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A Case Study on International Students' Attitudes Toward Their First On-Line Learning Experience

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Abstract

While a majority of the universities are offering traditional face-to-face formats to deliver courses in Instructional Design, there are also several institutions offering them in on-line formats. What concerns or suggestions do international students have when they are taking an Instructional Design course as an on-line course? This paper focuses on international students' perceptions and attitudes toward their first on-line course and shares their reflections on their first on-line learning experience in the United States.

Background

Numerous studies have compared the performance of distance learners to that of traditional learners (Russell, 1998; Moore & Thompson, 1990). The broad consensus among these performance studies is that there appears to be "no significant difference" in learner achievement between the two modes. Generally speaking, the attitudes of students were very positive and supportive toward the on-line instruction (Chang, 2000). However, there are few studies on international students' perceptions and attitudes towards the on-line learning environment.

Heikinhimo and Shute (1986) reported that most Asian students who study in the United States had problems with understanding lectures, taking notes, answering questions, and writing essays as a result of language obstacles. Most international students have different learning styles and cultural backgrounds compared to their American peers. These students are more comfortable with lecture based learning since the concept of on-line learning is still new in their countries.

Instructional Design is a required course for all the graduate students majoring in the field of Educational Technology. In most universities, instructional design is offered in a face-to-face teaching format. For the first time, the Instructional Design course in this study was offered in an on-line format. There were a few international students who enrolled in this course as their first on-line learning experience.

This study investigated international students' attitudes toward their first on-line learning experience to find out whether they would feel more comfortable and/or learn more effectively in the on-line environment. The primary research questions for the study were:

1. What were international students' attitudes toward their first on-line learning experiences?
2. Did international students prefer the on-line learning environment to the traditional classroom learning environment?
3. Did the on-line course provide more or less interaction than traditional courses for international students?

Method

Subjects

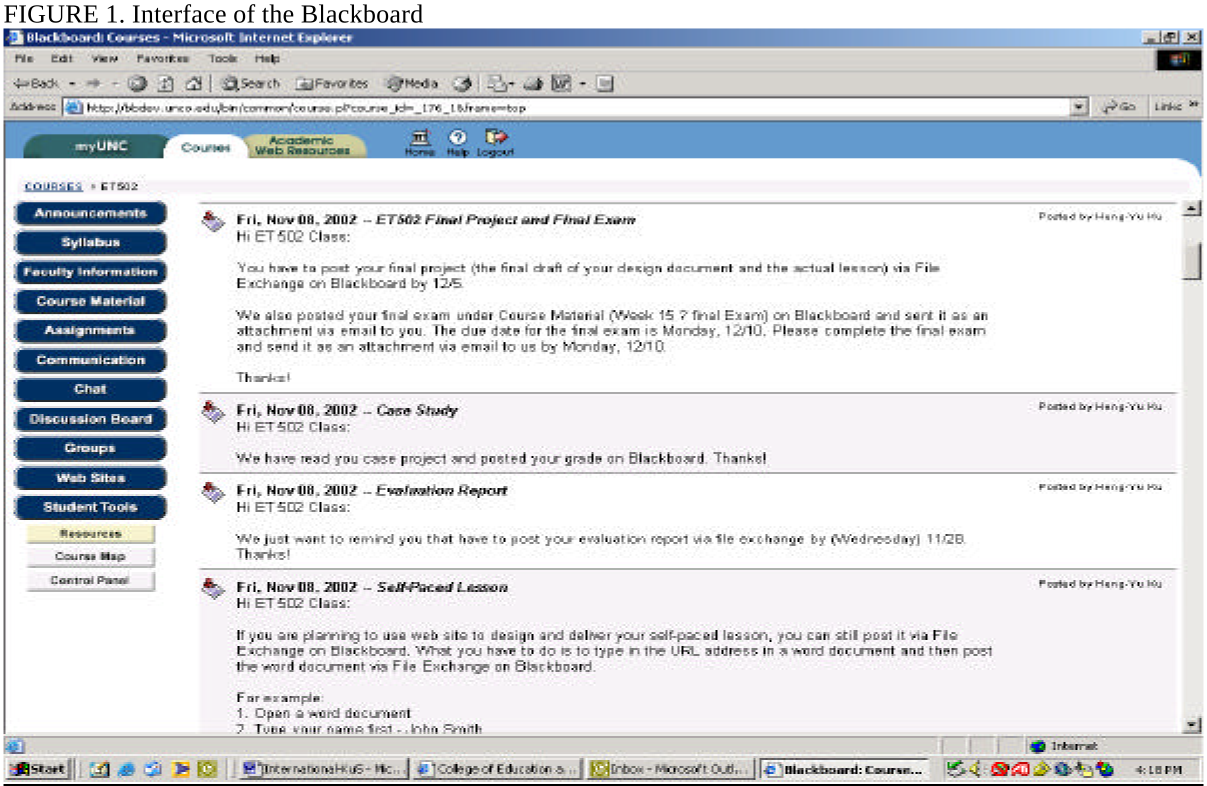
The subjects were five international students who were studying at a university in the Western area of the United States. Among these five students, two students were enrolled in the doctoral programs (Educational Technology and Educational Leadership) and three were enrolled in the masters program in Educational Technology. The nationality of the subjects is Chinese – two female students are from China, one male and two other female students are from Taiwan. None of them had previous experience with on-line courses. To keep the survey anonymous, pseudonyms have been used in this study.

On-Line Course Format

The ET502 – Instructional Design course was offered as a 100% on-line course for the first time in the Fall 2001 semester. Two instructors, one American female and one Asian male, co-taught this on-line course using a web-based course management system called Blackboard. The interface of the Blackboard is shown in Figure 1. Students had to choose one topic of interest and create a design document and self-paced lesson for the topic individually. In order to create an on-line community among students, instructors randomly assigned three people to form a group. All students were informed in the beginning of the semester that peer evaluation would be counted as 20% of their final grade. The instructors also developed weekly mini-lectures that synthesized important information for topics that were covered in the textbook. These mini-lessons were then posted to the Blackboard website. These topics included writing a needs statement, learner and contextual analysis, task analysis, instructional objectives, instructional sequencing, instructional strategies, designing questions and feedback, message design, and conducting formative and summative evaluations.

Within each group, individuals were required to work on the first draft of the weekly assignments, provide/receive feedback to/from their group members (peer feedback), revise their first draft based on the peer feedback, and post their second draft on-line. Following the posting of this second draft, both instructors would look over their revised assignments on-line and provide feedback to each student. Students would then revise their second draft based on the instructors' feedback. These same procedures were repeated for each assignment and students would compile all revised assignments together into a final design document. After all sections of the design process were covered, students would develop a self-paced lesson based on the design document that they had been developing. Students would then conduct a formative evaluation to test the self-paced lesson to its target audience. Finally, students submitted the final version of the design document and self-paced lesson on-line at the end of the semester.

FIGURE 1. Interface of the Blackboard



Materials

Student Attitude Survey. During the last week of the Fall 2001 semester, students completed a 21-item Student Attitude Survey designed for this study to indicate their attitudes toward this course and the on-line learning environment. These items were five-point Likert-type questions that ranged from 1 (strongly disagree) to 5 (strongly agree). Several open-ended questions dealing with students' likes and dislikes about this course, their preferred delivery format for this course, their suggestions to improve this course, and their perceptions toward on-line learning both before and after taking this course were asked.

Focus Group Interview. After student attitude survey data had been collected, coded, and analyzed, the authors found several emerged patterns that derived from the data and conducted a focus group interview with these participants.

Procedure

All subjects filled out the 21-item Student Survey and answered open-ended questions at the end of the Fall 2001 semester. A focus group interview was then conducted at the beginning of Spring 2002 semester. All five international students who enrolled in the Fall 2001 on-line course were gathered as one group in the department conference room. Their responses were recorded and the findings are reported in the results section. The whole interview lasted approximately 90 minutes.

Data Analyses

Both quantitative (Student Attitude Survey) and qualitative (Open-ended questions and Focus Group Interview) methods were used to analyze data in this study.

Results

Student Attitude Survey

The mean attitude scores and standard deviations for five international students' responses to the 21 statements on the five-point Likert-type attitude survey administered after completion of the on-line instructional design course program are shown in Table 1. Responses were scored as 5 for the most positive response to 1 for the most negative response. The overall mean score across the 21 Student Attitude Survey items was 4.06, a favorable rating indicating agreement with positive statements about this course. The three highest-rated statements on the survey were "I like to see pictures of my instructors and classmates on Blackboard" (M = 4.80, SD = .45); "I like to see the short biography of my instructors and classmates on Blackboard" (M = 4.80, SD = .45); and "I like the mini-lectures provided by the instructors" (M = 4.80, SD = .45). The two lowest-rated statements were "I would recommend this on-line course to others" (M = 3.00, SD = 1.23) and "I would take this course as an on-line course again" (M = 3.20, SD = 1.48).

Table 1. Student Attitude Survey Scores

	Statement	M	SD
1.	I like to see pictures of my instructors and classmates on Blackboard.	4.80	.45
2.	I like to see the short biography of my instructors and classmates on Blackboard.	4.80	.45
3.	I liked the mini-lectures provided by the instructors.	4.80	.45
4.	I liked the "file exchange" function on Blackboard.	4.60	.55
5.	I liked the feedback that my instructors provided.	4.60	.55
6.	I spent more time working on this course than my other courses.	4.60	.55
7.	I liked the "announcement" function on Blackboard.	4.40	.89
8.	I like to receive feedback from my group members.	4.20	.84
9.	I learned a lot from this course.	4.20	.45
10.	I would like to meet with my instructors and classmates face-to-face some day.	4.20	.84
11.	The grading was fair in this course.	4.00	1.00
12.	I liked the group format in this course.	3.80	.84
13.	I liked having two instructors (co-teaching) in this course.	3.80	.84
14.	I liked this course.	3.60	1.67
15.	I liked the on-line environment of the course.	3.60	1.67
16.	I like to provide feedback to my group members.	3.60	.89
17.	This course was easy.	3.60	.55
18.	I liked the textbook that we used in this course.	3.40	1.52
19.	The amount of the work required was fair.	3.40	1.34
20.	I would take this course as an on-line course again.	3.20	1.48
21.	I would recommend this on-line course to others.	3.00	1.23
	Total	4.06	.52

Note. Reponses ranged from 1 (Strongly Disagree) to 5 (Strongly Agree).

Student Perceptions and Attitudes Toward On-Line Learning

Students were asked to indicate their perceptions toward on-line courses before taking ET 502 course and after taking ET 502 course. Their responses are summarized and shown in Table 2.

Table 2. Student Comments About Their Perceptions

Student	Before	After
1	• Interesting • Excited	• Would never take on-line course again • This course was too demanding • Lacked of instant interactions • Struggled alone
2	• Informal • Supplement for the traditional course	• Made a good choice • Had to do my best on the projects and provide feedback to peers • Received great feedback from peers and instructor for further revisions
3	• Naïve attitudes	• Would be very cautious • Spent plenty of time on this course • Valued the experience
4	• Something far from my life • Extremely high-tech • Felt uneasy • Feared of unknown	• Liked the on-line learning environment • Interface was user friendly • Was easy to access class materials • Had plenty of interactions with peers and instructors • Felt comfortable of emailing the instructors with questions
5	• N/A	• N/A

When asked about students' likes and dislikes about this particular on-line course, students' responses are summarized in Table 3.

Table 3. Student Attitudes

Student	Likes	Dislikes
Overall Comments:	Convenience • Could get everything done at home • Did not need to worry about arriving in class late, finding a parking apace, and/or driving to school in cold snowing days Flexibility • No fixed class meeting time • Did not feel stressful psychologically or develop a fearful attitude towards this course • Could choose the right time to study when highly motivated • Read course materials at my own speed • Easy access to the class website Self-regulated Learning • Liked to work on individual project • Liked learner-centered approach • Provoked me to learn more	Interaction • The interactions among students and instructors were not enough • Lacked instant feedback Instructional Design Concept • The difficult nature of the course • Did not know what I was doing • The process of completing the project was painful Others • The rigid evaluation • Technical problems (File Exchange)

	information by myself • When the actual project was done, it looks like a baby was born Others • Liked to see different topics and ideas that other students posted on-line • Feedback provided by instructors and other group members • The mini-lectures are good study guides (concise and easy to read)

Student Preferences Toward On-Line Learning

The authors asked students, "Do you think the content of this course would be better taught in a 100% face-to-face environment, in a half face-to-face and half on-line environment, in a 100% on-line course, or other alternatives?" One student preferred to take this course in a 100% face-to face environment, two students preferred to take this course as in a half on-line and half face-to-face environment, one student preferred to take this course as in a 100% on-line environment, and one student indicated no preference. Their responses and reasons given are summaries in Table 4.

Table 4. Student Preferences

Student	Preferred Format	On-line	Face-to-face
1	100% face-to-face	• Too demanding • Content was too complex • No immediate feedback	• Better discussion with peers • Immediate interactions with instructors
2	50%/50%	• No time and place limit	• Questions could be answered instantly
3	50%/50%	• Flexible time	• Content could be better discussed in the traditional classroom
4	No preference	• No difference. Feel comfortable either way.	• No difference. Feel comfortable either way.
5	100% on-line	• Access anytime anywhere • Read materials at my own speed • Questions were answered "individually" by email from the instructors	• N/A

On-Line Learning Interactions

When asked students to identify their level of interactions with peers and instructors between the on-line course and traditional classroom environment, students' comments are summarized in Table 5.

Table 5. Student Interactions

Student	**On-line**	**Traditional**
Overall Comments:	• Felt isolated and lonely • Met with group members in person • Interacted "more" with American students (intellectually but not physically) • Some people did not provide constructive feedback • Teammates would disappeared for a	• Could received immediate interactions • Usually sit quiet, nod head, or simply smile when agreed. • With more "what's up, dude" "how are you" type of informal conversations • Could view body language and/or verbal cues • Would feel ashamed to express my

	while in the cyberspace • Required "real" participation with peers • Direct interaction – all interactions were very focused • Less language barriers in the on-line environment – no speaking and listening, only reading and writing • Less misunderstanding – accent, feel ashamed • Lacked language and cultural exchange	opinions because of my accent • Would improve my English listening and speaking skills • Whole approach: learning language and culture (ex, American students put their feet on the chair, eat in the classroom, and challenge their instructors. I could sense the class atmosphere, listen to humor or jokes from the instructor, and observe American teaching/learning styles in the classroom.).

Discussion and Educational Implications

This study investigated the cultural influences on the on-line learning environment and explored issues considered for international students who are planning to take their first on-line courses. Instructors should also take international student needs into account and develop appropriate strategies to assist international students who are taking on-line courses.

It is interesting to note that in the Student Attitude Survey, the highest-rated statements were "I like to see pictures of my instructors and classmates on Blackboard" and "I like to see the short biography of my instructors and classmates on Blackboard". It seems that international students liked the idea of building an on-line community among peers and instructors in this course. The two lowest-rated statements were "I would recommend this on-line course to others" and "I would take this course as an on-line course again". We believe that these two statements reflected on international students' attitude toward their first on-line learning course. As suggested by the overall high ratings of other survey items, the students overall liked the course. Their neutral opinions regarding recommending this course to others or taking this course as an on-line course again, however, suggest that the on-line experience could be improved for international students.

In the process of teaching this on-line course to international students, reading their feedback and assignments, and interviewing them during the focus group, the authors noted comments by the students. The authors would like to provide some suggestions regarding to teaching international students in the on-line learning environment.

Initial Support

- Instructors should provide more support to increase international students' self confidence and motivation in the beginning since it was their first time taking an on-line course. One student stated, "In the on-line environment, the initial support provided to students needs to be strong. International students had experienced traditional classroom experience since kindergarten. Anther student expressed that "I think that the grading for the first two assignments were not fair because of different class format (on-line versus traditional face-to-face format). The instructor should give more time in the beginning of the course for students to be familiar with the interface."

Group Format

- International students would prefer to work with a small group (preferably 3 or 4 people in one group) and to give or receive feedback within the group but would prefer to work on an individual project instead of a group project. One student expressed that "In tradition class when we discuss a topic because I do not have good communication skills nor do not know how to express myself well because I am an international student, I would let American students to express their opinions. But in the on-line environment, everyone is equal. Another student mentioned, "In the traditional class, if I have an idea I am usually quiet and will give in to the idea of American students in my group. I do not know why. I just give in… When working individually, I would stick with my own idea and just finish it. It's more work but it is worth it."
- International students would prefer not to be assigned to the same group with other international students in this on-line course. Several students stated, "Our English will never match up with American students since English is not our first language. Americans know how to express themselves well and have great commutation skills. For instance, when American students conducted a mediocre research, they could express their research to 100%. On the other hand, although Asian students understood the ins and outs of

their research studies, we could only express 50% no matter whether it is in the on-line or in the traditional classroom environment."

Peer Feedback

- Most International students supported the idea of providing feedback to their group members. In that way, they felt that they were "forced" and had responsibilities to read the chapters and mini-lectures thoroughly so they could provide constructive feedback to their group members.
- Most international students suggested that providing and receiving feedback within a group was an efficient way of learning and the feedback were got right to the point and professional sounded. However, they suggested that instructors should state criteria or rubrics for the peer feedback because some group members only provide superficial feedback to them.

Self-regulated Learning

- They strongly supported the learner-centered approach in the on-line environment and agreed that students should be responsible for their learning. They indicated that in the face-to-face classroom environment, they only need to sit quiet or nod their head when agree with something. However, it requires "real" participation and interaction in the on-line environment especially when peer feedback was involved.

Language and Culture

- International students felt that it was easier for them to communicate better with their group members on-line since there was no English speaking or listening involved in that environment. One student expressed, "I thought on-line course would be easier for me because my English speaking skill was not good so I do not need to "speak" in the on-line environment. Since I only had to write in this course, I had much more confidence." However, many of them felt isolated sometimes because they would like to have face-to-face interactions with American peers in order to improve their English as well as to learn more about American culture.

First Author/Instructor Reflections

Through my own observations, interacting with international students, being an international student and international faculty myself, I found this topic intriguing. During the process of finding out the international students' perceptions and attitudes toward their first on-line learning course experiences, I might have different opinions than my American co-author/instructor in this study because of different cultural backgrounds. I was born and raised in Taiwan, came to the United State ten years ago, and had never taken any on-line courses. I was doubtful about the effectiveness of on-line learning. I was wondering what students could learn from on-line courses? What were their motivations for taking on-line courses? Would the teaching preparation time for instructors be less in the on-line environment than traditional face-to-face classroom? I would like to express some of my observations and thoughts on these issues.

Students in Taiwan and China are eager to become proficient in English – reading, writing, listening, and speaking. Nowadays, students start learning English when they are in the fifth grade in Taiwan and in seventh grade in China. The newest trend in both Taiwan and China is to start English in the kindergarten. As long as English teachers "look" like westerners and are English speakers, help the enrollments of schools because they look like "live models." Students in Taiwan or China spent a lot of money to attend these English conversation schools to improve their English and learn some American culture from these instructors. I question whether students would still be interested in attending these courses and perform well if they are offered on-line.

Distance Education is getting more popular and it is a trend in higher education worldwide that no one can prevent. Sometime soon (or it might have already happened), I believe that a lot of students who are from Taiwan or China will have opportunities to take on-line courses that are offered by American schools without physically being in the United States. This might provide some advantages for some international students; for example, they do not need to leave their country and family, spend money on rent and foods, deal with visa issues, etc. On the other hand, they might miss some great opportunities to learn about American culture and English language, similar to this study suggested. Can international students learn about American culture in the on-line environment? I am not so sure. I believe that it would be like watching a travel channel on television and trying to learn the culture via the television. It would also be a pity for international students who completed their whole degree program on-line to graduate without knowing American culture and missing the opportunity to improve their English skills. And vice versa, it would be a shame to prevent Americans from learning more about the cultures of China and Taiwan.

For future studies, it would be interesting to ask international students to list advantages and disadvantages of taking the whole degree program in the on-line environment. It would be also interesting to explore whether American culture and/or language skills can be exchanged or transformed through the on-line environment among international students and American peers. The authors are planning to conduct further research in these areas.

Second Author/Instructor Reflections

In some respects many of the international student's attitudes about their on-line experience are no different than that of their American peers. Feelings of isolation, frustration over the lack of non-verbal cues, and the challenge of dealing with more verbally comfortable (and often less academically gifted) team members are expressed by American students as well. Appreciating the self-paced format, the ability to take a class without parking or travel hassles, and the opportunity to reflect and compose thought-out verbal responses are considered positive aspects of on-line learning by most students.

International students, however, have additional challenges in each of these areas because of different cultural norms and unfamiliar language. Future on-line courses can take the challenges experienced by international students into account by describing the culture of the on-line class up front. For example, students can be encouraged, perhaps even required, to get together in face-to-face on an occasional basis. Special face-to-face sessions with the instructor of on-line courses can also be offered. Skills needed for surviving in an on-line course can be articulated. Although most of these suggestions address the affective side of learning; these suggestions may provide an additional layer of comfort for international students new to the on-line environment.

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Are Professors Ready for the Technology Age?

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Abstract

Technology and the Internet have invaded the educational systems of higher education. Now, more than ever, universities are forced to change how they deal with the growing technical needs of these organizations. This is particularly evident as for the first time in academia; students entering college may be better equipped technologically than their faculty. Sixty-six professors were surveyed to determine their preparedness for technology integration into their curriculum. The findings suggested that faculty did not have the technical skills necessary to conduct distance education.

Background

Implementing the use of web-based technologies in teaching and learning requires fundamental changes in many areas of an institution. Higher education institutions in Puerto Rico are no different. This study was conducted to evaluate and assess the level of technical expertise or competency of the full time faculty in a private, nonprofit Puerto Rican university. The research site was established in 1949 as a two-year technical college. In the year 1991, it became a four-year college. In 2001, graduate programs began to be offered. Its academic programs lead to baccalaureate and associate degrees in liberal arts, education, business administration, office systems, science and tourism. It also has programs on a transfer basis to continue toward bachelor's degree, professional degrees, and certificates. This university also offers master's degrees in Human Resources, Administration and Supervision in Education, Marketing, Criminal Justice, and Management. The main campus has six university centers, spread out in different towns.

Population Characteristics

The student body is composed of young adults who mainly reside locally and also come from adjacent towns. The majority of students are from families with low incomes and limited education. The student body is also composed of youths and adults that have recently graduated from high school, as well as adults that have entered the job market and need to improve technical skills or desire an opportunity for self-improvement. Table 1 shows the amount of students per year in the program. On the main campus a 33% reduction of students can be seen between first and second year students. Attrition continues throughout the academic years and at both the main campus and the university centers. Further research should look at the extreme attrition found in the amount of students per year.

Table 1 - Student Profile

	First Year	Second Year	Third Year	Fourth Year	Total
Main campus	2186	717	430	315	3648
University Centers	1487	409	255	147	2298
Totals	3673	1126	685	462	5946

Table 2 - Faculty Profile

Full Time on Campus	Part Time on Campus	University Centers Part Time Only
72	143	193

As this institution recently went through the licensing renewing procedures, results of the evaluation suggested that it distinguishes itself from other local universities in the area in three main areas:

Open to change – There is a complete support system for change. Beginning with the Chancellor, most of the professors that experiment with new ways of doing something, always find support.

Professors are always looking for new ways of teaching or reaching the student. As the administration supports change, the field is open to new methodologies and techniques.

Student services – being a private institution, it is strange to find so many student services available. We have Freshmen Year Services Program, Professional Guidance and Counseling Programs, Advising Program, Mentoring Program, Assessment Program, Tutorial Services, Complementary Educational Services Program, Health Services, Social and Cultural Activities, Sports and Recreational Activities, Books and Supplies, Veterans Services, Student Activities, Student Organizations, Student Council, Academic Dean's List, Tutoring, Work Study Program, Institutional Scholarship Programs, After School Program for our students' children, and opening in January, 2002 a new Pre-School Center.

Review of the Literature

"Communications technologies have the potential to transform the educational process. [In many contexts], these technologies have the power to change the roles of faculty." (Needham, 1986). Technology and the Internet have invaded the educational system at all levels. Institutions frequently develop new programs or adopt new paradigms in response to perceived changes in the exigency of society as a whole or specific student patrons in particular.

On July 13–14, 2000, a group of sixteen higher education leaders gathered in Lake George, New York, to participate in a symposium. The topic was "Preserving Quality in Distributed Learning Environments." This was the third of the Pew Symposia in Learning and Technology. The purpose of these symposia was to conduct an ongoing national conversation about issues related to the intersection of learning and technology. During the presentations, data was presented that mentioned, according to Carole Cotton of CCA Consulting, a market research firm, that ninety-four percent of all colleges and universities are either currently (63%) or planning to be (31%) engaged in distance and distributed learning. Some believe that this extraordinary growth is surpassing the existing quality assurance capacities of accrediting agencies. Others counter that distance learning is a long-established form of higher education and that quality assurance practices for distance education are essentially the same as those used for traditional, on-campus education. Regardless, the arrival of distance and distributed learning has raised numerous questions about quality assurance. How do established distance learning institutions ensure quality? What more needs to be done? How do quality assurance agencies view the distinction between on- and off-campus teaching and learning (Twigg, 2000)?

Dissatisfaction with the educational status quo, both from inside and outside the university, has increased the pressure on higher education to reevaluate its traditional educational practices. Higher education is facing the challenges of the rapid development of information technology, increased accountability for quality education, competition from online institutions, rising costs, and changing student population (Ehrmann, 1995; Guskin, 1994; Handy, 1998; Owston, 1997).

Consequently some universities and colleges are considering several restructuring solutions. Some of these solutions target educational practices: modifications in mission statements urging better preparation of students for work and life skills (Handy, 1998); curricula re-design with emphasis on measurable learning outcomes (Diamond, 1997); a redefinition of pedagogical goals toward a more learner-centered pedagogy (Collis, 1998); and heavy investment in technological innovations, such as the Internet (Owston, 1997). Of theses solutions, the latter has received much attention in higher education literature. At the research site, as in many other universities, administrators have high expectations that the potential of the Internet can be realized to better serve higher education clientele (Duchastel, 1997) and thereby, address some of its restructuring concerns (Ehrmann, 1997a; Guskin, 1994; Owston, 1997).

Reasons for such expectations arise from several factors. First, the Internet's communication capabilities and its ability to transmit and store vast amounts of information hold great promise for the restructuring of teaching and learning practices. Already two of its most popular services, electronic mail (e-mail) and the World Wide Web (WWW) are changing teaching and learning practices since "teacher and text" are no longer perceived as the only resource available to learner. Today, e-mail allows for access to global peers, colleagues, experts, and researchers. Similarly, the WWW brings a variety of multi-media resources to the fingertips of students at a speed and quality of transmission never experienced before though networked computer technology.

The 1999 Campus Computing Project's annual national survey of information technology in higher education reported that many higher education institutions were providing more services through the WWW. For example, more than half (69.5%) of the institutions responding provided online undergraduate applications on their Web sites. More than three-fourths (77.3%) made the course catalog available online. A quarter (25%) of the institutions made library-based course reserve reading available online and almost half (46.5%) offered one or more full college courses online via the Internet and the WWW (Campus Computing Project, 1999).

Second, the Internet allows for greater adaptability of instructional methods to different learning environments making it ideal for distributed learning systems capable of accommodating the academic needs of a diverse adult student population. Third, traditional classrooms in higher education have been criticized for inadequate training of students for the work place. The boredom, seeming lack of personal attention, outdated class material, and inadequate sensitivity to a diverse population are some of the issues that have been questioned (Gardiner, 1997; Handy, 1998).

To further complicate matters, it has been argued that many students graduate without mastering core skills (Diamond, 1997). Meanwhile, state of the art technologies are being adopted by corporations which are spending billions of dollars annually on formal training to make curricula and teaching methods more relevant, interesting, and modern (Mauch, 1998). Such possibilities are forcing the traditional establishment and administration of higher education but to jump onto the technological bandwagon (Sherrit & Basom, 1997). Similarly, Rossner and Stockley (1997) summed up the situation as one of:

> ... increasing public access to information technology, government funding priorities for initiatives that support the development of distributed learning networks, increasing competition for students who no longer need to be present on a university campus, and the need to provide cost-effective, high quality education to greater numbers of students. (p.333)

At the research site, an intellectual debate has been brewing. Administrators have to contend with the pressure to integrate technology as a means of attracting student applications and faculty either rejecting its imposition onto their teaching practices or seek support for technology integration rewards, and recognition for the time and effort that goes into such efforts. Green (1999) reported that the 1999 survey of college faculty from UCLA's Higher Education Research Institute (HERI), which provides the first large-scale data on some aspects of the way college faculty use – and do not use – IT resources documented that "keeping up with information technology" is a major source of stress for fully two-thirds of the professorate (p.3).

Background and Problem

Though greeted with enthusiasm by the university community at large, technological integration remains controversial. Opponents caution against hasty and ad hoc technology integration into daily practices of teaching and learning, specifically without taking into consideration faculty and student willingness and cooperation in the integration efforts (Noble, 1998; Schrage, 1998; Turoff, 1997; Young, 1998).

The Internet is being heralded as a versatile medium to support learner-centered educational practices. It is being promoted as a technological innovation that can reduce mundane time-consuming tasks of faculty workload. However, there is evidence for discontentment and controversial opinions regarding the above from both faculty and student bodies that only time and empirical research could serve to dispel.

Many universities are making substantial investments in new technologies for teaching purposes. However, although there has been widespread adoption of new technologies for teaching in the last few years, they have not brought about major changes in the way teaching is organized and delivered (Bates, 1997).

Why use technology? It all depends who you ask. Politicians, university presidents, keynote speakers at conferences from industry, education and government and teachers themselves offer a number of different reasons to justify the use of technology. Bates (1997) mentions four reasons:

To improve access to education and training
To improve the quality of learning
To reduce the costs of education
To improve the cost-effectiveness of education

Some of these reasons seem conflicting. More students might be served by the institution through using technology: more means worse quality and more work for faculty. The initial set up cost anticipates delving deep into the university's pocket. For the same dollar amount learning effectiveness can be increased, or more students can be taught to the same standard for the same level of investment. This seems a great goal to strive for. Twigg (2000), states, "making use of new technologies to reduce the cost of instruction requires a fundamental shift in thinking." It requires challenging the assumption of the current instructional model: face-to-face, synchronous learning. Colleges and universities must focus on producing effective use of resources – faculty, time and technology, to increase student learning. In order to reduce costs, without hurting the quality of instruction, the university must move away from traditional management of resources, contact hours, and time. (Twigg, 2000; Bates, 1997).

Twigg (2000) states that “A substantial amount of an institution’s faculty members must have an understanding of and some experience with integrating elements of a computer-based instruction into existing courses.” This is paramount. When the organization purchases technology, it is imperative to involve professors, administrators, support personnel and students. Some faculty members may have a great enthusiasm for redesigning their courses, but have little experience in this area. Twigg (2000) mentions that experts have stated that 13 to 15 percent of the faculty should constitute critical mass. More specifically, 13 to 15 percent of faculty is needed to begin smaller instructional technologies units and thus satisfy integration needs in order to create a change reaction moving towards large-scale redesign efforts. It is clear then, that universities must begin by engaging faculty, training them and providing the professional development needed. Again, the need to acquaint faculty to the organization’s technical efforts is crucial. “One of the main challenges of making technology-based teaching a core function is to extend its implementation from a relatively small number of enthusiasts and early adopters to the main body of the teaching force” (Bates, 1997). Teaching with technology is not an inferred process, appropriate training must be emphasized. Faculty must go through a four-step sequence to develop skills in using technology in teaching. First, they must understand the importance of using technology for teaching. They need some basic understanding of teaching and learning processes and different approaches. Third, they must comprehend the roles that technology can play in teaching and how this changes the organization of content. Fourth, they should know how to use a particular piece of technology. (Bates, 1997).

Methodology/Results

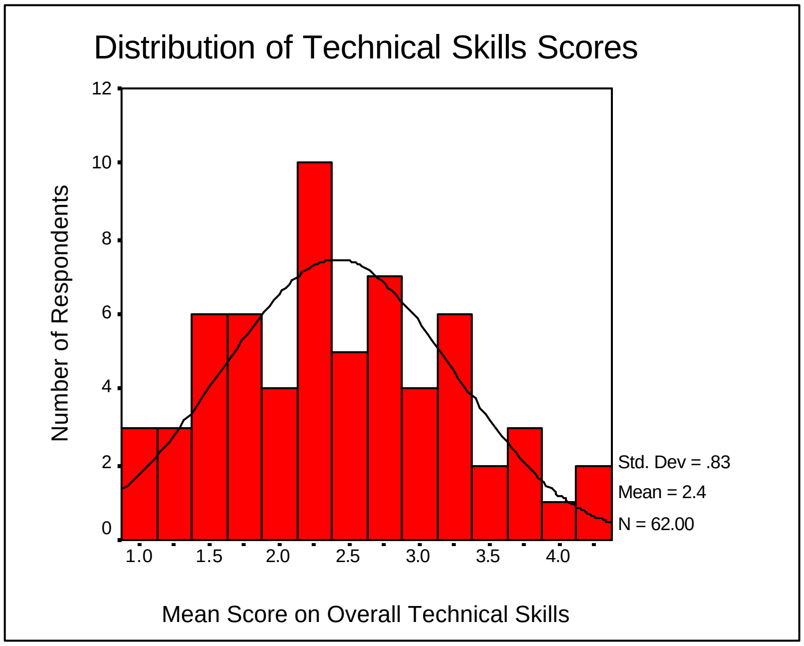
The primary goal of this research study was to quantify the level of technical expertise or competency of the full-time faculty through self-report. It was determined that the full-time professors would provide more generalizable data, due to the fact that they are involved in the university growth. A technical skills survey was given to all full-time faculty (n=72). The response rate was excellent (92%) as 66 replied. Data was collected during a yearly faculty meeting at the beginning of the 2001 academic year. Variables that were assessed included: department, years of experience, and technical skill level. The technical skills reported by faculty were: Word processing, Presentations, Using Laptop with Projector, Email, Databases, WWW, Discussion Board, Spreadsheets, Distance Education, Statistics, Chats, HTML, Mailing Lists, and Graphic Design. Information was also collected regarding prior experience with distance education and the level of experience with distance education based on the following three categories: some resources on the web, web enhanced (additional resources) and completely on-line.

The results are divided into three sections. The opening section involves the primary analysis of the data (descriptive statistics for the overall sample, departmental affiliation, and years of experience). The next section involves the secondary analysis of the data, specifically, differences by departmental affiliation and also years of experience and its relationship to technical skill level. Finally, previous experience with distance education will be highlighted.

Descriptive Statistics

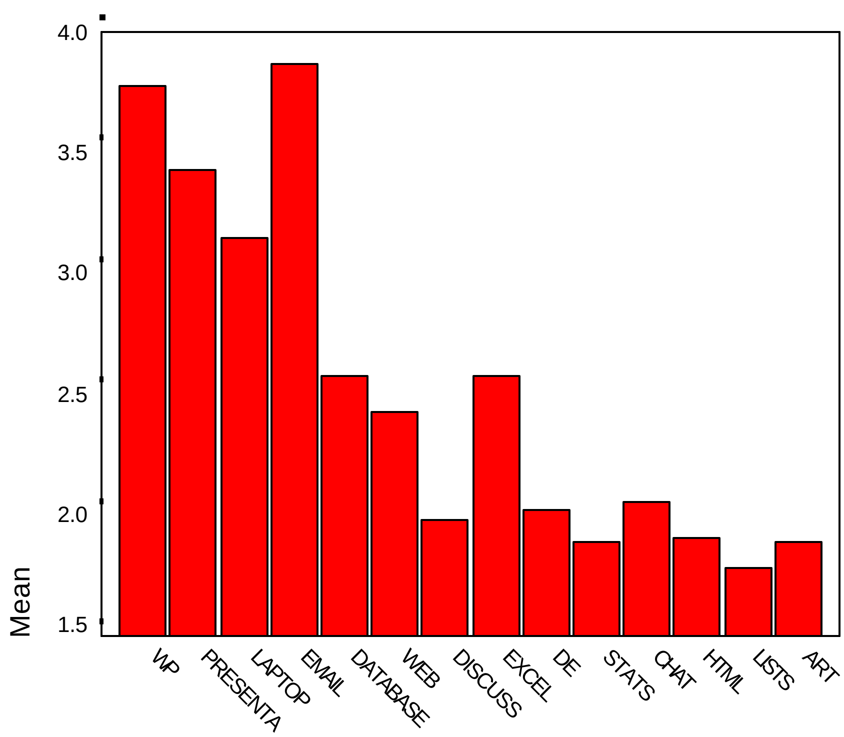
The overall sample distribution of mean technical skills are listed below in Figure 1. This figure represents the entire sample’s responses to the technical skills portion of the survey. This evenly distributed bell-shaped curve was indicative of typical performance.

FIGURE 1 – Distribution of Technical Skills Scores



In Figure 2, bars represent each technical skill and the corresponding average for the entire sample. E-mail (3.89) and word processing (3.82) were self-reported as being the highest level of competency. Graphic design (1.84) and mailing list (1.82) were ranked at the bottom in terms of technical skill level.

FIGURE 2 – Technical Skills and Corresponding Averages



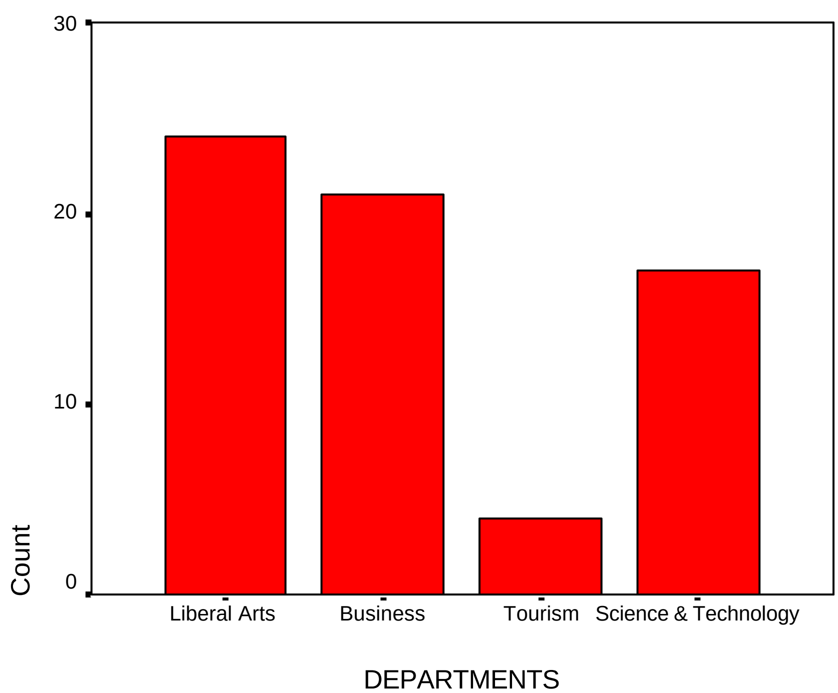
The following table (Table 3) includes the results of the fourteen technical skills for the entire sample (n=66). These descriptive statistics include means and standard deviations. As displayed by the lowest standard deviations, the sample shared the greatest similarity regarding mailing lists (also referred to as list-servs).

Table 3 – Technical Skills, Means and Standard Deviations

Skills	N	M	SD
EMAIL	66	3.89	1.27
WP	64	3.82	1.26
PRESENTA	65	3.46	1.42
LAPTOP	64	3.20	1.62
EXCEL	63	2.63	1.54
DATABASE	64	2.60	1.34
WEB	63	2.36	1.40
CHAT	62	2.04	1.48
STATS	63	2.00	1.29
DE	61	1.96	1.25
DISCUSS	63	1.92	1.33
HTML	63	1.84	1.25
GRAPHICS	63	1.84	1.23
LISTS	62	1.82	1.20

As seen in Figure 1, the overall sample generated a highly consistent and typical bell-shaped curve. However, when the departments were analyzed separately, significant differences were exposed. The following graph (Figure 3) represents the sample breakdown by department. Departments were somewhat evenly distributed which was hoped to produce stable inferences. However, please note, due to the relatively small amount of faculty in Tourism, faculty in this department were not included in the statistical analyses.

FIGURE 3 – Sample Breakdown by Department



Results of the highest and lowest self-rated technical skills by department are listed below in Table 4. Liberal Arts and Business both stated email as the highest technical level. As seen in the overall sample, the departmental affiliation demonstrated consistent findings.

Table 4 – Highest and Lowest Technical Skills by Department

Department	Highest	Lowest
Liberal Arts	email (3.12)	Mailing lists (1.27)
Business	email (4.38)	Art/Drawing/Graphic Design (1.94)
Science & Technology	WP (4.50)	HTML (1.70)

Averages were computed for all technical skills by each department and statistically significant differences were found. These departments and their corresponding averages are listed. Liberal Arts and Languages: (1.80) Science & Technology: (2.58), Business Administration: (2.97). Cohen's d effect sizes statistics (1988) were computed to compare overall differences among departments. This statistic quantifies the difference between means, and does so in standard deviation units. For example, a Cohen's d of .5 is interpreted as two groups being half a standard deviation apart. Cohen (1988) stated that anything above .20 is small, .50 is medium, and .80 is large. Differences regarded as "large" were found when conducting this comparative statistic.

This apparent variation in the overall scores of departments was further uncovered through an analysis of each technical skill. Based upon departmental scores of the 14 categories of technical skills, 7 were found significant at the .01 level and 4 were significant at the .05 level. Those significant at the .01 level were: Word processing, presentations, laptop, email, database, excel, and chat. At the .05 level were: WWW, stats, html, and mailing lists. Differences among the departments were so great in technical skills that only 3 skills did not produce statistically significant results. These were discussion boards, distance education and graphic design. There were great disparities in skill levels based on department affiliation. This is obviously a concern to the university and therefore; any faculty development initiatives should involve a further investigation of this apparent variation of technical skills among departments.

Table 5 – Years of Experience

Years of Experience	Highest	Lowest
0-5	email (4.11)	Mailing Lists (2.00)
6-10	WP/email (4.40)	Mailing Lists (2.20)
11-15	WP/email (4.00)	HTML (1.60)
16-20	email (3.75)	Discussion Board (1.25)
21 +	WP (3.70)	HTML (1.45)

The breakdown by years of experience did not produce statistically significant differences. In essence, the groups shared similar characteristics regarding technical skills levels. Again, these groupings shared responses that were similar to the overall sample.

Correlations between Years of Experience & Technical Skill Level

While groups based on years of experience alone did not differ significantly significant differences, correlations (Spearman's rho) analyzing years of experience and technical skill levels did produce statistically significant results. Chat and HTML offered negative correlations at the $p<.01$ level. Therefore, faculty with less years of experience had higher ratings in these areas. Conversely, faculty with more years of experience had lower ratings in these areas. These findings were very consistent with the literature and the researchers' expectations. It appears that younger faculty have more familiarity with these higher order technical skills than older faculty. Such findings point to the need to include all members of the faculty in terms of professional development.

Distance Education Experience

Information was collected to meet Twigg's theory of critical mass. On the following survey question dealing with "Experience with Distance Education", the following responses were stated: yes (n=13) no (n=51). Also, of those that stated having previous experience with distance education (n=13), based on the three categories, the responses are shown below in Table 6.

Table 6 – Distance Education Categories/ Levels

Level	Description	Responses
1	Some resources on the WWW	7
2	Web-enhanced	5
3	Fully on-line	1

This finding can be interpreted as such; 20% of faculty surveyed had previous experience with Distance Education. This meets (and exceeds) Twigg's recommendation necessary for critical mass. While this finding is interesting, it only hints that a move to distance education would be successful. This university is beginning to involve itself more in this genre, however, based on the low technical levels of the faculty, this finding is still left to conjecture.

Conclusions

The findings of this research convey an apparent disproportion of technical skills among faculty. Departmental affiliation provided the greatest variation in technical skills. This points to the need for greater semblance of technical skills among faculty at this institution. In a perfect world, all faculty in an academic institution would share common technical skills. Yet, as reflected in society, commonalities regarding technical competency is atypical. The "digital divide" apparent in society is also reflected in academia.

Based on the findings of this study, the critical mass required to effectively integrate technology was evident. Yet, the variations in skills level provided a great disparity among faculty. Basically, faculty appear interested, albeit at different levels. However, this is not acceptable in higher education where standards are typically required to ensure equal outputs in terms of students objectives, etc. Thus, to level the playing field, faculty development should look to raise the technical levels of those determined to be "weak".

While this institution is interested in conducting distance education in the near future, the faculty preponderance of lower level skills is a concern. As expected, the Science/Technology and Business departments scored higher than Liberal Arts. However, the technical skills ranked highly were typically "lower-level" skills (email, word processing). While the entire sample shared similar low levels of technical skill competencies (email, word processing), there was an overall lack of the higher order skills typically used in distance education (html, mailing lists).

Further Research

The conclusion of this study also gives direction to further research. These findings demonstrated weak levels of technical competencies which point to the need for better preparation regarding the technical skills and the integration of these skills into instruction. As purported by Bates (1997) faculty must go through a four-step sequence to develop skills in using technology in teaching. They must understand the importance of using technology for teaching. They need some basic understanding of teaching and learning processes and different approaches. They must comprehend the roles that technology can play in teaching and how this changes the organization of content. Finally, they should know how to use a particular piece of technology. A further investigation determining the level of understanding regarding these principles should be completed to greater understand the process of integrating technology into teaching. The inclusion of these approaches in professional development would be an effective start to ameliorate such deficiencies of faculty.

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Developing and Using Case Studies to Encourage Reflective Practice in Teacher Preparation

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Abstract

The School of Education at Indiana University South Bend endeavors to develop committed educators to meet the needs of a diverse population. Reflective practice is one of the cornerstones used in teacher development. In this paper, we explore the use of case studies to assist novice teacher educators to reflect on issues associated with the integration of technology into their teaching practices and patterns.

Introduction

The School of Education at Indiana University South Bend endeavors to develop committed educators to meet the needs of a diverse population. Reflective practice is one of the cornerstones used in teacher development. Case studies provide one avenue of developing reflective practice. Cases can provide an opportunity to experience issues similar to those they might encounter as they move from pre-service teachers to novice teachers in the classroom. The case experience can provide a structure for them to use as they engage in reflective problem solving and assess their own performance in the classroom. In this research project, we explored the use of case studies to assist pre-service teacher educators to reflect on issues associated with the integration of technology into their teaching practices and patterns.

Background

Research from this project was primarily focused on case studies as a tool for reflective practice. To a lesser extent, we also addressed the role of novice and expert in approaches to learning. In her review of case studies in teacher education, Merseth (1996) observes that cases should be real, require research, and provide a source for discussion by users. One of the emerging formats for case studies identified by Ertmer and Russell (1995) was fiction ground in real-world practice end experience that focused on key issues or a central theme. Exploration of fictionalized cases to help students develop their problem –solving skills and to create links between theory and practice have been extant for some time (Kinzie, Hrabe & Larsen, 1998; McNergney, Herbert & Ford, 1993; Cooper & McNergney, 1995; Julian, Kinzie & Larsen, 2001)

We were also interested in touching upon how pre-service teachers perceived the expert-novice connections with the context of the case. We turned to research in instructional design (ID) practice in the 1990s that explored the dynamics of the profession through the eyes of those deemed experts. Building upon and confirming prior research into professional design practice, Julian (2001) established that expert instructional designers often integrate professional knowledge with prior experience to assess situations and consider potential solutions. Experts recognize that situations are commonly influenced by multiple factors and therefore interpret problems as ill defined, spending more time on front-end analysis. They often use mental models or templates for the analysis and solution generation, and recommend a variety of interventions (Rowland, Parra & Basnet 1994). The ability to solve complex problems and identify solutions in this way, however, does not ensure successful practice. The artistic and intrinsic elements of "professional practice have at least as much to do with finding the problem as with solving the problem" (Schon, 1987, p.18). The successful professional has the ability to build a sense of community among stakeholders; creating an environment of joint exploration, enabling clients and colleagues to participate in the process from the discovery of the instructional need, to an analysis that leads the team on a path towards the best possible solution (Pitnik, 1995). We hoped to incorporate these components in the case developed for this investigation.

Method

Case studies were introduced into a technology-related course offered by the IUSB School of Education during the fall of 2002 to further reflective practice. Prior to the class case analysis, a formative evaluation was conducted for purposes of usability testing the case in a separate course. The researcher and instructors for the courses reviewed the procedures for the case study. Students in the School of Education were invited to participate by exploring the case, discussing the ideas with other members of the class and posting responses to questions about the case in a designated forum in Oncourse. The IUSB School of Education uses Oncourse, a proprietary, online course management application developed by Indiana University, for Web-based instruction and/or instructional support (Indiana University, 2000). Case questions were formulated based on identification of issues, values, knowledge, actions and the consequences of actions (Kinzie, Hrabe & Larsen, 1998; McNergney, Herbert & Ford, 1993; Ertmer & Quinn, 2003). Although students are involved in the study, they are as participants and not researchers for the study. The participation is voluntary. Participation grades were assigned. Alternative activities were provided to earn participation points for students who elected not to participate in the case. participants involvement required a commitment of approximately seven hours to the research. Students read case related materials in advance of class (approximately 2-3 hours). Participant involvement in the study lasted three weeks in two different sessions. The first session was a 75-minute training period using *Terry Kirkland*. The participants received print copies of the case and were prepared for discussion. The second case, *Becky's Time Quest*, was discussed two weeks later. The case was posted to Oncourse the weekend prior to the class meeting. Questions were posted on the Oncouse discussion forum for response. In class, participants discussed the case within small groups of three, and then posted responses to the questions as a team here and after referred to as "respondent". Since the responses posted were a group consensus, individual identifications have been removed. Although they had the option to post responses in the forum for one week following the research activity, all the teams finished during allotted class period of 2.5 hours. Facts/Issues/Problems/Opportunities: What knowledge or information do you already possess about instruction in this situation? What additional information do you need to know to address Becky's situation?

- Perspectives: Who are the stakeholders in this case scenario? What perspectives do they (or might they) bring to this situation?
- Knowledge: Can you describe how an expert instructor might successfully facilitate this unit? Please consider responses from the perspectives of instructional methods, management, learners with special needs, integration of subjects and invisible use of technology.
- Actions: Describe potential solutions to the issues identified. Can you describe what a novice teacher might do in the same situation and what challenges he or she might encounter? Please reflect upon the following aspects: issues concerning classroom management, issues concerning scheduling, student use of video technology, student use of software for design and promotion (storyboarding, budgeting, etc.), colleagues, administration, assessment and standardized testing requirements.
- Consequences: Consider and describe the possible consequences of each solution.
- Recommendations: Make a recommendation for action after weighing the advantages and limitations of each solution.
- Other: Do you think this case will help you transition fro m novice to an expert in the classroom?

Student responses were assessed and evaluated using qualitative methodology. In addition to written case responses, student response to semi-structured interviews will be explored using qualitative analysis methods to identify patterns, etc. Analysis techniques will be refined and new avenues may be explored as the case is developed during the spring semester of 2002.

Results

A total of ten (10) students elected to participate in the case; one of which was used for formative evaluation. Since the class mix was dependent on enrollment, and there was not a specific focus on the balance of male/female student population. In this instance, all participants were female. All case participants were pursuing careers in special education. No minors were involved in the study. The results are reported in general terms but individual quotes were pulled for purposes of elucidation, clarification, or emphasis.

Facts/Issues/ Problems/Opportunities:. All four respondents [teams] identified the majority of issues. Among them, all issues were identified. One team introduced their issues statement as follows:

Being in education we understand that:

- enthusiasm sometimes overpowers practicality
- it is often easier to learn than to teach

- some ideas seem really fun, but are a lot more work than meets the eye

One facet of case analysis considers what information is yet needed to better assess the situation. Suggestions from participants included more data on the technology background of Becky and her students, substantially more background on the special needs of her students, adding that it would be "*helpful to know if she collaborated with special educators of her students prior to implementing the project*". One respondent observed some positive aspects to Becky's experience as well, observing that:

Becky was excited about teaching.
Technology was being used in the classroom.
Some students who were not performing previously are now participating.

<u>Perspectives</u>: Some teams identified stakeholders in greater depth and details than others. Two respondents elected to define nearly all of the characters by function rather than name. One respondent [team] opted to align the descriptions of various teachers and parents in the case into stakeholders who supported the protagonist efforts and those who did not. Each respondent identified the major stakeholders, a couple respondents identified additional important stakeholders, collectively, the respondents identified all the stakeholders. Participants demonstrated a clear understanding that stakeholders extended beyond the immediate characters. Three of the four respondents identified the school administration as stakeholder, describing the principal as "*impressed with integration of technology*" and "*supportive of her efforts to integrate technology into the classroom*". One even discussed the project from the perspective of the school corporation in which Becky's school resides.

<u>Knowledge</u>: Describe how an expert instructor might successfully facilitate this unit. They considered responses from the angles of instructional methods, classroom management, students with special needs, integration of subjects, and transparent use of technology.

In analyzing instructional methods, all respondents identified that an expert would have spent more time in front –end planning and preparation such as more detailed initial learner analysis of their backgrounds, values, skills, and learning styles.

If you have students who do not do well with independent activities and research, then they will not do well with this project.

[Becky] should have incorporated background knowledge into the lesson
a) needed information on how to do the assigned tasks (research, writing, editing, organizing)
b) she should have taught the students how to properly use the technology (and she should have learned too)
c) she should have had a lesson on what is appropriate to video tape and what is not

The respondents were clearly aware of the protagonist's classroom management difficulties. They recognized that Becky was easily distracted in the classroom. They also observed that she liked to teach and wanted to make the classroom a good experience for her students.

Becky did not have much control over what she was teaching. She did not start the whole introduction well. She needed to set guidelines and goals for the students to reach. They needed to know exactly what she expected from them. She insisted that it would be a fun project. Each time she introduced something new she should have set up their rules and reasons why they were doing that portion for the project. She needed to be clear that it was not just a film-making project.

Not surprisingly, all respondents identified Becky Dawson's shortcomings in addressing the special needs of one of her students. All respondents addressed the role of the Individualized Education Plan (IEP) within the case. One response implied the teacher had not consulted the IEP. Others went into more depth; exploring the compound inter-relationship among failure to assign tasks that were both specific and appropriate for the student, the focus on a primary technology at the expense of others, and the classroom management issues that culminated in letting a quiet, special needs student slip through the cracks.

For students with special needs, it is very important to know exactly what accommodations and modifications need to be made before the lessons even begin. You need to actually decide on how to teach the lesson and what you expect them to learn. Instead of having the special needs students do the research and screen writing. She may have been able to make a poster aboard or a different type of project hat will incorporate her goals and class objectives. We need to know what her needs are what she expected to know. You also have to know if she is able to be video taped.

She needed to set up specific tasks for each group member. She needed to set up specific tasks to meet IEP goals for special education students. She needed a rubric for the project so students would know what was expected of them and so they could keep on task

All four respondents identified the protagonist's failure to integrate subjects effectively. Three of four respondents commented about integrated subjects within the contact of Becky's political naiveté with her fellow teachers. Although we wanted the students to identify and relate to the political ramification that occur within a school setting, we had anticipated that this response would be oriented to the sixth grade project. No team, however, noted the positive support from the principal. This response would suggest an opportunity for improving the case. Becky was a fairly new teacher with little experience in implementing a thematic unit using technology.
She should have talked with other teachers to incorporate other subject areas and the teachers into the project. She could have the technology club come into the classroom and tape the projects

Only one respondent addressed transparent use of technology as an isolated item. Further investigation is needed on this point. Perhaps they felt they had discussed technology concerns adequately elsewhere in their analysis. It might indicate as well the phrase "invisible" or "transparent" was not meaningful to this particular population.

The technology could have been used instead to gather information or used [in] other multimedia presentations that were not so focused on making a film.

<u>Actions</u>: Next, the respondents posted potential solutions to their identified issues, describing what a novice teacher might do in the same situation and what challenges he or she might encounter. All respondents identified classroom management as critical problem area. They recommended specific task assignments and in some cases alternate assignments.

She needed to set up specific tasks for each group member.
She needed to have some "down time" to have the students adjust and get ready for their next class

The respondents specified numerous actions that Becky might consider for scheduling. Some suggestions interfaced with the suggestions for enhancing classroom management such as due dates for individuals tasks. They also recommended that Becky should have scheduled more time to prepare herself for the project. The respondents recognized that at a novice teachers can be overwhelmed with the sheer range and volume of activities in a classroom, and that help she should have reasonably expected wasn't available. Nevertheless, they felt many of the scheduling problems might have been avoided with greater attention to detail.
[Becky] needed to have a qualified assistant to help with the video equipment and should have talked about scheduling concerns.
She should have scheduled conferences to see student progress

When analyzing student use of video technology, the respondents readily acknowledged the instructional gap between attending a technology workshop and implementing that technology into a major instructional unit. They also recognized that a number of ethical and behavioral issues are associated with technology usage.

She should have tried to use the video equipment herself to see if it worked
She should[have] scheduled a lesson to teach students how to use the equipment properly and with the right amount of respect

Case participants missed some aspects of the question regarding student use of software for design and promotion, mostly answering in the context of rubrics for grading. Elements of desktop publishing software and other applications the middle school students in the case might have used had been edited from the case. However, they had already addressed video related concerns earlier. This was not an effective question and may be revised or removed be in future.

She could have used a rubric to explain what was required for the design and promotion

The respondents identified numerous tactical improvements in the political arena. Participants recognized that the principal was supportive of technology integration and wished for Becky's success. All were quite clear about describing problems that stemmed from Becky's lack of buy-in from here colleagues in the idle school.

She should have presented the project to the administration to see what they would think about it she should have involved her colleagues more with the preplanning, planning, and post-planning. She should discuss their concerns over the project. She should have asked for ideas on how to integrate their subjects into the project

All respondents suggested means for incorporating standards into the project. Some suggestions included communication with parents to inform them of the impending project and generate interest, increased coordination with her administration, and development of lesson plans that correlated objectives to state standards.

> *She should also send a letter home to the parents letting them know about the project ahead of time. Also it would be a good idea for Becky to run the project past her superiors to get their input/approval including a detail description of how this project will meet the state standards.*
>
> *The most important goal of creating projects is how it meets standards and standardizes testing requirements. She should have had these clear before making out the goals and objectives for her lessons. She could then show others how her project does fit into the curriculum and testing requirements.*

Consequences: The respondents next considered and described the possible consequences of their proposed actions. One respondent was clearly on track, but brief. Two of the four respondent comments were very detailed and carefully considered. The remaining respondent integrated actions and consequences into a single narrative stream. All comments were relevant and pertinent. Overall, respondents' comments reflected the potentially beneficial consequences and were well delineated; the possible negative outcomes were less well represented in the discussion forum. Perhaps the participants figured the protagonist's situation couldn't get much worse. As one team member observed, *"I wouldn't want to be in Becky's shoes"*.

> *By hearing her colleagues' concerns prior to implementing the project, Becky may have to further delay starting the project in order to meet with all of her colleagues. Meeting with the special educators may also delay the project. Sending a letter home, again will take time away from the implementation of the project. Also there may be more questions and concerns for Becky to deal with requiring more of her time that she is already lacking. By getting the approval of her superiors, Becky might run into financial concerns from the administration. Also this approval process [may] take time away from the implementation of the project. The students' contracts may result with a student losing the privilege of using the technology, thus losing the point of the project.*

Recommendations: Respondent recommendations for corrective action for Becky were similar to one another. Two respondents recommended that the protagonist try the project again, perhaps in the next year. They suggested that a period of careful assessment and implementation of specifically improvements detailed in their earlier case analysis. Their suggested targets included improvements in unit plans, lesson plans, consultations with special needs students, becoming more familiar with the technology and some serious networking with her colleagues and administrators. One respondent recommended that Becky "*assess the students on what they have learned and set new goals'*, making corrective action immediately. The fourth respondent refined an earlier list of actions, but suggested no time frame.

> *?Becky should assess the students on what they have learned and set new goals on what they have not learned that will be needed for the standardized assessment. She should explain that they need to focus on these skills and they are responsible to know these aspects for the end of the marking periods. She then needs to find an alternative to the filmmaking. Her ideas were exciting, just not necessarily appropriate at this time. She could still have the students research topics and share with others but they need to be meaningful to the class standards.*

Other: All teams wrote that this case would help them to transition from novice to expert regarding the classroom integration of technology. All respondents noted that case scenario increased their awareness of the importance of careful planning and implementation in order to optimize successful integration of technology into their own classrooms. One respondent added that more consideration needs to be taken for special education students and their use of and difficulties with technology in the classroom.

> *By reading this case scenario, we are better able to take into consideration the problems that may arise from implementing technology into our own classrooms. We now realize that this implementation needs to be done slowly with a great amount of preparation in order for it to be successful.*

The entire activity, including discussion of the case and posting of responses, was completed in less than or equal to 2.0 hours. The participants felt this case was easier than the analysis of *Terry Kirkland*, the case used for training. A few commented that, as pre-service or in-service teachers, they could relate more closely to the character Becky Dawson than to Terry Kirkland.

Conclusion

The case participants in each team successfully identified the majority of the primary issues intended by the case designers. As might be expected, the participants with classroom experience responded in greater depth with more specific suggestions or analysis. Participants were actively engaged in discussions that preceded the posted case response. All felt the case would enhance their capacity to plan integration of technology into their classrooms. Two major themes emerged from posted responses

- Integrating technology for the first time requires taking risks and embracing both successes and failures, but has some reward. They are cognizant that technology integration is a lengthy process that requires a lot of investment.
- The respondents demonstrated their use of reflective practice by describing their knowledge and prior experience in learning and teaching and then relating that to the challenges that Becky encountered.

  By reading this case scenario, we are better able to take into consideration the problems that may arise from implementing technology into our own classrooms. We now realize that this implementation needs to be done slowly with a great amount of preparation in order for it to be successful.

Discussion and Future Development

Some possible avenues for research and further exploration of the case include the following:

- As teacher education and P-12 institutions guide novice teachers in their development of the skills and abilities needed for successful practice, case studies can provide experiences to address questions such as: What concepts and methods enhance this learning experience and enable novice teachers to transfer what they learned to actual practice? How might case studies help to address this question?
- The role of disposition is not addressed in this case. This is a case that could easily be revised to address this issue among others and will be considered by the authors.
- This case is well suited for adaptation to a multimedia format with video clips, additional ancillary supplements such as the Jefferson Middle School Technology Plan, IEP, and interim student work samples.
- The case should be tested with a larger, representative group of in-service teachers.

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Reflections on Educational Technology and System Science

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Abstract

The contribution of systems science is of critical importance as a foundational paradigm and theory, which has extensive influence on the growth of theories and practices of educational technology. Unlike system science that evolves and develops through convergence and divergence, however, educational technology does not reflect on these changes even though it is based on system science. This paper reviews the main concepts and theories of systems science as the basis theory of educational technology and explores new methods for the paradigm and methodology of systems science to support educational technology by analyzing and linking educational technology and system science. One of the major findings of systems science is that educational technology has a variety of educational situations and systems, and each system is unique. In a nutshell, one alternative direction that educational technology suggests based on this finding is that although it has provided solutions to resolve current problems, it should develop to the point where it is able to construct preventative measures in the future.

Introduction

Systems science has served as a foundation for the development and growth of educational technology as its foundational theory and paradigm. Systems science, the parent theory has undergone various changes and developments with criticism and self-reflection; however, educational technology has been criticized for its lack of growth and self-reflection. It is high time to review the existing paradigms, theories, and methodologies that underpin the very foundation of system science, and this should be linked to voluntary changes within educational technology. This paper explores methods for systems science to effectively support the growth of educational technology by 1) reviewing special qualities of systems science as a basis theory of educational technology, 2) examining major theories and concepts of systems science, and 3) analyzing the current educational technology in link with systems science paradigm.

Review of Systems Paradigm of Educational Technology

Systems science has been applied to educational technology from 1950 and 1960 to the present (Saettler, 1990; Finn, 1956; Finn, 1965; Seels & Richey, 1994). Great increases in language labs, programmed instruction, simultaneous use of various media, and instructional computers in the '50s and '60s gave birth to systems approaches that focus on integrated systems and processes. In the 1960s, the total systems approach was coined to explain interaction between human beings and machinery in organization theory (Saettler, 1990).

In the 1970s, the Association for Educational Communications & Technology (AECT) defined educational technology as a systematic method that designs, executes and evaluates the whole process of learning and instruction according to specific learning goals based on human learning and communication theories (Commission on Instructional Technology, 1970, P. 21). Definitions of Silber (1970), MacKenzie and Eraut (1971) and AECT (1972) value the word, systematic, as a major concept of educational technology and it is the most common word in their definitions. Ely (1973) also pointed out that a systematic approach, a study of means, and a field directed approach toward some purpose are the three core concepts in the various definitions of educational technology. It is clear that early educational technology with early system approach's adaptation was in line with absolute and recursive characteristics that pursue structural, analytical and stage approaches.

For a few decades after the 1970s, the term, systems approach has been used to explain procedures reflecting goals and means perspectives with heavy links to linear and behavioral concepts in instructional systems design and development and educational planning. As a result, numerous people in the educational technology circle adopted the term as a systematic, anti-creative and mechanical approach that enables easier management of projects (Romiszowski, 1996). This systems approach is a practical methodology with strong systematic and phase characteristics, and it has served as a concrete model for integration of instructional system design. The most popular model is that of Dick and Carey.

Some systems scientists, such as Banathy advocated systemic perspective, systemic philosophy, systemic research and systemic methodology by suggesting an instructional systems design that embodies expansionism and active, non-linear, synthesis-orientation and holistic mode thinking, rather than classic scientific thinking of an analytic, restorative and linear causality approach. However, practical philosophers in particular within the educational technology circle have considered this model as an excessively complicated model without practicality. As a result, this model has not made it into the main stream of educational technology.

According to the definition and area of educational technology, recently recognized by AECT, the design area of educational technology evolved from instructional psychology into the instructional systems design area through the adaptation of systems theory. Designing in this process is defined as follow. Design embodies both systemic approach (macro level) and each step within it (micro level). ISD is a typically linear and reoccurring process that demands consistency and completeness in every stage. In ISD, process is as important as outcome since the validity of the outcome depends on the process (Seels & Richey, 1994). Even the latest definitions reiterate the importance of process, stage, linear aspect, recurrence, completeness, consistency, and balance, signaling a shift to analytical, closed and determinist methodology from the general systems theory of wholeness, dynamic interaction, self-control and openness.

Saettler (1990) points out that Gagne and Briggs's instructional systems models and other models are not or merely related to general systems theory but the assumptions and provided processes are more related to instructional design and system analysis than to instructional 'systems' design. Yet, educational technologists and curriculum designers are trying to rationalize their program designing approaches with general systems theories, according to Saettler. Yoo (1994) raised a question about whether the current systems approach regarding ISD can be viewed as a real systems approach in its essence.

System Science

Systems inquiry is valued as a study that introduced new thinking, overhauling the classic science paradigms of analytical thinking, reductionism, and determinism. Systems paradigms embody synthetic thinking, emergence, communication and control, expansionism, and teleology. First, synthetic thinking conceptualizes the object (system) of understanding as a part of a bigger whole comprised with one or more parts, not as a whole that should be divided to be understood. Second, another new concept brought by systems inquiry is expansionism as an alternative for reductionism, and this suggests that ultimate understanding is not something palpable but an ideal stage that learners can get continuously closer to. Continuous progress toward ultimate understanding is decided by the scope of understanding on a bigger and more comprehensive whole. Third, the idea of non-deterministic causality (Singer, 1959) developed subjective teleology – a conceptual system in which teleological concepts, such as free will, free choice, free function and free intention can be functionally defined and integrated (Cavallo, 1979).

General Systems Theory

Studying of paradigms and core concepts of GST makes it clear that numerous traditional instructional system models, including models of Gagne and Briggs and Dick & Carey, are not or merely related to GST but only part of theories, such as wholeness, negative feedback and boundary concepts are related to GST to some extent.

Biologist Ludwig Von Bertalanffy realized the limitation of reductionistic scientism and introduced GST as an inter-discipline focused on wholeness and dynamic interactions. He is one of the scientists who paid early attention to the difference between closed systems and open systems. Differentiation of open/closed systems has served as a foundation for systemic thinking and has been helpful for the paradigm shift away from the absolutism of Newtonian science. Since this development, GST has served as a foundation for various system theories and methodologies and it has evolved and expanded into various philosophies, theories and methodologies in numerous academic areas. Soft systems theory with strong characteristics of methodology developed basic philosophy and theories of GST into a concrete solution for problems of HASs. GST gave birth to the following concepts that define the essential characteristics of systems.

Wholeness: Systems developed by organic creatures and human beings are unified wholes with integrated and sustaining rules and regulations. Properties of a system are not a simple sum of subsystems or sub-elements but those of the whole system.

Openness and Boundary: Organisms including the universe, mankind and living creatures, or systems made by human beings are not things that exist in a closed universe. They can exist without falling apart into pieces, since they have the ability to exchange information, energy, and substances with their environment through permeable boundaries.

Dynamics: System function has a generic characteristic of emergence, since each part of a system interacts with at least one of others. Changes within an organization depend on interactions and structural relations of sub-groups, not on individuals. It is also a characteristic of GST that conceptualizes systems dynamics in relation to inter-connectivity.

Feedback: The prerequisite for system feedback is that there are two different types of feedback: negative and positive. Negative feedback corrects systems to return within the radius accepted by a controlling mechanism when the system deviates from self-determined or programmed objectives or status. Negative feedback encourages more stable, adaptive and goal-oriented systems. Positive feedback guides the system to the changing direction of output (the current status), thereby maintaining growth or reduction.

Interconnectivity: The perspective that everything is inter-connected suggests every system is not isolated but inter-dependent and inter-connected and the causalities are often not linear. More extreme GST argues that the system evolves as a result of interaction with its environment and co-evolves with the environment due to its generic characteristic of interconnectivity. It means that the environment changes due to interaction with its sub-elements. Banathy (1991), Gareth Morgan (1986) and Birch (1990) are some of those who advocated co-evolution of systems.

Equifinality: Equifinality is a system's ability that ensures systems to reach the same end, even with different starting points and different methods (Bertalanffy, 1956). Equifinality implies that systems are moving toward a common goal and it is adoptive since it has self-regulation and autopoiesis; moreover, it has significant meaning in the management of human beings and organizations. Equifinality also suggests that there cannot be one single correct way but there can be various right ways, depending on the changing conditions of the environment. Therefore, prescribing a single strategy or method to achieve specific goals and excessive adherence to that method will not be efficient.

Soft Systems Theory

Unlike hard systems theory with systems engineering and operations research for resolution of technical issues, soft systems theory views human systems and social systems as a soft system, and it has gained more popularity since the 1970s. In particular, the distinction between hard systems and soft systems seems to be related to the work of Checkland and Churchman. These two researchers examine theories and approaches within the framework of soft systems concepts for dealing with human activity systems (HASs) in which any output cannot be predicted, and factors outside the designer's control can emerge in the inner system.

Soft Systems Methodology (SSM): Checkland argues that natural science methodologies cannot be applied to ill-structured issues and further suggested a systems methodology called CATWOE to study soft systems. As it is well proclaimed in this model, basic conditions of soft systems theory are sustained and iterative methodologies and directions of changes and execution are set by stakeholders' views and values through dialogues and discussions.

Systems Design: Banathy is one of the strong advocates, who view soft systems theory and its methodology as the most ideal educational planning and instructional system design. Emerging design inquiry seems to be dynamic and wholistic; iterative and integrative; spiral and interactive; participative, dialogue-oriented and consensual (Banathy, 1987, P95). His system methodology is a spiral design with a use-designer approach (Banathy, 1987; Banathy, 1991; Lee, 1995).

The concept of 'user = designer' is based on the belief that systems can be most successful, executable and productive and the commitment for execution is the most binding force if it is managed by future users of the system. Banathy (1998) suggested that HASs, such as family, learning systems, instructional systems and education systems have five different types of systems based on (1) closeness and openness, (2) simplicity and complexity, (3) mechanical and systemic characteristics, and (4) unitary and pluralistic objectives. Combination of these four dimensions can lead to five different types of systems: (1) rigidly controlled systems, (2) deterministic systems, (3) purposive systems, (4) heuristic systems and (5) purpose seeking systems (Banathy, 1991). First, rigidly controlled systems are closed with restricted and well-controlled interaction with its environment. Second, deterministic systems are unitary since they are open to their environment but still have stronger characteristics of closeness and clearly defined objectives. Third, purposive systems are still unitary with defined objectives, but they have freedom of choice for functional objectives and methods. Fourth, heuristic systems are more or less pluralistic since they decide their own goals under the general guideline. Lastly, purpose-seeking systems are ideal-seeking, directed according to their visions of the future.

Cybernetic Theory

Cybernetics is a stream of system theory and has evolved into first-order cybernetics and second-order cybernetics. Cybernetics has the closest connection with educational technology among various system theories (Winn, 1975). It is a mechanism of early cybernetics system control with a feedback concept and second-order cybernetics; in particular, it provides strong supporting concepts on constructive position (Bopry, 1999). It is shown in Table 1 that the two streams of cybernetics have different but complimentary perspectives.

First-order Cybernetics: First-order cybernetics is a perspective that harnesses information on output with feedback as a controlling mechanism. This perspective quantifies information that moves from one place to another and ignores the contents, meaning, and intention of the information (Gleick, 1987). First-order cybernetics deals with systems issues through technical rationality based on traditional objectivism and absolutism. First-order cybernetists stand in a position to observe phenomenon and what they describe about the phenomenon is their experiences with the phenomenon. As a result, systems are objects to be observed. This perspective is interested in internal communication and control, and it focuses on a causal feedback mechanism with cyclical process of self-organization and self-regulation. This principle has laid the foundation for computer/cognitive science and it is viewed as the neural network approach in computer science.

Second-order Cybernetics: Foerster (1984) coined the word second-order cybernetics. First-order cybernetics focuses on feedback while second-order cybernetics on reflexivity; therefore, the latter tries to understand and solve phenomena through their relations with other systems. Second-order cybernetists include themselves as a part of phenomena and systems to be observed (Foerster, 1972). Therefore, this perspective leads us to consider that context, contents, meaning and intention of information are the center of the observance, thus reiterating the importance of language, culture and communication as analysis methods in order to observe and describe the phenomenon. Second-order cybernetics tries to inquire about the meaning of cognition and communication in social implementation studies, such as natural science, social science, humanity, information science, construction, education, organization, art, management and politics through the concept of self-reference.

Table 1. Complimentary Perspectives of First-order and Second-order Cybernetics (Bai, 1999)

Focus	First-order cybernetics	Second-order cybernetics
Feedback types	Negative feedback	Positive feedback & negative feedback, feedforward
Pursuing status	Stability, homogeneity	Morphogenesis, development, self-adaptation, autopoiesis
Objects of interests	Mechanic system	Biological system, organic system, social systems
Instruments	Feedback control	Self-references, cooperation, learning, communication
Goal-creator	External system	Internal system
Views on reality	Independent from observers	Interaction between observers and the observed

Autopoiesis Theory: Autopoiesis theory, coined by Maturana and Varela, is a type of second-order cybernetics. It is a complex and delicate theory, which explains language, human behaviors, cognition, self-consciousness and living systems as the entity experiencing continuous autopoiesis process (Luhmann, 1995). Autopoiesis systems are autonomic since they do not depend on an external production process and have a characteristic of self-reference due to self-defined structure (Mingers, 1997). Autopoiesis theory explains the importance of relations, meaning and communication of systems through the concept of structural coupling.

Structural Coupling: Structural coupling occurs when two systems or one system and its environment co-exist with structural interaction and experience iterative interaction within the environment while maintaining their identities (Mingers, 1997). All social systems have structural coupling among their organisms with neural systems that fine-tune behaviors of other systems and human social systems, including family. Within these systems, regular patterns of behavior are manifested through structural coupling of members (Mingers, 1997), and the formations of harmonious relations and consensual domain are possible through communication through language or linguistic behaviors.

Meaning and Communication: When social systems are viewed as a structural pattern of behaviors (Luhmann, 1995), a social system has to make choices to survive and grow within its complex structure, and this process is affected by various factors. However, it makes decisions as a principle body. This decision-making enables a system to construct an independent meaning itself. This social system, also called as system of sense, communicates with other systems by assimilating their meanings (that is, sharing the method for reducing the complexity of each sub-element or system). Systems sometimes communicate in order to reinforce their accumulated sense or to replace the existing meanings or to adapt themselves to the environment. This method leads systems to be more complicated, thereby making them more differentiated from their environments (Bausch, 1997).

Self-reflection: Systems become more flexible as their internal complexities get intense and they better understand the contingency of choices. As a result, systems start learning not only about themselves but also their environments and use self-reflection and self-examination capabilities to devise sub-systems that are controlled by preceding systems to deal with environment.

Implications of Systems Science

Although systems science has grown and developed with an evolutionary manner through conversion and diversion since the 1960s, educational technology has lacked reflection of these changes and growth. Reviewing concepts and terms of systems science that have been applied to educational technology raises a question about whether system theory, particularly general system theory, has actually served as the pillar of educational technology and whether it is fully understood or not. If systems science is the foundation of educational technology, the educational technology academic should be more adoptive to the development of system paradigms and methodologies and should use that theoretical development as the basis for practices of educational technology. Fortunately, faced with a variety of changes, educational technology, especially the ISD area, is showing signs of changes and self-reflection (Wilson, 1997; Wilson, 1999; Ritchie and Earnest, 1999). It airs a voice of reconsideration to present new directions at least in three areas.

(1) Excessive inclination to determinism: traditional instructional systems design models widely accepted and utilized are linear, based on behaviorism and reflecting goals-means approaches. These models are overly simplified, thus lack flexibility (Saettler, 1990; Richey, 1995). Instructional systems design theories and their models based on rational and 'mechanical rationales' (Schon, 1987) imply problems of not appropriately reflecting the design process of professional instructional systems designers. Experts are highly flexible and very adaptive in application of their knowledge to real problems (Nelson, Magliaro & Sherman, 1988; nelson & Orey, 1991; Thiagarajan, 1976). They do not simply apply formulated theories but develop their own models by discarding unnecessary factors with their own discretion and combining models and ideas (Tessmer & Wedman, 1992; Wedman & Tessmer, 1990). Then, instructional systems design theories that are utilized to resolve ill-defined problems are cornered with their prescription adherence to design process and final outputs

(2) Gap with context: traditional instructional systems design theories and models are based on the perspectives that learning becomes most efficient when a learner is trained away from daily business and tasks. In addition, instructional systems design models sometimes do not reflect how training is designed and developed in 'real world' (Dick, 1995). Instructional systems development should be more responsive to market demands.

(3) Excessive process orientation: learning principles and theories have always been integrated into traditional micro designing models, such as Gagne's learning events and Merrill's CDT and have been recommended to be grafted to instructional systems design methods. However, many experts have expressed their concerns over the typical tendency of instructional designers, who stress the design 'process', emphasized in models but they overlook the implementation of learning principles (Winn, 1989).

Systems theory experienced a weakening of recognition in the 1980s, but fortunately made a strong rebound in the 1990s. There are some movements to adopt systems theories and systemic thinking for educational system designing and educational reform as a macro solution to educational problems (Banathy, 1991; Reigeluth, 1988, 1992; Lee, 1995; Lee, 1995) and adopt systems theory as a methodology to support constructivistic learning environment systems design and hypermedia and cyber educational systems design.

Romiszowski (1996) suggested the following important roles of systemic approach in the above areas. Systemic perspectives of cybernetics make it possible to understand the complexity of real problems related to all the endeavors of restructuring and innovation and to present clear visions. Meanwhile, from the perspective of constructivism, instructional systems design has shifted its focus to knowledge-base creation that can be commonly used under the learner's control from teacher's control due to the multiplicity of learners' intentions and capability. Its focus shift to systemic analysis of knowledge structure also should be regarded. In particular, hypertext-based knowledge creation cannot choose but to depend on highly sophisticated systemic thinking.

Systemic Characteristics of Multimedia and Cyberspace

There are increasing demands for educational technology to tackle ill-defined problems and highly open systems, such as design, operation and evaluation of hypermedia and cyber educational systems. As a result, analyzing system types and applying appropriate interventions and methodologies expected to be applied in our field.

Multimedia applications provide users with endless path and variations and massive information. Compared with the web, however, they are relatively closed systems. In other words, their scope for storage capacity is limited; thus, multimedia applications contain what designers provide. As a result, learners have freedom to move around within the multimedia environment, but their choices are something that is pre-decided by the designers. Unlike multimedia, applications in cyberspace are not stand-alone but open systems that can be indefinitely linked according to multiple intentions and situations of users. In general, designers cannot make users take specific paths to materials in cyberspace that they designed and provided and users can have direct access to any page in cyberspace. In addition, designers cannot predict how future users will make use of these materials and if the materials are open worldwide, and designers cannot know which language users will utilize them.

Information and structures are easily changed in cyberspace. In the case of the web, browser types, versions and configurations can generate web pages with very different appearances and contents of the web are potentially indefinite (Jones & Farquhar, 1997). Jones and Farquhar (1997) understand that the openness of the web significantly affects design principles, thus making design extremely difficult. Unlike the design of traditional closed systems – for example, traditional instructional design or stand-along applications design - the web inevitably relinquishes a significant part of controlling authority to users. They classified the loss of control that used to be in the hands of instructional designers in terms of technical control and curriculum control.

According to the system types suggested by Banathy, cyberspace has the nature of most heuristic and purpose seeking systems. It is a complex and pluralistic system with the characteristics of wholeness, openness, dynamics, interconnectivity, equifinality, positive feedback, feedforward, morphogenesis, development, self-adaptation, autopoiesis, cooperation, learning and communication. Elements and members within this system build their own meanings by exchanging information through language, thus operate as an autonomic entity in creating knowledge.

Highly complex and open structures of multimedia, particularly cyberspace with characteristics of network, overhaul traditional learning and instructional theories of absolutism. This is because the characteristics of relativity, transformation, connectivity, interaction, uniqueness and non-formality, and digital are overwhelmingly strong to be understood and supported by traditional paradigms and theories. Therefore, it requires alternative methodologies and alternative paradigms and theories that can properly interpret these phenomena. As Romiszowski (1996) suggested, the creation of a hypertext knowledge-base depends on a high level of systemic thinking to analyze structures of specific knowledge domains, to design optimal methods representing this structure within the database, and to enable various future utilization to get maximum benefits from the outputs that are currently being designed. Distance education experts, such as Bates (1996) and Moore and Kearsley (1996), have pursued theories and implementation based on systemic approaches maybe because they understand the enormous influence of systemic characteristics of cyberspace. As the space for distance education becomes more like complex social systems, understanding of systemic perspectives and theories will become a necessary part of educational technology.

Systemic Characteristics of Constructivism

The rise of constructivism in educational technology laid a foundation for a better understanding of basic concepts and a philosophy of systems science. Constructivism is a learning theory that does not provide necessary methodologies to challenge mechanical design approaches and implementation trends or resolve problems that have dominated this field. Constructivistic learning theories themselves cannot provide practical solutions to various problems that require decision making on design. For example, what kinds of decisions can be made based on what standards for a learning community in which extremely conflicting values among learners exist? If learning materials are extremely transformative, how can we provide them to learners so that they can utilize these materials? Systemic approaches and methodologies will enable constructivistic learning theories to emerge as practical solutions in educational systems.

Constructivism enhances interest in the learning environment, learning community design, learner-centered instructional theories and ill-defined learning domains, thus increasing the necessity for theories to design these systems. Bopry (1999) and Knuth and Cunningham (1993) discussed the characteristics of constructivistic design based on systemic approaches.

Bopry (1999) discussed the meaning of autonomous systems theory, one stream of second-order cybernetics theories in educational technology, particularly in implementation of constructivistic educational technology. He took the main concepts of second-order cybernetics - (1) structural determination, (2) structural coupling, (3) effective action and (4) organizational closure – linked them with constructivistic concepts and suggested them as supporting concepts for constructivistic educational design.

Knuth and Cunningham (1993) designed the following seven principles based on the hypothesis that learners are observing systems with structural determination, informational closure, and structural coupling: (1) All knowledge is constructed, and learners experience relative constructedness; (2) Multiple worlds are possible; thus multiple perspectives are possible; (3) Knowledge is an effective action and a process; (4) Learning is embedded in the structural coupling; (5) Knowledge is not dependent on signs, which are languages; (6) Worldviews are searchable and are changed through tools and means; and (7) Our knowing about how to know is the most ultimate human achievement.

In constructivism, instructional design or educational design is considered as a process of designing complex social systems into a learning environment or learning community, structured by various core elements and supporting elements, rather than simple design of instructional programs design. When understanding various emerging natures of a social system, expressed during the process of maintenance and growth as an integrated complex social system with various components, people better appreciate that systems theory can provide basic concepts and methodologies for design, such as dialogue, languages and culture that are necessary for the optimization of learning.

New Direction for Educational Technology

This paper reviewed the main trends of systems science and constructivism and multimedia environment that are gaining more importance in educational technology, in relation to systems science. The results suggest that systems science still provides essential perspectives and methodologies to educational technology. The most meaningful insight enabled by systems science is that educational technology has various types of educational situations and systems, and each system is unique. Therefore, various methodologies and educational tools should be developed that are appropriate for various types of systems, and a macro knowledge base should be created and shared within the educational technology society. Based on these lessons from systems science, new alternative directions for educational technology can be suggested. The essence of the new direction is that educational technology has so far pursued prescriptions to resolve educational issues and problems; however, it should focus more on proscription (that is design) in the future.

1. Situations–specific problem-solving methods and design should be pursued. Systems' uniqueness suggests that educational systems and instructional systems design should be created to be more specific to different situations within each community. Each community is unique, and thus each needs a unique design; therefore, one design developed for a specific community cannot be applied to another community without reflection and alterations. Fortunately, there have been substantial efforts to better understand the influence of 'situations' and develop theories and models for instructional systems design in accordance with this uniqueness. In particular, constructivistic psychology features the fact that learning process and knowledge construction is decided by generic characteristics of the environment of the learners. Learning environments include every physical, situational and human factor that may affect learning processes and performance following this learning (Vazquez-Abad & Winer, 1992). The systems approach pursuing situation-specific designs considers dynamics of more comprehensive situations and permits more independence from design procedures and more creativity (Banathy, 1987; Romiszowski, 1981; Rowland, 1993). As a result, it enables a more flexible design. Willis (1995) suggested the R2D2 model (Recursive, reflective design and development model) as an instructional systems design process, differentiated from traditional ISDs, and it can be acknowledged as a method that can produce situation-specific designs by a recursive and non-linear design process, breaking away from existing linear and step-oriented models.

2. Design approaches and methodologies and tools suitable for the target systems should be selected. Based on the perspectives that each system is unique, very different specific systems techniques and methodologies should be developed to deal with the problems that emerge in different types of systems. Flood & Jackson (1991), for example, recommended operation research, systems analysis or systems engineering for simple-unitary situations and take interactive plans and soft systems methodology for complex-pluralistic situations. They also suggested taking design methodologies, such as Banathy's model, for purpose-seeking systems and heuristic systems based on Banathy's classification. But they also argued that this design methodology is not suitable for coercive systems where their sub systems do not share common interests and cannot have genuine agreements, since they have conflicting values, means and goals. I agree with this argument, since Banathy's design methodology is based on a very idealistic systems approach which essentially ignores conceptual and methodological considerations on conflict and power dynamics. The methodology of second-order cybernetics can provide valuable approaches to learning systems based on multimedia and cyber space and development and operation of educational programs that are learners-driven open systems.

3. Expansion of participatory design and organizational learning abilities for design should be pursued. When all stakeholders are considered as learners, breaking away from the existing simple perspective of a learner, defining those learners is critical for learning systems design. In order to design human activity systems, such as learning or instructional systems through participatory design (user = designer), even development of organizational capabilities is needed. Obtaining individual or group ability for designing participation is a prerequisite stage for design performance and it includes developing design thinking and obtaining the abilities of using approaches, methods and tools appropriate for systems design (Banathy, 1991; Lee, 1995).

4. Pluralistic design approaches should be pursued. Systems approaches provide pluralistic perspective of "and/ both", rather than unitary perspectives of "either/or". Since there can be a variety of solutions to changing

conditions of the environment, researchers do not need to prescribe a single strategy or method and excessively adhere to the execution of this prescription. Banathy argues that if systems design occurs within an existing system context, we cannot put the efforts on solely redesigning it while giving up on the existing system; rather we also need to pay attention to the here and now so that the current system can enhance its efficiency and effectiveness.

Concluding Remarks and Suggestions

Educational technology is receiving demands for decisions based on learning perspectives, human learning and social systems design rather than designs based on instructional perspectives. Now we can find the real value of educational technology not in instructional design anymore but in creating a supportive environment for the learners to establish their own knowledge and experience. Therefore, it should shed more light on ill-defined problems, which are fundamentally problems of open systems. Then, educational design, as suggested by Bopry (1999), will be a more appropriate term than instructional design. In-depth understanding of systems theories can provide powerful methodologies for educational technology to resolve learning and education problems which are ill-defined and complex because systems perspective and methodology provide foundations needed for defining the characteristics of systems to be dealt with by educational technology. More specifically, they identify the natures of sub-elements and their functions and provide supports for future designs.

However, it should be made clear that we should break away from the traditional practice of adhering to 'systematic' and 'systemic' comparison. The main streams of systems science are not much involved in comparison between systematic and systemic characteristics of a system, but rather classify the system types according to the combination of different variables based on the systemic concept, understand them and suggest suitable methodologies to each unique system type. As previously discussed in New Direction for Educational Technology, it will be more appropriate to focus on identifying system types and solving problems through methodologies suitable to the types.

Current educational technology is undergoing a lot of changes and new trials. New concepts and theories have not garnered full support yet, but various new trials are emerging all around the world. Since traditional educational technology with analysis, absolutism, and reductionism orientations was born and developed in the west, especially in the United States, the other educational technology circles tended to follow the thinking and theories of western researchers without sincere and deep reflections. However, it is high time for the other educational technology circles to break away from this vicious cycle and begin as initiators and real partners in the educational technology academia for the following two reasons. First, the advent of more complex and a dynamic educational environment that cannot be properly explained or resolved by traditional paradigms - for example, hypermedia, cyber and constructivistic learning environments. The unknown world is waiting to be tapped, but nobody has provided the right answers, even Gagne and Merrill. Researchers in other circles are expecting someone in the west to suggest right answers for them and try to understand, quote and learn their models as if they are perfect, which is not a desirable approach. Synthesizing the changes of postmodernism, constructivism and systems science, it becomes clear that western academia itself acknowledges that its research was traditionally too reductive and analytical and now it is trying to embrace new paradigms.

Second, the systems paradigm is in some sense more likely oriental thinking and methodology. The traditions of oriental academia are based on cosmological and wholistic thinking, which already have become the main issues of systems theory. The same is true of the oriental outlook on the universe, oriental philosophy, and oriental medical science. The oriental educational technologies already have laid the generic foundation for systems study. If they try to reflect these generic qualities of thinking and values within themselves, tap these opportunities and combine them to their academic research, they will be able to become the co-partners of western researchers in the educational technology circle in the next century.

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Using Interactive Videoconferencing Technology for Fostering Cross-Cultural Understanding: The Case of ISIS (International Studies for Indiana Schools)

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Abstract

This paper examines the use of interactive videoconferencing technology for providing cross-cultural exposures to culturally and racially homogeneous K-12 leaning environments. Through the case of International Studies for Indiana Schools (ISIS), the authors provide an instance of such technology integration. The present state and activities of ISIS are discussed as well as the research plan on ISIS.

Introduction

International Studies for Indiana Schools, also known as ISIS, is a video distance-learning (VDL) program that uses interactive video technology to connect K-12 schools and community groups in Indiana with Indiana University (IU) international students, scholars, and specialists. In 1995, ISIS was created jointly by the Office of International Programs and the Center for Research on Learning and Teaching. Using presenters from Indiana University's many world area studies centers, this unique outreach program is realized by means of Vision Athena, an interactive video project sponsored by Ameritech's non-profit Corporation for Educational Communications.

The current state of ISIS

The main goal of the ISIS program is to provide Indiana students with access to other cultures through live interaction with the speakers from those cultures. With its large number of international students, IU serves as a wonderful pool of speakers. When interested teachers contact the director of ISIS, she identifies possible presenters and together they design and develop the program for a particular classroom. The program is tailored according to the nature of the specific topic and the particular class context. For example, when a high school French teacher requested a program on Francophone Africa, the coordinator of ISIS found an ethnomusicology graduate who studied Mali music and set up an interactive program on the influence of French colonization on Mali music for the French class. ISIS topics include a range of information and issues related to foreign cultures and countries. Examples of past programs, to name a few, include *Tea Ceremony of Japan* (for 5th grade), *The Culture of Afghanistan* (for 10th grade social studies) and *Daily life in Korea* (for 7th graders). ISIS uses two-way interactive video technology (IAV) through fiber optic lines or Internet protocol (IP) connection.

Need for cross-cultural understanding

Since the tragedy of September 11th, many Americans, along with the rest of the world, have come to realize the importance of fostering mutual respect for peoples of other nations and their cultures. With recent developments in world affairs, many educators feel an urgent need to increase the inclusion of international content, issues and perspectives into the existing curriculum. An effective international education curriculum consists of more than simple facts and figures about nations and their relations with one another; it also encourages understanding of cultural differences and similarities, tolerance, and a globally interdependent view of the world (Pinhey, 2001). Such curriculum can help students grow beyond their original cultural parameters, and thus achieve a sense of identity and selfhood that is at once individualized and universalized (Kim, 2001).

Over the past 30 years, numerous non-profit organizations and grassroots groups across the United States have organized to further the integration of international studies into their existing curricula (Pinhey, 2001). In California, for example, the Stanford Program on International and Cross-Cultural Education (SPICE) has supported efforts to internationalize elementary and secondary school curricula by linking the research and teaching at Stanford University with children in K-12 schools (http://spice.stanford.edu/about/index.html). Tye (2002) points out that most educators who have become involved in such efforts share the following general goals: (a) broadening students' horizons, including helping them to see world issues from a variety of perspectives; (b) building critical thinking skills;(c) better preparing young people for productive lives in a nation that belongs to an increasingly interdependent world community.

Once general awareness of the need for such programs has been established, these goals should be translated to be realized in more localized contexts. It is, therefore, very important that the educators of Indiana should make serious, immediate efforts to include international studies for K-12 schools in rural Indiana. Because of their isolation and relative homogeneity of their cultural environments, without some effective intervention the students in rural Indiana schools are at a relative disadvantage in preparing themselves for the global age.

For the state of Indiana, the pressure to provide accurate international programs for global education is not only because of the state's population in relation to external population. According to documents provided by Indiana University International Resource Center (IUIRC), Indiana has experienced a recent increase in numbers of immigrants, and this has occurred especially in the traditionally homogeneous smaller communities. New manufacturers and industries have contributed to this phenomenon. The findings of the IUIRC show that the small towns into which a large number of immigrants have moved are facing new challenges in all sectors of community life. More often than not, many of the original residents of these communities do not have sufficient understanding of cross-cultural issues to welcome the new residents. These internal conditions within Indiana, as well as the external factors of understanding the United States' place in a globalizing world, call for more international content in the Indiana school curriculum. If done well, such international curriculum will help to prepare our children for a multi-cultural and global society.

One of the effective ways of bringing the world to these rural schools is using interactive videoconferencing technology. Videoconferencing technology is relatively simple to use, yet highly effective when appropriately integrated into the curriculum. The interactive and synchronous nature of the technology makes it especially useful in teaching about different cultures. Using this technology, a video image of the speaker is received on the classroom television and the speaker can tell about their countries and the students can interact with the speaker during the presentation.

In this regard, the ISIS project has received much positive feedback from teachers and the students who have used the program in their curriculum and many new requests have been received. In February 2002, ISIS did a session with a senior high school world history class on life and culture of Afghanistan. The speaker was a female law student at IU who had dual citizenship for Afghanistan and the United States. The followings are actual comments from the response papers of three students about the program:

> *The distance learning that was on Friday was an eye opener and a mouth dropping experience…. I've seen interviews of Afghanistan women on television, talking about what it was like to live there. Just like the interviews on television, I thought talking to Amida*(the name has been changed) would be the same feeling, but it wasn't. It was very different. Actually being able to see her and the fact knowing that she could see us, made me think I wasn't just watching TV, but instead having a face-to-face conversation.*
>
> *I was shocked by how much information she gave us in an hour. She had covered racial profiling to a new government in Afghanistan. I am very glad that I had the chance to listen to this amazing point of view.*
>
> *After this distance learning I got a better understanding of the relationships between the US and Afghanistan. I also now understand how natives of the Afghanistan homeland who live in the US must feel. Thanks to this distance learning, I'm not so narrow minded about the world today.*

From August 15, 2000 to August 14, 2001, there were approximately 80 requests, in response to which 65 programs were carried out. This year the number and variety of requests has increased. For example, in addition to typical requests for a single cultural program, some teachers have asked for a series of programs or programs to supplement foreign language courses.

Interactive Videoconferencing

In the researches on telecommunication, researchers have shown that telecommunications help bringing students and teachers out of the isolation from their schools into a real world. Telecommunications not only helps curricula of subjects like social studies by providing more access to current information but also expand the communication beyond the classrooms and schools, bringing together people with different perspectives (Roberts et al, 1990). In many cases, the interactive videoconferencing (IAV) shares the same benefits as those of telecommunication. Learning about other cultures can be done most effectively with some direct experiences with that culture. However, when such option is not possible like in the cases of rural Indiana where white populations exceed 95% easily, one can turn to appropriate technology that can simulate the face-to-face interaction most closely. IAC can serve as such technology. *The Guide to Distance Learning* points out that the real-time broadcast of video-based instruction is the closest replication of the traditional classroom that distance-learning technology offers (Yoakam, 1995). The fact that IAV is low cost and closely resembles real human interaction makes the use of the technology for the content of international studies, a perfect fit. Opportunities for learners to express their own points of view explaining the issues in their own words and to formulate opposing or different arguments have always been related to deep-level learning and the development of critical thinking.

Synchronous communication by voice and, better still, vision overcomes the prolonging of exchanges, but of course requires immediate response. However, if the presenter is not spontaneous enough, the characteristic of immediacy can work against him/her. Long pauses in conversation are not acceptable and hence, 'thinking on one's feet' is necessary in synchronous communication (Mason, 1995).

In the ISIS sessions, it was clear to see how both the presenter and the students benefited from the interactivity of the medium. The session has to be a dialogue between the representatives of two cultures, not a one-way lecture. The facilitators of the sessions always encouraged the presenter to ask and solicit questions, because we truly believed having the synchronous interaction with the representative from another culture will not only make the sessions more interesting and exciting but will also foster further interest in that culture in the long run. In this regard, it is very important to solicit as much input from students during the course of presentation as possible. By not providing the presenters with any questions beforehand but giving them at the real time, the students could get more honest, first-hand answers. Because the questions are not screened beforehand, there are times when children ask or answer questions that might be considered "impolite" without any intentions of doing so. It is important for the presenter in this situation to understand that such incidences are usually due to the lack of sufficient exposure to other cultures. As a matter of fact, we take such cases as an evidence of why program like ISIS is really important to the students. Some of the useful tips for facilitating ISIS sessions are as follows:

- Invite questions from audience after each topic
- Show great enthusiasm
- Focus only on 3-4 main points
- Change activities every 5-10 minutes
- Ask audience's opinion on the topics

The characteristics pertaining to the particular audience such as the grade level is also a very important point of consideration because the effective level of interactivity varies accordingly.

The research on ISIS

In spite of a short but successful history in terms of increasing demand and anecdotal evidence of satisfaction, no formal research has been conducted on if these programs actually have an impact on the understanding and the attitudes towards other cultures of rural Indiana students. Also in the field of Instructional Technology, where the issues of technology integration have received full attention, there has not been much research done specifically on the use of interactive videoconferencing for instructional purposes. The previous researches on videoconferencing have mainly been limited to design and implementation tactics on a very general level.

A recent effort has been made to study the possible integration of technology into multicultural education (Marshall, 2001). It seems that the time is ripe for looking at the use and the impact of videoconferencing in international studies curriculum for rural K-12 students.

The purpose of this study is to obtain a better understanding of the situations and conditions affecting the cross- and multicultural awareness of students in rural Indiana and the role of the videoconferencing technology in such situations. Understanding others' perspectives is a crucial component of multicultural knowledge development as well as of cultural identity construction; that is, how one sees one's place in the world. Videoconferencing technology can serve as an effective solution to rural (or even urban) isolation from people from other national backgrounds by bringing people and artifacts of other cultures into classrooms. Marshall (2001) points out that technologies such as interactive videoconferencing can be used to promote positive self-concept and foster positive relationships between people from diverse backgrounds.

As mentioned previously, ISIS is affiliated with two organizations: International Programs and the Center of Research and Learning in Technology. There are many parties involved in these videoconferencing programs: the Center for Interactive Learning and Collaboration (CILC), Vision Athena, the participating schools and students, as well as the ISIS. With extensive experience in the use of instructional technology and its design issues, the research team will work closely with both the school and campus-based parties involved. Once the impact of these international programs is closely examined, the research team will be able to provide more information that will contribute to opening more doors to the world for our rural students. In this sense, interactive videoconferencing is the technology, which not only provides otherwise impossible contact with various cultures but also connects people in a way that closely resembles personal interaction.

Research Questions

Two interconnected questions guide this research:

1. What are the reactions of Indiana middle school students from racially homogeneous environments when introduced to the series of international studies programs through interactive videoconferencing technology?
2. How is interactive videoconferencing technology used as a medium for bringing global context to racially isolated students?

A description of the research process

In order to examine the interrelated factors that influence the multi-cultural awareness in the rural K-12 learning environment, qualitative case study is appropriate. The impact of the program which will be implemented for a whole school year cannot be accurately analyzed by simple questionnaires or surveys, from the point of both the content and technology. An ethnographic approach that takes into consideration of various aspects as well as giving a thick description can provide a detailed picture.

Site selection

Two school sites in rural Indiana have been selected by purposive sampling. They meet the following criteria: (1) both sites are social studies classes in junior high schools in rural Indiana, (2) the social studies teachers have agreed to having the international studies program incorporated as an integral part of their social studies curriculum throughout the school year of 2002-2003, and (3) classrooms are in culturally isolated rural schools with a history of a very high level of racial homogeneity with the current student population being at least 95% white Both sites have both have a racial profile of 100% Caucasian (Indiana Census, 2001). Although the state average of white dominance is 87.5%, there are 67 out of a total of 92 counties where at least 95% of residents are white.

Sampling of participants

Upon the suggestion of the participating teachers, two 7th grade social studies classes have been selected. The teachers felt that these two classes provide a good range of students with different performance levels.

Data collection

The data for this study will be comprised of observations, interviews and document analysis. They will be collected at both sites between October 2002 and May 2003. The *Table 1*.below provides the specific method of data collection.

Observation	♦ Classrooms (regular)	♦ Twice a month for 50 min. each
	♦ ISIS sessions	♦ 6-8 sessions for 45-60 min. each
	♦ The school sites (hallways, cafeterias & etc)	♦ Once a week
Interviews	♦ Students	♦ Twice (individual/focus group)
	♦ Teachers	♦ Three times
	♦ ISIS/CILC personnel	♦ Once
	♦ IU presenters (6-10)	♦ Once
Document Analysis	♦ Textbooks	♦ Occasionally
	♦ Other instructional materials	♦ Occasionally
	♦ Reflection papers	♦ 6-8 tines, once after each session
Field notes	♦ Informal conversations with teachers	♦ Frequently

Table 1. The method of data collection

As shown above, the people who are involved in the design and implementation of the ISIS program will also be interviewed aside from interviewing the students and the teachers. This group of interviewees will consist of the coordinator of ISIS, officials of CILC, and the international student presenters who participated in ISIS programs at each site. The purpose of interviewing these individuals is to compare their vision, expectations and reactions to the program to those of the recipients of the program; that is, the students and the teachers. Bringing such multiple perspectives will provide a deeper understanding of the impact of such program and the technology used. During the study, literature reviews of the purposes and goals of global studies will be continuously carried out. In addition, other types of international studies curricula from a variety of locations will be inspected. All interviews will be conducted face-to-face.

Data Analysis

Critical ethnography (Carspecken, 1996) and emancipatory collaborative research methodology (Lather, 1991) will provide guidance for the data analysis of this study. The decisions regarding how faithfully the research team will follow the more detailed suggestions of the two methodologies will be made through continuous dialogue with the participants of the study. The software for qualitative study, NVivo, will be used for coding and analysis process.

Conclusion

By introducing the International Studies for Indiana Schools (ISIS), this paper has attempted to examine a case of videoconferencing technology integration for cross-cultural education in rural K-12 environments. The design plan of the long-term research on ISIS introduced in this paper is a work in progress. Through the collaborative research design with the teachers, the ISIS coordinators and the research team, the result of this study will be able to provide helpful guidelines for further use of the technology for bringing the world into the classroom.

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Assisting Faculty With Technology Integration: A Case Study Of A Student/faculty Mentoring Program

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Abstract

Student/faculty mentoring models have shown promise as an effective technique for integrating technology into courses and classes among teacher educators. (Kortecamp & Cronginger, 1995; Mergendoller, 1994). Mentoring is reported as a valuable means in assisting teacher education faculty in integrating technology in their courses (Thompson, 1995). It has emerged as a promising staff development model to help teacher education faculty learn and use technology (Kortecamp & Croninger, 1996; Abate, 2001; Thompson & Schmidt, 1995). However, little is known about how and why mentoring programs work to assist faculty members in integrating technology.

This research investigated how and why the student/faculty mentoring program in the Department of Curriculum and Instruction at Iowa State University works as an effective staff development approach to assist teacher education faculty in integrating technology. It explored the characteristics of successful mentoring relationship in the ISU student/faculty mentoring program, the roles of mentors and mentees, and the perspectives from both faculty members and student mentors about how and why the mentoring program assists faculty in using and integrating technology. A qualitative case study approach is used to describe and analyze the ISU student/faculty mentoring program. Three graduate students and five faculty mentees who joined the mentoring program in the Fall, 2000 participated in the research study. Data such as interviews, documents, and observation were collected to describe and analyze the characteristics of successful mentoring relationships, roles of mentors and mentees, and perspectives of both faculty mentees and student mentors about mentoring. Findings from the research study indicate that using student mentors to assist faculty members to integrate technology into teaching is a promising approach for higher education. Results will provide information on designing an effective mentoring model for higher education faculty staff development.

ISU Student/faculty Mentoring Program

The establishment of the student/faculty mentoring program in the Department of Curriculum and Instruction at Iowa State University can be traced back to 1991. The purpose of the ISU student/faculty mentoring program is to assist faculty members as they learn about and use technology. It provides teacher education faculty with an opportunity to learn about technology in a non-threatening learning environment. The ultimate goal of the mentoring program is for faculty members to become confident, independent computer users who model effective uses of technology in their courses.

In 1991, the department began providing office computers to all faculty members who were interested in using technology in their classes. With grant funding, the department continues to upgrade faculty computers and to provide software for faculty to use in their courses. As access to computers increased for faculty, the need to support their efforts to learn about using the technology grew. Hence, graduate students and faculty members voluntarily paired up and worked together on specific technology projects that faculty mentees had identified. Thus, faculty members who were interested in using and learning about technology had access to a computer and support from their student mentor.

Since 1993, the department has connected the mentoring program with a graduate course entitled "Technology in Teacher Education (C I 610). As a part of the course, students who had technology expertise were matched up with faculty members desiring assistance according to their personality, interest, background, and technology experience (Thompson et al, 1996). Student mentors then help faculty members at their level of technology experience and cater to their individual needs and interest (Zachariadess & Roberts, 1995). It is the responsibility of the teacher education faculty members to define their own working agenda, choose the mentoring meeting place, and set up mentoring meeting times. During the first meeting, both the student mentor and faculty mentee set up goals for the semester and schedule their meeting times. The remaining mentoring sessions throughout the semester are focused on the faculty members' needs and interests. After each mentoring session, student mentors are required to write and reflected about session's accomplishments. The purpose of the student journals is to record the interaction and happenings of each mentoring session. Besides meeting with their faculty mentees each week, graduate students also meet as a group for seminar once a week. These seminars provide opportunities for the graduate students to share their thoughts about their mentoring experience, to get help and suggestions from the course instructor and other students, and to participate and discuss articles about contemporary technology issues in teacher education. By the end of the course, the student mentors write up a case report that describes their mentoring experience and their perspectives on the mentoring process. Since establishment of the mentoring program, an increasing number of faculty members and graduate students have joined the mentoring program. In 2002, 29 or the 30 tenure track faculty in the department had participated in the mentoring program for at least one semester. The mentoring program has gradually become a systematic approach in the department to assist teacher education faculty in using and integrating technology.

The ISU student/faculty mentoring program also receives administrative support from the Department of Curriculum and Instruction and the Center for Technology in Learning and Teaching. The chair of the Department of Curriculum & Instruction has been highly supportive of the mentoring program. Every fall, the opportunity to participate in mentoring program is announced during a departmental faculty meeting. Faculty are then encouraged to sign up for the program to receive assistance from graduate student mentors. It is also worth noting the support that the Center of Technology in Teaching and Learning (CTLT) in the College of Education provides for the mentoring program. The CTLT is a nurturing environment and is comprised of a group of faculty, graduate students, undergraduate students, and staff who are interested in using technology in education. The CTLT is a technology-rich learning environment that includes three computer labs, technology production facilities, and a model student-centered classroom with distance education capabilities. Whenever faculty members have a need for using technology in their teaching, they can reserve equipment and/or a computer lab. Faculty and students can also check out hardware, software and books from the CTLT. Naturally, CTLT provides the space and support that faculty may need to incorporate technology integration ideas into their courses. Both student mentors and their faculty mentees receive assistance from CTLT staff when encountering hardware/software problems or generating technology integration ideas for their classes.

In summary, the ISU student/faculty mentoring model is a systematic approach used to assist teacher education faculty in the Department of Curriculum & Instruction in their attempts to use and integrate technology. However, the mentoring model has not been thoroughly investigated. Research is needed to fully understand how and why this mentoring model might assist the teacher education faculty in learning about technology. Issues such as characteristics of successful mentoring relationships and roles of student mentors and faculty mentee need to be examined (Reinhart, 1997). The more we understand about the components of this mentoring model, the better we can assist teacher education faculty with technology use and integration. Therefore, it is critical to further investigate this student/faculty mentoring model.

Research Questions

This research study is to investigate how and why the Iowa State University (ISU) student/faculty mentoring model works to assist teacher education faculty to use and integrate technology in the Department of Curriculum and Instruction at ISU. The guiding questions of this research study are:

1) What are the characteristics of successful mentoring relationships of the ISU student/faculty mentoring program?
2) What are the roles of student mentors and faculty mentees in the ISU student/faculty mentoring program?
3) What are the perspectives from teacher education faculty members about how and why the ISU student/faculty mentoring program assists them to use and integrate technology?
4) What are the perspectives from student mentors about how and why the ISU student/faculty mentoring program assists teacher education faculty to use and integrate technology?

Research Participants

Three student mentors who were enrolled in the C I 610 during fall semester, 2000 and their faculty mentees were selected for this research study. Participant selection was based on the following criteria: 1) Only the student mentors and their teacher education faculty mentees worked in the Department of Curriclum & Instruction. 2) they held weekly mentoring meetings 3) they worked collaboratively on technology integration projects identified by faculty mentees. A brief profile for each student mentor and faculty mentee was provided in Table 1. All research participants were assigned names for the sake of confidentiality.

Table 1. Description of faculty mentees and student mentors

Faculty mentees	Student Mentor
John: assistant professor, teaches courses in multiculturalism	Mary: 2nd year doctoral student, research assistant in the Department of Curriculum & Instruction, worked in a publishing business before coming to graduate school.
Tom: assistant professor, teaches courses in educational foundations	
Edward: professor, teaches courses in special education.	Jane: a first semester masters student in the Department of Curriculum and Instruction, taught at elementary level for 3 years before coming to graduate school.
Diana: temporary instructor, teaches courses in educational foundations and children's literature.	Crystal: 1st year doctoral student, teaching assistant for the Department of Curriculum and Instruction, taught high school English before coming to graduate school.
Cindy: associate professor, teaches courses in literacy and reading education	

Research Design

Case study is a preferred research methodology used when "how" and "why" questions are being posed, when the investigator has little control over events, and when the focus is on a contemporary phenomenon within some real-life context (Yin, 1994). Because this research study explores 'how" and 'why" the ISU mentoring model works to support and facilitate faculty use of computer technology, the case study approach was selected to reveal the dynamic process of mentoring. Due to the nature of the mentoring process, words rather than numbers will better illustrate and capture the phenomena of the entire mentoring process (Merriam, 1988)

Research Procedures

The three student mentors and their faculty mentees met one hour per week for the entire semester. These meetings were scheduled by each mentoring pair. After each mentoring session, student mentors were required to record in a journal the progress of their mentoring session. These entries included such details like achievements and challenges that were faced by the mentoring pairs. Each week, graduate student mentors also met for two hours with classmates and the course instructor to share information about their mentoring experiences and to explore the contemporary issues about technology in teacher education. At the end of the semester, student mentors were required to write a case study report about their own mentoring experiences and perspectives on mentoring. In each case report, student mentors provided a mentor/mentee profile, a reflection of their mentoring experience, and a summary of what they gained from the mentoring experience.

At the end of the semester, the three student mentors and their faculty mentees were interviewed by the researcher. The purpose of the interview was to gather additional information about their mentoring experiences. Interview questions were e-mailed to interviewees prior to the interview. Interview questions were structured so additional data about mentoring characteristic, roles and perspectives would be gathers.

Finally, the researcher interviewed both the associate director of the Center of Technology in Teaching and Learning and the chair of the Department of Curriculum and Instruction. These interviews were conducted to gather data about the program background and history and how administration has supported this program.

It is worth to note that in order to have an insider view of the mentoring program, the researcher signed up as a student mentor in the mentoring program by enrolling in the course C I 610 in the fall, 2000 and fully participated in the mentoring program herself.

Data Collection and Analysis

The purpose of this study was to describe and to analyze how and why mentoring is an effective approach to assist teacher education faculty in improving computer skills and to use technology in their teaching. The study aimed at presenting a full perspective of the mentoring program from both faculty mentees and graduate mentors. In this descriptive case study, data such as student mentors' journals, case reports, interviews and observations were collected and analyzed to answer the following research questions.

The data were then analyzed by using the constant comparative method (Merriam, 1988). It has four main phases: unitizing, categorizing, filling in patterns, and member checking. Unitizing is the process of extracting the small pieces of meaningful information from the data. In this research study, data were collected from interview, student journals, student mentors' case reports, and class observations. Categorizing is to place the units in provisional categories. Based on the research questions, initial categories of the data were developed: characteristics of successful mentoring relationship, mentor roles, mentee roles, the perspective of student mentors about mentoring, and the perspective of faculty mentees about mentoring. Additional categories such as mentoring objectives were developed with the actual data analysis process. The third phase is to fill in the patterns. After categorizing data, categories were reviewed for possible overlaps and relations. Then the researcher carefully examined data of each category and the emerging themes were identified to reveal the pattern of the mentoring process (Merriam, 1985). With each emerging theme, pieces of evidences from the data were illustrated to support the themes. The final phase is to member checking. This phase involves taking the data and interpretations back to the participants who provided the data and to check with them to see if the results are reported accurately and realistically (Merriam, 1988).

Findings and Discussions

Research Question One

What are the characteristics of effective mentoring relationship in ISU student/faculty mentoring program?

There are many factors that contribute to the dynamics of mentoring relationship. All characteristics for a successful mentoring relationship identified in this research comply with literature findings. Facutly mentees and student mentors in the ISU mentoring program believe the following characteristics are essential to ensure their effective mentoring relationships.

- Time. Time is the precondition for the mentoring to occur (Kay, 1990). Making time for the mentoring sessions is vital for the effective mentoring relationships. Mentors and mentees need time to establish trust, credibility and rapport in the mentoring relationship. Without investing a sufficient amount of time, a good and healthy relationship can't be nurtured during the mentoring program. Participants in this research study mentioned that setting aside time to work together was very important. In the ISU student/faculty mentoring program, student mentors and faculty mentees were required to set aside one hour each week to work on their technology project. All participants made a deliberate effort to keep their commitment and scheduled regular mentoring sessions every week.
- Mutual trust and respect. Mutual trust and respect is needed for faculty mentees and student mentors to build an effective mentoring relationship with each other. Mary and her faculty mentee Dr. Johnson revealed the importance of mutual trust and respect in their mentoring. Dr. Johnson said that “I admire her [Mary] expertise in technology and wish to learn from her. She showed great interest in my course and respects my expertise in my subject matter. I guess, we trust and respect each other and that helps.” Because mentoring involves an ongoing, caring relationship, a good mentoring relationship can only be fostered with mutual respect and trust (Janas, 1996). The mutual trust and respect in the mentoring relationship allows ideas, cooperation, communication, and personal relationships to flourish (MacArthur, 1995).
- Personal fit. Personal fit between faculty mentees and their student mentors helps them to establish a meaningful professional relationship with each other when assigning partners. Mentors and mentees who have similar backgrounds, common interests, and compatible personalities tend to have successful mentoring relationships. Crystal, Dr. Clark and Ms. Davison who all are language teachers were paired up. They all shared common interest in using technology in language teaching and learning. Mary was matched with Dr. Johnson and Dr. Taylor and they were all interested in designing web pages and online courses. Jane and Dr. Erickson both were interested in exploring PowerPoint.
- Communication. Open dialogue between the mentor and mentee allowing each participant to express their feelings, talents, knowledge and expectations is essential for a successful mentoring relationship. Effective mentoring relationships occur when mentors and mentees clarify their roles and expectations for each other in mentoring. Without good communication, student mentors and faculty mentees may have misconception about mentoring.
- Mutual benefit. Both the mentor and mentee should benefit from the relationship. Mentees gain knowledge, skills, insights, and experience. Mentors sharpen skills and knowledge, learn new things, and reward from the collaboration with the mentee (Clemson, 1987). Both faculty mentees and student mentors must feel they benefited from participating in the mentoring experience. They both need to be rewarded from participating in the mentoring relationship. As Ms. Davison and Dr. Clark stated that they were "a step further in technology" and that their "comfort level is going up" respectively (Ms. Davison, interview; Dr. Clark, interview). Student mentors indicated they refined their computer skills, became familiar with the

department's context, gained professional knowledge, and established a professional relationship with faculty in the department (Jane, interview; Mary, case report; Crystal, interview).

Research Question Two

What are the roles of faculty mentees and what are the roles of student mentors?

In the ISU student/faculty mentoring program, faculty mentees were motivated learners and active participants in the mentoring. Faculty mentees presented their learning needs and their strong desire to learn by setting learning goals and objectives, identifying technology projects to work on, and completing their technology homework resulted from the mentoring sessions. The faculty mentees really took on the role of the learner in the mentoring experience. Ms. Davison said, “I am definitely a learner. Sometimes, my mentor knows every question and tutors me in every aspect. Sometimes, she doesn’t have answers, so we learn together.” Thus, the mentees play roles of students in the mentoring (Clemson, 1987)

In the mentoring program, the roles of the mentors were evolving and changing (McArthur, 1995). Student mentors in the ISU student/faculty mentoring program became tutors, coaches, facilitators, counselors, and learners. Faculty mentees and student mentors described the roles of student mentors as a tutor, a buddy expert, a consultant, an advisor, a guide, a learning partner, a companion, a friend, a resource person, a coach, a facilitator, a collaborator, a supporter, a helper, and a good listener. The roles of student mentors were summarized and discussed as follows:

- The student mentors are tutors. Student mentors are the people who can respond to the needs of mentees by providing instructions and feedback for faculty mentees. They are coaches who provide encouragement and direction for the faculty mentees. Crystal taught Dr. Clark Microsoft Excel and Web page design and helped Ms. Davison with Easy book; Mary helped Dr. Johnson learn WebCT and helped Dr. Taylor with Imovie digital editing; and Jan taught Dr. Erickson how to use PowerPoint. All of the student mentors demonstrated their computer skills and suggested possible uses of technology in the mentee’s course. They assessed how they could assist faculty mentees, what faculty had mastered, and which skills needed reinforcement.
- The student mentors are facilitators. The mentors works as a resource people for faculty mentees, supporting and assisting them to locate hardware/software and to acquire desirable computer skills. The mentors facilitate the learning process with technology and assist faculty mentees to accomplish their technology projects. Crystal facilitated Ms. Davision to locate appropriate software for her class. Mary helped Dr. Johnson to learn WebCT and offered suggestion to help Dr. Johnson visualize his technology project. Mary wrote in her student journal, “I feel like a facilitator. The mentor role is to help the faculty to visualize what they can do and understand that. I am going to look for information to facilitate the faculty’s learning process.”
- *The student mentors are consultants. The student mentors are good listeners and consultants. They provide guidance as they consulted with faculty on things they wanted to learn about and complete. In the ISU student/faculty mentoring program, student mentors listened to, probed, and provided suggestions to their faculty mentees. They were good listeners and responded to their faculty mentees in a positive and favorable way. Jane offered advice and helped Dr. Erickson to visualize his technology ideas for his class (Jane, interview). Crystal acted like a consultant and suggested how Dr. Clark could use her technology project for her class (Dr. Clark, Interview). Likewise, Mary helped Dr. Johnson visualize his course activity using WebCT (Mary, interview). Student mentors became counselors who advised faculty mentees on how technology works and how it can be managed.*
- The student mentors are learners. Besides the traditional roles of mentors, this research study clearly indicated that the student mentors learn technology together with their faculty mentees. Because technology field is constantly changing and evolving, no one knows or is expected to know everything (Brzycki, Yost & Dudt, 2001). Student mentors often learn new computer software or new skills together with their faculty mentees. Jane wrote in her student journal: “The only thing I knew about PowerPoint was to make a basic slide when I began my mentoring. Now I know how to put in animation, insert graphics, and how to put slides together.” Mary felt that she “learned as much from them and with them [Dr. Johnson & Dr. Taylor]. Jane and Crystal also learned new computer programs and technical skills.

Research Question Three

What is the perspective of faculty on mentoring regarding how and why mentoring works for them to learn and use technology?

Faculty indicated that one-on-one mentoring is an ideal situation for them to learn about technology. They reported that their comfort level of using technology in their teaching and research has increased. Dr. Clark expressed her favor for mentoring: “I think it [mentoring] is a blessing. I think the mentoring program is wonderful. I am a lot further in technology today because of the mentoring program. I probably wouldn’t do it otherwise.”

There are six specific themes emerged from this research study that reveals how and why mentoring works for faculty to learn and use technology.

- This mentoring program creates a one-to-one relationship. It produces a learning situation for faculty, where individualized instruction is designed to meet faculty’s unique interest, technology experience, and needs. Data indicated participants were appreciative of being able to work with someone one-on-one. Faculty mentees learn at different rates and bring a myriad of experiences, needs, interests, background, and beliefs with them to the learning and using technology (Bahannon, 2001),. This one-on-one model is helpful in adjusing to personal learning style and preferences and catering to each faculty member’s unique interest and needs.
- This mentoring program cultivates a comfortable and nonthreatening technology learning environment.The mentoring relationship is an interpersonal and caring relationship (Gehrke, 1998). Dr. Erickson said during the interview, “I am not in a group that is better than me. It intimidates me a little bit. When I am just in my office and someone is sitting next to me, it’s just more comfortable. No peer pressure.”
- This mentoring program helps faculty to continuously improve computer skills with multiple mentoring sessions. Faculty repeatedly commented that meeting with their mentors every week helped them continually learn about technology. Since the mentor was scheduled to meet with their mentee an hour every week, faculty felt they were “pushed” to set aside time to learn technology. Without meeting regularly, the faculty mentees admitted that they tended to “push technology down on their working list” (Ms. Davison, interview). The multiple and repeated mentoring meeting sessions helped faculty to increase comfort level and competence in using computers. This finding corresponds with the literature that faculty members need time to be set aside to learn and practice computer sills before they gain comfort level and computer competency.
- This mentoring program helps nurture a technology learning community for faculty. All faculty indicated that they have use the department technology center (Center of Technology in Teaching and Learning , a department technology center) more often during and after the mentoring program than before. They came to recognize “friendly faces” down in the technology center and felt they were better connected with departmental technology initiatives. They became more familiar with what the department technology center had to offer and gradually began to see themselves becoming a part of learning community where everyone learns together.
- This mentoring program gets extensive administrative support and encouragement from the Department of Curriculum and Instruction. All faculty members are encouraged to sign up to obtain assistance from student mentors. Without the recognition and support from administrative level, faculty may not be encouraged to put time and effort to try to integrate technology into their teaching (Cobb, Hensman, Jones & Richards, 1995) In addition, the department technology center provides hardware and software and personnel support for the mentoring program. Because inadequate or obsolete equipment and limited availability of equipment would block faculty from their usage of technology (Cuban, 1993), the CTLT acts an important in the student/faculty mentoring program to ensure the accessibility of hardware and software by faculty mentees. Along with the good accessibility of technology resources, the CTLT provides good personnel support to the student/faculty mentoring program. Student mentors and faculty mentees directed their questions to the technical experts in the center and department and received help to solve their technical problems. Jane commented, "I can't imagine what my mentoring experience would be if there's nobody in the center [CTLT] that can help me." (Jane, interview).

Research Question Four

What is the perspective of student mentors on mentoring program regarding assisting faculty learning and using technology?

Student mentors reported that mentoring was an excellent way to help faculty learn to use technology. They agreed that this mentoring program was very helpful and effective to assist technology integration into their courses.

There are four themes that emerged from student mentors' perspective about how and why this mentoring program works:

- Individualized instruction to faculty mentees is critical to help faculty learn and use technology. Like faculty, student mentors feel that one-on-one nature of mentoring relationship creates the best situation to cater to individual needs of faculty mentees.
- Providing a private and comfortable learning environment enables faculty to learn technology in a non-threatening way. According the student mentors, this is an advantage of mentoring over traditional workshop models. This mentoring model provided a private and secure environment for faculty mentees to learn technology without worrying about asking "stupid" questions in front of peers.
- This mentoring program is appealing and effective because it focused on assist faculty mentees to learn and use technology in their "specific' courses. It gave them the opportunity to explore technology activities in their own courses. Instead of learning technical skills superficially, faculty mentees are actually designing/developing technology projects for their own courses.
- This mentoring program allows student mentors and faculty mentees to receive support from C I 610 and the department technology center. Faculty mentees and student mentors received help from the technology center's staff. C I 610 course provided student mentors with a secure place to share, discuss, and get advice about their individual mentoring experience. This kind of support is essential to the success of this mentoring program.

Conclusion

In conclusion, this research investigated how and why the student/faculty mentoring program in the Department of Curriculum and Instruction at Iowa State University assists teacher education faculty with technology integration. The research explored characteristics of effective mentoring relationships, the roles of student mentors and faculty mentees in the student/faculty mentoring program, and the perspectives from the faculty mentees and student mentors about mentoring.

Research results indicated that characteristics of effective mentoring relationships of ISU student/faculty mentoring program are: time, mutual trust and respect, personal fit, communication, and mutual benefit. In this student/faculty mentoring program, faculty mentees were active learners and motivated participants. Student mentors were tutors, facilitators, counselors, and learners. This student/faculty mentoring program was effective because of: the one-on-one individualized instruction; the non-threatening technology learning environment; the continuous improvement of computer skills with multiple mentoring meeting sessions; the fact that faculty allotted one hour a week to work on technology, a nurturing technology learning community; and administrative support and encouragement.

This research study deepens the understanding of how and why using student mentors is a promising strategy to assist teacher education faculty with technology use and integration. The results providevaluable information and experience about how to design an effective student/faculty mentoring program. Teacher education programs interested in using such an approach should work toward making sure these characteristics are present and should clarify the roles of student mentors and faculty mentees to design an effective student/faculty mentoring model.

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The Effects of Peer Feedback in Technology Classes

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Abstract

Feedback is considered an important instructional variable in improving students' achievement. Although several studies have indicated that teacher feedback is a powerful variable in terms of enhancing students' learning, the issue of peer feedback has not been well explored. The present study examined the effects of various different of peer feedback on learner achievement and motivation. Within three sections in a Technology in Secondary Teaching course (n = 35), the three feedback treatments were assigned to intact groups. A two- factor repeated measures ANOVA was used to compare achievement and attitude across time and across the treatments. Although each group showed improvement upon receiving feedback, a significant difference for treatments was not found. Due to the positive impact of peer feedback for both raters and ratees, suggestions for refining this area of research are discussed.

Background

Feedback has been found to be an important instructional variable in improving student achievement. Bangert-Drowns, Kulik and Morgan (as cited in Mory, 1996) indicated that feedback is incorporated in both behavioral and cognitive learning paradigms and is an essential element of theories of learning and instruction. Clariana, Ross, and Morrision (1991) noted that while the benefit of feedback in general is taken for granted, uncertainty still exists as to how to select and optimize the uses of different forms of feedback depending on characteristics of students and the learning situation. This notion was supported by Clark and Dwyer (1998) who stated that knowledge of response feedback enhanced performances when the task involved discrimination or rote learning.

Although several studies (Silverman, 1992; Elwell & Tiberio, 1994) have indicated that teacher feedback is a powerful variable in terms of enhancing students' learning (as cited in Burnett, 2001), the issue of peer feedback has not been well explored.

Peer feedback refers to when students learn from each other by exchanging and comparing their particular strategies or ideas on instructional activities. Peer feedback may be a way to increase student learning and motivation. The present study investigates effects of varying levels of peer feedback among students.

Research Questions

The following research questions were investigated:

1. Do different types of peer feedback have different effects on learner achievement?
2. What type of peer feedback can best stimulate students' motivation to learn?

Method

Subjects

The subjects were 35 undergraduate students in three different sections of a Technology in Secondary Teaching course. All subjects are pre-service teachers and this technical class is required of them. All of them are undergraduate students from sophomore to senior. There were 13 males and 22 female with a mean age of 22.4. Each section was assigned to one of the three levels of feedback treatment (CF-CF Feedback group, EF-CF Feedback group, or EF-EF Feedback group). The Checklist Feedback (CF) is a simple level of feedback, which provides check marks on the rubric to tell subjects which level they reached and their final scores. The Elaborative Feedback (EF) is feedback of a higher level. It not only contains CF information, but also provides reasons why students received certain scores for each category and relevant revision suggestions.

Materials

As required for their final projects, subjects created a personal website, which was an electronic portfolio to show their work and prepare them for their job hunt. This web site included their (1) Basic Information: education, work history and accomplishments, etc. (2) Teaching philosophy and (3) Examples of work they have done in preparation for a teaching position.

A rubric was given to the subjects before they started to do the project to indicate how the assignment would be evaluated. The grading criteria were divided into five major categories: content, presentation, navigation, links, and mechanics. The total possible points are 34.

Subjects completed a 6-item inventory designed for this study to indicate students' attitudes toward feedback before the treatment. The first three items were designed to measure students' beliefs; the other three address comfort. These questions include:

(1) I believe receiving feedback from my instructor will help me improve my work.
(2) I believe receiving feedback from my peers will help me improve my work.
(3) I believe providing feedback to other people would help me learn more.
(4) I feel comfortable receiving feedback from my instructor.
(5) I feel comfortable receiving feedback from my peers.
(6) I feel comfortable providing feedback to my peers.

Response options to these items range from strongly agree to strongly disagree on a five-point Likert scale (5 = strongly agree to 1 = strongly disagree).

After the feedback treatment, subjects completed the same 6-item inventory and four additional open-ended questions as listed below:

(1) What did you like most about this approach on providing feedback to peers?
(2) What did you like most about this approach on receiving feedback from peers?
(3) What do you like least about this approach on providing feedback to peers?
(4) What do you like least about this approach on receiving feedback from peers?

Treatment

Each section was assigned to one of the three levels of feedback treatment (CF-CF, EF-CF or EF-EF). The researcher randomly assigned the intact groups to the different levels of treatment. The grading criteria were given to each student in advance and students provided their feedback in a CF form or in an EF form.

(1) CF-CF Treatment (n = 17). Subjects provided CF to peers. The instructor organized their feedback and then returned the final results as CF to subjects.
(2) EF-CF Treatment (n = 11). Subjects provided EF to peers. The instructor organized their feedback and then only provided the final results as CF to subjects.
(3) EF- EF Treatment (n = 7). Subjects provided EF to peers. The instructor organized their feedback and then returned the final results as EF to subjects.

The CF-CF group provided CF to their peers; the EF-CF and EF-EF group provided EF to the peers in their class. All students taking the class were required to complete the website project regardless of whether or not they were involved in the research study.

Procedure

Students who enrolled in the Technology in Secondary Teaching course were selected to participate in the study. Subjects were contacted initially by announcing the project orally in the beginning of the class. Students were asked to sign a letter of consent if they wished to participate and asked to complete the Students Learning Motivation (SLM) Survey questionnaires. General demographic information (i.e., Last 6 digits of subjects' social security number, major, gender, age and class section number) was solicited on the questionnaires, but no other identification of respondents was collected. The researcher informed subjects that the purpose of this study was to examine the factors that affect learning. Subjects knew that they would be asked to participate in some learning activities, such as giving feedback to peers, but they did not know which treatment group they were in or the researcher's expectations.

Subjects went through the same instructional content over a three-week period that was taught by the same instructor, and then worked on the website assignment for one week.

After receiving the assignment via E-mail, the instructor graded each assignment and recorded the first score based on the rubric. Then, the instructor uploaded each student's assignment to the class website and allowed subjects to view their peers' assignments online. Students received the first scores and also were informed that only the revised scores would be recorded as the projects final scores. Students also received bonus credit for providing feedback according to the feedback quality.

After subjects saved their feedback to floppy disks and gave them to the instructor, the feedback was organized, put into the proper format, and provided to the website projects' creators. Then, the instructor asked subjects to revise their projects according to the feedback they received and send the revised projects back within one week. The instructor evaluated the revised projects and gave a final score to each student. After the students turned in the revised projects, the subjects completed the SLM Survey.

Criterion Measures

A two-factor repeated measures ANOVA was used to analyze the achievement and attitude of individuals, across the CF-CF, EF-CF and EF-EF treatments and across the impact of the feedback. After finding a significant main effect, the researcher ran post-hoc ANOVAS to determine the nature of the interaction.

The achievement scores were collected from subjects' original and revised website projects according to the rubric. The attitude scores were collected from subjects' pre and post SLM Surveys. A significance level of .05 was used to run the analyses.

Result

The reported results for this investigation are separated into two sections: the effects on learner achievement with different types of peer feedback and the relationship between peer feedback and students' learning motivation

<u>Achievement</u>

Means and standard deviations of the responses for the first and revised projects of treatment groups are reported in Table 1.

Table 1 Mean and Standard Deviation for the Treatment Groups

	Treatment Groups	*M*	*SD*	*n*
First Project	CF-CF	26.94	4.67	17
	EF-CF	16.91	7.02	7
	EF-EF	23.64	2.61	11
	Total	23.13	6.77	35
Revised Project	CF-CF	29.21	3.91	17
	EF-CF	27.09	6.70	7
	EF-EF	31.00	4.37	11
	Total	28.90	5.08	35

Note. The total possible point for the website project is 34.

A two-factor repeated measures ANOVA revealed the mean of the revised projects was significantly higher than the mean of the first projects across the three treatments, $F = 67.86$, $p < .01$. As expected, the students had shown significant improvement of their revised projects (see Figure 1).

FIGURE 1. The Achievement for Three Treatment Groups

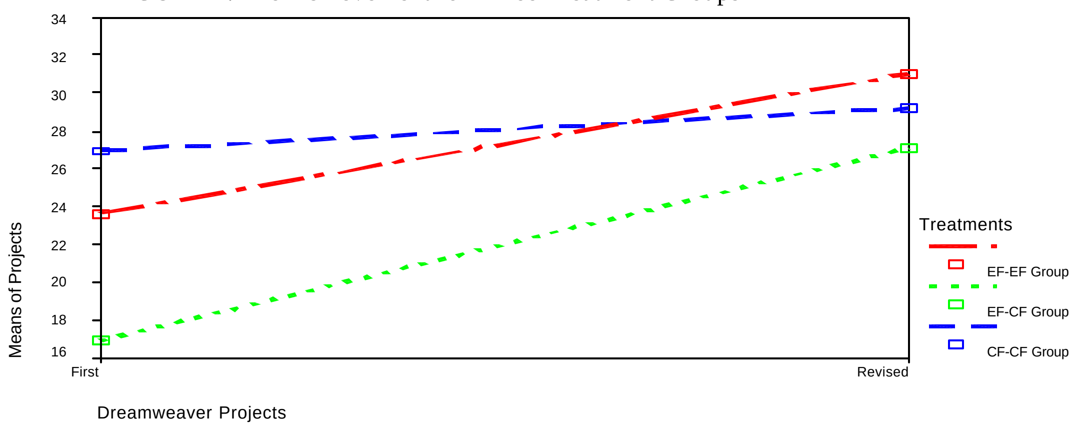

Table 2. Multivariate Tests

Effect	*F*	*p*
Project	67.86	<.01
Treatments	6.09	<.01
Project * Treatments	11.15	<.01

There was an overall significant interaction between the repeated factor and the treatments, $F = 11.15$, $p < .01$ (see Table 2). Follow-up post-hoc ANOVAS revealed that there was no significant interaction in EF-EF vs. EF-CF, $F = 1.07$, $p = .32$. However, there is a significant disordinal interaction showed in EF-EF vs. CF-CF, $F = 12.63$, $p < .01$, and a significant ordinal interaction in EF-CF vs. CF-CF, $F = 20.47$, $p < .01$ (see Figure1 and Table 3).

Table 3. Interaction between Projects and Treatments

Treatment Groups	*F*	*p*
EF-EF vs. EF-CF	1.07	.32
EF-EF vs. CF-CF	12.63	< .01
EF-CF vs. CF-CF	20.47	< .01

ANOVA was conducted for comparing scores of the first projects (see Table 4) to examine the pre-treatment difference. For the first score, EF-EF was significantly higher than EF-CF ($p = .03$), EF-EF was not significantly different with CF-CF, and EF-CF was significantly lower than CF-CF ($p < .01$) (see Table 4 and Figure 1). Because these two groups (EF-EF vs. CF-CF and EF-CF vs. CF-CF) already had a pre-existing difference before the treatment, it was hard to claim the interaction came from the treatment not from their original difference.

Table 4. Projects' First Scores Comparison

	Treatment Groups	*p*
Projects' First Scores	EF-EF vs. EF-CF	.03*
	EF-EF vs. CF-CF	.35
	EF-CF vs. CF-CF	< .01*

$p < .05$

Students Learning Motivation

The first three questions addressed student beliefs; the other three addressed comfort. Questions one and four of the survey dealt with receiving feedback from instructors (Q1: I believe receiving feedback from my instructor will help me improve my work; Q4: I feel comfortable receiving feedback from my instructor). Questions two and five looked at the benefit and comfort levels of receiving feedback from peers (Q2: I believe receiving feedback from my peers will help me improve my work; Q5: I feel comfortable receiving feedback from my peers). Questions three and six regarded providing feedback to peers (Q3: I believe providing feedback to other people would help me learn more; Q6: I feel comfortable providing feedback to my peers.).

The researchers first ran a Cronbach's alpha on the set of six SLM survey items to examine the internal reliability. The Cronbach's alphas reliability coefficient for the pre and post SLM surveys were .79 and .87.

A follow-up two-factor repeated measures ANOVA to compare the attitudes across time and across the treatments. The scores were collected from subjects' pre and post SLM surveys based on the means of the six survey items (see Table 4). There was no significant interaction between the administrations and treatments, $p = .24$.

Table 5. Mean and Standard Deviation for Pre and Post SLM Surveys

	Survey	*Pre*		*Post*	
	Questions	*M*	*SD*	*M*	*SD*
Q1:	I believe receiving feedback from my instructor will help me improve my work.	4.51	.92	4.51	.82
Q2:	I believe receiving feedback from my peers will help me improve my work.	3.86	.88	3.89	1.16
Q3:	I believe providing feedback to other people would help me learn more.	3.86	.85	3.91	1.01
Q4:	I feel comfortable receiving feedback from my instructor.	4.51	.66	4.34	.87
Q5:	I feel comfortable receiving feedback from my peers.	3.80	.93	3.97	1.07
Q6:	I feel comfortable providing feedback to my peers.	3.94	.94	3.94	1.03

Note. Reponses ranged from 1 (Strongly Disagree) to 5 (Strongly Agree).

Students feel at least as comfortable receiving feedback fro m peers as before the treatment (*M* = 3.80 and *M* = 3.97).

With regard to the open-ended instrument, the first two questions address student likes about this approach; the other two address student dislikes about this approach. Questions one and three dealt with providing feedback to peers (Q1: What did you like most about this approach on providing feedback to peers; Q3: What did you like least about this approach on providing feedback to peers). Questions two and four regarded receiving feedback frompeers (Q2: What did you like most about this approach on receiving feedback from peers; Q4: What did you like least about this approach on receiving feedback from peers)

When *providing* feedback to peers, eight students in the CF-CF (*n* = 17) group reported it was way too time consuming for them at the end of the semester and a lot of extra work. Four students reported that this approach took way too long and was tedious. Five students in EF-CF group (*n* = 11) also thought providing feedback to peers was a time consuming process. Two students felt uncomfortable and did not feel like it was their place to give peers feedback. However, seven students had a positive attitude for this approach. They reported it enabled them to see how much they could improve their own project by seeing peers' projects that were in depth. All of the students in the EF-EF group (*n* = 7) reported there was nothing they disliked about this approach on providing feedback to peers.

When *receiving* feedback from peers, the two students in CF-CF (*n* = 17) group reported that CF does not really tell them what they need to improve or the reasons they received a low/high grade. In the EF-CF group (*n* = 11), five students disliked this approach because they did not get peers' comments; only the scores. In the EF-EF group (*n* = 7), four students reported there was nothing they did not like about receiving feedback from others For example, "I was able to see different peoples opinions on what I could do better." and "Getting to see the different things people suggested I improve upon".

Most of students had a positive attitude towards this peer approach. They reported it enabled them to see how much they could improve their own project by seeing their peers' projects that were in depth.

Discussion

The results of this exploratory study suggest three findings regarding peer feedback in student work and provoke a number of questions for further research. First, feedback was useful for improving students' scores. However, the specific effects the treatments were confounded in this study. Second, students' perceptions of what they learned by viewing peers' projects were generally positive although some had reservations about its potential to improve their own work. Most students believed that the feedback they received after their projects were evaluated by a peer was helpful; however, a few had a more negative view of the experience. Third, students' perceptions of the comfort level they experienced providing and receiving feedback form peers were generally positive.

Peer Feedback Level

The EF-EF group that provided and received an Elaborative Feedback (EF) form their peers had higher achievement than the CF-CF group that provided and received Checklist Feedback (CF) form to their peers.

Because the CF provides only check marks on the rubric and their final scores, the CF-CF students reported that CF does not really tell them what they need to improve or why they received a low/high grade. The students in the EF-EF treatment were able to see different peoples opinions on what they could do better and get to see the different things people suggested they improve upon. They can fix the projects and saw things wrong with it after peers critiqued their projects. However, this result is reported guardedly due to other is sues with the study.

A possible confound is suggested by Dominick's (1997) finding of no significant difference between the feedback group (participants who give and receive behavior peer feedback) and exposure group (participants who give, but do not receive peer feedback). In other words, the benefits of *giving* elaborative feedback may outweigh the limitation of *receiving* less feedback.

(1) Learning from viewing peers' projects. This finding centered on the learning involved in viewing peers' projects and providing feedback to peers. Students showed improvement in their revised projects because they received the new ideas the peers had, which they applied in their projects. Peers reflected on how they might improve a particular part when they observed or noted differences in style. They then were able to rework their problem areas. When students provided feedback to peers, they also noticed what the weakness and strengths for their own projects were, no matter which treatment groups they were in. It also helped them to evaluate their own projects. These comparisons may have been all the more relevant since they had both experienced essentially the same educational program and had a shared knowledge base and level of discourse. Since their next desired step is a teaching position, there is a strong inclination to try to improve their electronic portfolio project after viewing others' projects.

(2) Students' grading attitude. Some students did not learn from this peer approach because they felt uncomfortable. It may be some peers were a little too nice in providing feedback in order not to hurt someone's feelings instead of being honest regarding what they thought could really be improved. Another explanation for these less positive perceptions is that they felt their peers might not have taken it seriously and did not provide honest feedback. Not all students engaged in the process. Therefore, these students did not engage in the opportunity to reflect on the experiences and gain insight from each other. Some students felt confused because they received different feedback in the same category, and they did not know which direction should they go.

(3) Weakness of the design and rubric. In the Nonequivalent Control-Group Design (NEGD), because it is often likely that the groups are not equivalent, as a result, the groups may be different prior to the study. That is, the NEGD is especially susceptible to the internal validity threat of selection. Any prior differences between the groups may affect the outcome of the study. The main threat to the internal validity of a NEGD experiment is the possibility that group differences on the posttest are due to pre-existing group differences rather than a treatment effect. In this case, because in EF-EF vs. EF-CF and EF-CF vs. CF-CF comparison already had significant differences on their first scores, even though EF-CF vs. CF-CF comparison had significant interaction, this may be due to pre-existing group differences rather than a treatment effect.

There is also a doubt about the rubric design. In EF-CF treatment, subjects received CF from peers. In EF- EF treatment, subjects received EF from peers. Although it seems there are two types of feedback on the receiving part, the rubric contained elaborate narrative even in the CF treatment. Because the rubric clarified why students received certain scores for each category, even the subjects in the EF-CF treatment who received CF received similar information as the subjects in the EF-EF treatment.

Students' Learning Motivation

A possible reason why there was no significant difference in comparing the attitudes across time and across the treatments is the ceiling effect. The means on the pre survey were above 3.8 on a five-point Likert scale (5 = strongly agree to 1 = strongly disagree), leaving relatively little room for improvement on the post survey.

Student teachers had a positive perception of their comfort level and the instructional value of feedback received from two types of evaluators: instructor and peers. More specifically, students had the most positive perceptions of a reciprocal peer evaluation process that asked them to provide and receive elaborative feedback (EF). The ratings indicate that student teachers feel most comfortable in receiving feedback from their instructor.

Students have the same comfort level on providing feedback to peers as before the treatment (M = 3.94). Since the sample size in the CF-CF group was the largest among the three treatment groups, and students needed to view through their peers' projects (n = 17) and then gave peers the checklist feedback, most students reported it was way too time consuming for them at the end of the semester and a lot of extra work.

Since the students just needed to provide check marks, students could complete the feedback process with little concern as to its value. However, some students were not satisfied with their grades. They believed that the grader did not fully understand the rubric grading system or its instructions because he or she provided ambiguous feedback to others. In other words, they did not think their peers really cared or took their time to actually grade their project.

The researchers believe that peer feedback was usually welcomed, particularly when it was constructive or prompted new insights. They appreciated honest and thoughtful suggestions and alternative ideas. On many occasions, students reported that the questions and comments of their peers prompted them to offer an explanation of their projects.

It appears that some students did not learn from each other for a variety of reasons. When students showed little interest in their peers' project but rather viewed the process as a requirement to complete, they reported learning little. They provided feedback casually and had less motivation to revise their own projects. It is possible that students who differed in learning motivation, experience, or personality benefited less from their learning experience.

Suggestions for the Future Study

Because each treatment group showed improvement, further research might use a more traditional control group. The researcher could then investigate the interactive effects between varying levels of feedback and no feedback (control group). Because the subjects might learn from viewing and providing feedback to peers without receiving feedback from peers, future research might examine the interactive effects on providing peer feedback procedure only.

The main threat to the internal validity of a nonequivalent control-group experiment is the possibility that group differences on the posttest are due to pre-existing group differences rather than a treatment effect. The future research should reduce the effects of initial group differences by applying treatment to intact groups who have similar performance before the treatment.

Because this research asked subjects to provide feedback to every individual project, subjects felt it was a tedious process and even lost patience for providing serious feedback. The future study might let students work as small groups to discuss the strengths and weaknesses about peers' project, and the students can reduce workload by cooperative learning. The feedback provided by students also should be counted as part as to their project grades to adjust their attitudes in providing feedback.

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Policy Perspectives on Selected Virtual Universities in the United States

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The use of the Internet in distance education has increased at a tremendous pace. By 1997 forty percent of all higher education institutions in the United States offered some type of online distance learning course (Council for Higher Education Accreditation, 1999). In March of 2000, the Los Angeles Time reported that one in three U.S. colleges offered an accredited degree online (Los Angles Times, 2000). Many education scholars agree that applications of web-based instruction have developed at a faster pace than any other development in the history of higher education (Twigg & Oblinger, 1996; Thrall, 1999; Gladieux & Swail, 1999).

The Development of Virtual Institutions

The use of the Internet to teach distance education courses has transcended from a type of distance education course to new types of institutions that provide greater access to higher education. Institutions of higher education and state legislatures have created virtual collaborations as an opportunity to extend the benefits of higher education beyond its traditional boundaries. Although there have been a number of consortiums developed that could be titled virtual universities, Western Governors University was the first virtual university in the United States to attract attention from the mass media (WGU, 2000). By March of 1999, the State Higher Education Executive Officers (SHEEO) published a report that stated that thirty-three state or regional consortia had developed virtual universities (Council of Higher Education Accreditation, 1999).

Due to the newness of the virtual university, there is little research in this area, particularly research with a focus on policy development. In an article published in the *Technology Source* in March of 1999, Trevor Thrall argued that Virtual Universities have bypassed some of the traditional decision-making processes due to their lack of a brick and mortar mindset. A great deal of public funding has been directed towards virtual universities without a comprehensive examination of the policy characteristics of these institutions. This article reports on a policy analysis that examined the development process of public virtual universities. The study first classified existing public virtual universities in the United States using Wolf and Johnstone's (1999) taxonomy, then, using a content analysis approach, examined policy development for institutions falling under selected classifications. A focus on public virtual universities was chosen due to the fact that private institutions do not have the same government mandated policy requirements as public institutions. Eighteen public virtual institutions were identified as operating at the time of this study (2000). One additional public virtual institution, which had recently ceased operation (in 1999), was also included.

Wolf and Johnstone's Institutional Taxonomy

In May of 1999 David B. Wolf and Sally M. Johnstone published an article in Change entitled *Cleaning up the Language of Electronically Delivered Academic Programs*. They argued that the language used to refer to new forms of electronically delivered programs was disorganized and chaotic, pointing to the fact that there are several meanings for the same phrase. The authors cited the use of the phrase 'virtual university' as an example. The authors noted, "We sometimes use one term to refer to very different types of arrangements" (Wolf & Johnstone, 1999, p.1). In order to provide clarification to this issue the authors "developed a taxonomy to help make the variety of organizational arrangements used to administer electronic offerings more explicit" (Wolf & Johnstone, 1999, p.2). The institutional taxonomy was created to take advantage of conventional terms that align with accepted existing structures of higher education. The Institutional Taxonomy is as follows:

Virtual University / College – academic degree granting with no campus.

Virtual University Consortium– no degree granted but accredited academic institutions are linked online and supply centralized or coordinated services to students with mutual articulation among consortium members.

Academic Services Consortium– no degree granted but accredited academic institutions are linked online and supply centralized or coordinated services to students with no articulation among consortium members.

University Information Consortium – no degree granted and no centralized or coordinated services to students but accredited academic institutions are linked electronically.
Virtual Program – degree granted without coming to a campus from a traditional accredited academic institution where the majority of services are still offered in a face-to-face environment.
Virtual Commercial Certification Institution – Certification granted but no academic credit awarded.
Traditional Accredited Institution with Some Electronic Courses – Credit is awarded but there is no coherence among electronically offered courses that could lead to a degree (Wolf & Johnstone, 1999, p.2)

Applying Wolf and Johnstone's Institutional Taxonomy

A *Public Virtual University Classification Matrix* (Table 1) was developed as part of this study to assist in the process of differentiating between the different types of public virtual universities using the Wolf and Johnstone criteria. The matrix was created using the eight distinctive characteristics Wolfe and Johnstone described in their classification system:

1. Institutions of origin linked by a Virtual University.
2. Independent institutions or non-for-profit virtual universities
3. Centralized or coordinated student services
4. Includes mutual course articulation and/or transfer agreements
5. No mutual course articulation and/or transfer agreement
6. Degree granted by institution of origin
7. Degree granted by virtual university
8. Competency-based credit processes in place

Information for each of the nineteen public virtual universities was examined and the presence or absence of these characteristics noted. Institutions were then classified based on these characteristics into one of the seven categories in the Wolfe and Johnstone Institutional Taxonomy. A review of matrix reveals that Western Governors University was the only public virtual university in the United States that could be classified under the *Virtual University / College* typology. Two public virtual universities were classified under the *Virtual University Consortium* typology. These two virtual universities were, the SUNY Learning Network and the University of Texas Telecampus. Five public virtual universities were classified under the *Academic Services Consortium* typology. These five virtual universities included the California

Table 1: Public Virtual University Classification and Selection Matrix

Institution	A	B	C	D	E	F	G	H	Classification	Selected
Arizona Regents	X			X		X			University Information Consortium	No
California Virtual	X		X		X	X			Academic Services Consortium	Yes
Florida Virtual	X		X		X	X			Academic Services Consortium	Yes
Georgia Globe	X				X	X			University Information Consortium	No
Illinois Virtual	X				X	X			University Information Consortium	No
Indiana Network	X				X	X			University Information Consortium	No
Kentucky Virtual	X		X		X	X			Academic Services Consortium	Yes
Maryland Online	X				X	X			University Information Consortium	No
Michigan Virtual [a]	X	X	X		X	X			Virtual University Consortium	No
Minnesota Virtual	X		X		X	X			Academic Services Consortium	Yes
New Jersey Virtual	X				X	X			University Information Consortium	No
Ohio Learning Network	X				X	X			University Information Consortium	No

Online College Oklahoma	X				X	X			University Information Consortium	No
South Dakota Electronic	X				X	X			University Information Consortium	No
Southern Regional	X			X		X			University Information Consortium	No
SUNY Learning Network	X		X	X		X			Virtual University Consortium	Yes
Tennessee Virtual	X				X	X			University Information Consortium	No
UT: Telecampus	X		X	X		X			Virtual University Consortium	Yes
Western Governors			X	X			X	X	Virtual University/College	No

Characteristics: A=institutions of origin linked by virtual university; B=independent institution or non-for-profit virtual university; C=centralized or coordinated student services; D=mutual course articulation and/or transfer agreements; E=no mutual course articulation and/or transfer agreements; F=degree granted by institution of origin; G=degree granted by virtual university; H=competency-based credit processes

[a] - review of the data indicate that this institution operates as a private rather than public entity.

Virtual University, the Florida Virtual Campus, the Kentucky Virtual University, the Michigan Virtual University and the Minnesota Virtual University. The *University Information Consortium* typology contained the largest number of public virtual universities. This typology contained ten institutions. The institutions that were classified in this category included the Arizona Regents University, the Georgia GLOBE, the Illinois Virtual Campus, the Indiana College Network, MarylandOnline, the New Jersey Virtual University, the Ohio Learning Network, the Online College of Oklahoma, the South Dakota Electronic University Consortium, and the Southern Regional Electronic Campus. Each of the remaining three virtual university typologies from the Wolf and Johnstone Institutional Taxonomy did not contain any of the public virtual universities in the United States (Wolf and Johnstone, 1999).

Following the review of the public virtual institutions using the Wolf and Johnstone criteria, the institutions classified as *Virtual University Cosortium* and *Academic Services Consortium* were selected to examine more closely. The public virtual universities that were included in the policy analysis component of this study were all virtual universities that 1) were created as a collaborative virtual institution that linked accredited academic institutions online, 2) supplied centralized or coordinated services to students, 3) provided either a direct or indirect articulation among consortium members, and 4) provided degree granting opportunities at an institution of origin within the consortium of participating institutions. Seven institutions met these criteria. Of these, one institution was found to be operating as a private entity and was deleted from the mix (Michigan Virtual University). This choice resulted in the selection of six institutions for further policy analysis. These six institutions included: the California Virtual University (CVU), the Florida Virtual Campus (FVC), the Kentucky Commonwealth Virtual University (KYVU), the Minnesota Virtual University (MNVU), the SUNY Learning Network (SLN), and the University of Texas Telecampus (UT:Telecampus).

To examine their policies more closely, it was important to first select a policy analysis framework to use as a lens through which to look at these institutions.

Development of a Policy Analysis Framework

A policy analysis framework can provide guidance in looking at policy structures, identifying essential policy areas, activities and processes that may be fundamental to the operation of a public institution of higher education. Four analysis frameworks found in the literature were reviewed, culminating in the development of a framework for use in this study. The components of the four frameworks are compared in table 2. Berg's (1998) study, Public Policy on Distance Learning in Higher Education: California State University and Western Governors Association Initiatives utilized a policy analysis framework that consisted of seven constructs. Berg's study was conducted in 1998 during the early stages of the virtual university development process. A number of the constructs in the Berg study were clearly focused on the feasibility of a virtual university. It should also be noted that the Berg study was focused specifically on the policy differences between Western Governors University and the California Virtual University.

In 1998 Gellman-Danley and Fetzner published an article in the Online Journal of Distance Learning Administration entitled *Asking the Really Tough Questions: Policy Issues for Distance Learning*. In this article

Gellman-Danley and Fetzner proposed a seven element model to assist distance education decision-makers with policy issues. In an article published later in 1998, entitled *Barriers to Online Teaching in Post-Secondary Institutions: Can Policy Changes Fix It*?, Berge added two areas to the policy framework that was developed by Gellman-Danley and Fetzner.

In the spring of 2000 a team of faculty members and graduate students from the University of Nebraska published a paper in the Online Journal of Distance Learning Administration entitled *Policy Frameworks for Distance Education: Implications for Decision Makers*. This policy framework was designed to assist decision-makers with the growing number of policy issues in the distance education arena (King, Nugent, Russell, Eich, Lacy, 2000). This group adapted policy frameworks of Gellman-Danley and Fetzner (1998) and Berge (1998) hoping to create a policy analysis framework for distance education that could be adapted and generalized for a variety of post-secondary environments including four year colleges, community colleges, private universities and public universities.

The policy categories that were selected to be included in this study were present in at least three of the four distance learning frameworks that had been previously developed (see Table 2). The exceptions to this rule are the 'Private Industry' policy category and the 'Access to Education' policy category. The 'Private Industry' policy category was included in the Public Virtual University Policy Analysis Framework based on the Rosevear's (1999) examination of the virtual university and the need to develop partnerships with private industry. Rosevear (1999) argued that virtual universities need to develop partnerships with the private sector in order to be successful in meeting the needs of the community and the industries that the virtual universities serve.

Table 2: Comparison of policy categories from previous studies.

Policy Categories	Berg	Gellman-Danley & Fetzner	Berge	King et.al
Private industry	X			
Competency-based	X			
Governance	X	X	X	X
Labor/Management/Administration	X	X	X	X
Accreditation	X			
Training	X			
Funding/Fiscal	X	X	X	X
Consumerism	X			
Academic		X	X	X
Geographic		X	X	
Legal		X	X	
Student Support Services		X	X	X
Technical			X	X
Cultural			X	X

Note: Shaded categories were included in framework developed for this study.

The 'Access to Education' policy category was added to examine the issue of access to education, an element appearing in public venues as a primary reason for developing and marketing online education such as that offered through virtual universities. The resulting policy analysis framework used in this study is described below.

Academic	Admission Standards, Admissions Process, Course/Program/Degree Availability, Course Integrity, Curriculum/Course Approval, Accreditation, Course Logistics, Faculty Development and Resources
Access to Education	Access to Technology, Access to Internet Resources, Scholarships, Policies that Support Learner-Centered Instruction and the Needs of Diverse Students, Instruction Models that Allow Students to Work in Small Groups, and Curriculums Organized Around Central Concepts
Funding / Fiscal	Fees, State Fiscal Regulations, Tuition Disbursement, Tuition Rate Adjustments, Legislative Funding, Financing, Grants
Governance / Administration	Staffing, Institutional Communication, Technology, Institutional Technical Support, Faculty and Personnel Issues, Board Oversight, Union Contracts, Mission, Planning

Private Industry	Partnerships, Support, Research
Student Services	Availability, Library Services, Registration, Financial Aid, Student Accounts, Counseling, Academic Advising, Assessment Testing, Test Proctoring, Student Records, Student Technical Support

Data Collection and Analysis

Six types of policy documents were selected to be included in this examination. These were common documents that appeared to be readily available from the majority of public virtual universities. The policy documents collected from each of the selected public virtual universities included: enabling legislation, funding legislation, institutional / operational documents, statewide or regional governing board documents, internal and external press releases, and journal / magazine articles. The list below defines the selected documents.

Enabling Legislation	Documents related to the creation of the virtual university. These policy documents may be from either state legislation or regional consortia.
Funding Legislation	Documents related to the funding of a virtual university can originate from a state legislature, a regional consortium of states, public institutions of higher education, a state board of higher education, state/federal granting agencies, private funding agency, or private partnerships.
Institutional/Operational Documents	Documents related to the operational policies and procedures of the virtual university. Examples of these documents would include the mission statement, goals, strategic planning documents, student handbook or any other document related to the operation of the virtual university.
Statewide or Regional Governing Board Documents	Documents originating from a statewide or regional governing board. These documents may focus on the development or operation of the virtual university.
Internal and External Press Releases	Documents released in the general press regarding a specific virtual university or an examination of a group of virtual universities. These documents may originate from an independent press agency or from the public relations department of a virtual university.
Journal and Magazine	Documents originating from either a journal or magazine article. These articles may be either technical in nature or descriptive. These articles many also originate from a professional news source.

Several processes were used to collect these policy documents, including a detailed examination of the web sites related to the public virtual universities, including the web sites for the state or regional governing boards, and a review of all online distance-learning journals. Primary library databases, including Lexus/Nexus, were searched for any references to the virtual universities included in the study. A policy document request letter was sent to the public relations contact for each public virtual university requesting all previously outlined policy documents. This was followed up when necessary with sending a policy document request letter to the chief executive officer or president at each public virtual university. Qualitative document analysis procedures were used to further examine the collected documents. Data from the six public virtual universities examined in this study were grouped according to the policy categories.

Findings

The policy documents were reviewed and highlighted according to the themes of the policy categories from McCoy's Public Virtual University Policy Analysis Framework. Tables of policy categories were then created for each institution. These tables were then used to discover the existence of patterns in policy characteristics within each of the public virtual universities and across institutions. The researcher determined that a pattern existed if three or more institutions contained the same emphasis on a specific policy characteristic.

Patterns in Policy Characteristics Related to the Academic Policy Category

A single finding emerged from an examination of the text data related to the academic policy category. This finding is related to the availability of faculty development and training resources and emerged from the policy documents from three of the six public virtual universities included in this study.

Three of the institutions included in the study developed and provided faculty development, faculty training opportunities, and faculty resources: the UT TeleCampus, SLN, and the KYVU. These three public virtual universities also reported high levels of enrollments. Therefore, this finding may suggest a relationship between the availability of faculty resources and increased annual enrollments. Patterns in policy characteristics from the academic policy category are summarized in Table 3.

Table 3: Summary of Characteristics Related to Academic Policies for Six Selected Public Virtual Universities in the United States

Institutions	Policy Characteristics
CVU	No mention of academic policies related to faculty development.
FVC	No mention of academic policies related to faculty development.
KYVU	Workgroups in place and faculty/staff advise director. Faculty development program available and faculty discussion forums provided.
MNVU	No mention of academic policies related to faculty development.
SLN	Training and technical support provided for faculty.
UT Telecampus	Assistance for faculty with course development and delivery and intellectual property and copyright issues. Provides an online library.

Academic: admission standards, admission process, course/program/degree availability, course integrity, curriculum/course approval, accreditation, course logistics, faculty development, and resources.

Patterns in Policy Characteristics Related to the Access to Education Policy Category

The text data collected from all six virtual universities revealed that five of the six virtual universities had data that supported a central theme of providing increased access to education. The data for CVU are lacking a foundation in the concept of providing increased access to education. This finding suggested a potential relationship between virtual universities that contained a central theme of providing increased access to education and surviving virtual universities.

In CVU policy documents, the three issues that drove the development of the CVU included economic development, exporting to global market, and dealing with influx of new students in California rather than expanding access to new groups of students. Table 4 summarizes the access to education policies found in the policy documents.

Table 4: Summary of Characteristics Related to Access to Education Policies for Six Selected Public Virtual Universities in the United States

Institutions	Policy Characteristics
CVU	Absorb additional students based on demographic bulge, economic development
FVC	Affordable access to quality learning opportunities to citizens, seamless distance learning experience, address welfare to work programs.
KYVU	Make postsecondary education more accessible, efficient, and responsive to citizens; help more citizens realize their educational dreams; increase educational attainment
MNVU	Make higher education more accessible to citizens of the state
SLN	Provide accessible, affordable, high-quality education for citizens; help citizens fulfill educational goals
UT Telecampus	Provide equitable distribution of higher education opportunities to all citizens; increase access to education; and build intellectual capital, workforce development

Access: access to technology, access to Internet resources, scholarships, policies that support learner-centered instruction and the needs of diverse students, instruction models that allow students to work in small groups, application of team teaching concepts, curricula organized around central concepts,assessment services provided based on social stratifications and structural basis of dominance.

Patterns in Policy Characteristics Related to the Funding/Fiscal Policy Category

Three patterns emerged from the policy analysis process related to the funding/ fiscal policy category. The first was related to initiating agency providing the funding sources and the variation of funding sources among the individual virtual universities. This finding indicated that funding sources and the availability of alternative funding for the public virtual universities might differ based on the type of statewide postsecondary structure. The second finding indicated a potential relationship between the level of funding at the public virtual universities and increased enrollments. The third finding was related to the funding of CVU. This finding indicated that while the funding level for CVU was comparable to the funding that the other public virtual universities received, there were differences in funding sources that may have implications for policy.

First, initial funding sources for the public virtual universities appeared to vary based on the type of statewide postsecondary structure. Four of the public virtual universities included in this study were based on an open postsecondary system. These institutions included CVU, MNVU, the FVC, and KYVU. The public virtual universities in these states were initiated by a legislative act. The annual funding levels for these public virtual universities varied from $350,000 to $3.5 million. These institutions were all classified as Academic Services Consortium based on the Wolf and Johnstone (1999) Institutional Taxonomy.

Two of the public virtual universities included in this study were based on integrated statewide systems for postsecondary education. These institutions include the UT TeleCampus and the SLN. The public virtual universities in these states were initiated by the boards of regents that represented all of the public postsecondary institutions of higher education in the specific states. Funding in these cases relied heavily on institutional contributions. The annual funding levels for these public virtual universities varied from $1.2 million to $3.4 million. These two institutions were classified as Virtual University Consortia based on the Wolf and Johnstone (1999) Institutional Taxonomy. While the initiating agencies differed by postsecondary structure, the funding level for each of the public virtual universities included in the study appears to depend on neither the type of postsecondary system that existed in each of the states nor the type of virtual institution (Academic Service Consortium or Virtual University Consortium

Four of the public virtual universities included in this study received alternative funding for the sale of services, fromcorporate partnerships, or from education foundations. The funding from these sources was added to the overall operational budget of each of these institutions. The levels of alternative funding varied from $4.1 million at the SLN to in-kind contributions at the MNVU. Alternative funding for the public virtual universities did not appear to depend on the type of postsecondary educational structure in the sponsor state and neither did the survival of the institution seem to depend on the level of alternative funding.

A second finding indicated a possible relationship between the annual level of funding for the public virtual universities and increased enrollments. The three virtual universities included in this study that reported the highest levels of institutional and/or alternative funding are also the three institutions that reported the highest levels of annual enrollments.

A third finding relates to CVU. The California state legislature initially provided funding comparable to the level of funding that the other public virtual universities received. Although the state funding for CVU was discontinued during the second year of operation, CVU was able to generate alternative sources of revenue that were as large as the state funding levels for the FVC or MNVU.

While the funding level does not seem to be the key to understanding the fate of CVU, examining the source of the funding might provide better insights. When CVU's state funding was withdrawn during the second year of operation, the virtual institution was reliant upon corporate sources of funding and grants from foundations and was told to operate as a nonprofit institution without state funds. The SLN was the only other virtual institution included in the policy analysis component of this study that had significant reliance upon foundation sources of support. However, unlike CVU, the SLN was able to maintain the core support from the state in addition to the funding it received from the Sloan Foundation. CVU was the only virtual institution whose operational budget was primarily funded through corporate and foundation contributions after the initial support from the state.

What is not documented in these policy documents from CVU is the requirements or constraints connected to the alternative funding that CVU received from the corporations. Additional research related to the dissolution of CVU might investigate the contingencies placed on CVU by the corporations and foundations that provided the alternative funding once CVU became a not-for-profit entity. The issue of generating revenue from advertising and book sales adds to the concern about the status of the corporations that had provided alternative funding for CVU.

Among the six institutions studied, four were initially supported from state revenues. Two, the SLN and the UT TeleCampus, were initially supported institutionally or from the Board of Regents with additional sources of funding provided from foundations or sales of services. Amounts of funding for these institutions varied widely. Among the six, CVU was the only public virtual institution whose funding from the state was eliminated and the institution became funded through corporate and foundation donations. These data indicate that the fiscal factor in the dissolution of the CVU was not due to the lack of financial support but perhaps due to the lack of state commitment. The difference between hard money (state revenue supported) and soft money (corporate and foundation supported) may have provided unique challenges to CVU. These data may indicate a need to examine the commitment of public legislative or governing bodies as a policy area connected to the success of virtual institutions. Table 5 summarizes findings related to the funding/fiscal policy area.

Table 5: Summary of Characteristics Related to Funding/Fiscal Policies for Six Selected Public Virtual Universities in the United States

Institutions	Policy Characteristics
CVU	Initially state funded ($6.1 million), shifted to bulk of funding from corporate sponsors ($2 million) and some from Alfred P. Sloan Foundation ($625,000). Told to operate as a nonprofit organization without state funding.
FVC	Funded through state budget at $375,000.
KYVU	Funded through state budget at $8 million.
MNVU	Funded primarily through state budget ($1 million) with some in-kind contributions from partners.
SLN	Half funded through the Sloan Foundation ($1.2 million annually) with the other half consisting of in-kind contributions from the SUNY system.
UT TeleCampus	Funded primarily by the Board of Regents ($3.4 million) with some contributions from sales of services.

Funding/Fiscal: fees, state fiscal regulations, tuition disbursement, tuition rates and adjustments, legislative funding, financing grants.

Patterns in Policy Characteristics Related to the Governance/Administration Policy Category

Three significant findings emerged from the examination of documents related to the governance/administration policy category. First, five of the six public virtual universities utilized some form of strategic planning process during the development phase of the virtual university, and completed similar steps during the development phase.

Second, each of these five public virtual universities utilized some sort of planning committee to develop a strategic or master plan. The CVU Design Team, established by executive order, developed a blueprint for the CVU. Florida Distance Learning Institute established the Virtual Design Team to develop the recommended structure and design of the FVC. The Council of Postsecondary Education was responsible for the development of KYVU. The Kentucky Council of Postsecondary Education developed the organizational structure, policies, and procedures related to the development of KYVU. Four design committees were responsible for the development of MNVU, a coordinating board, student services design team, a quality-in-learning team, and a technology team. The UT system developed the Distance Education/Virtual University Master Plan Organization to prepare the UT TeleCampus Master Plan.

Each public virtual university established a committee or council to develop the strategic plans or master plans that led to the development of these institutions. Although the process utilized by each institution was unique, they were all similar in that they utilized key academic and political stakeholders to guide the development of the virtual university. The process that CVU utilized for planning and development was similar to comparable public virtual universities.

The third finding pointed to the importance of a mission statement or an institutional goal statement. Each of the institutions included in the study created and operationalized some form of mission statement or institutional goal during the development phase of the virtual university.

The contrast between the mission and goal statements for the six public virtual universities is also notable. Three of the institutions, the FVC, KYVU, and MVU, had similar mission statements in that they each promoted availability of resources and increased access to postsecondary educational opportunities. The mission and goal statements from CVU, the SLN, and the UT TeleCampus were based on the concepts of technology, innovation, and the economies of scale inherent in distance-learning initiatives. Although there is considerable contrast in the content of the mission statements or the institutional goal statements, the significance of this finding is the completion of the mission or goal-setting process. Table 6 summarizes findings related to governance and administration.

Table 6: Summary of Characteristics Related to Governance/Administration Policies for Six Selected Public Virtual Universities in the United States.

Institutions	Policy Characteristics
CVU	Blueprint, design team from higher education colleges and universities. Goal is to tie together online and distance-education offerings of the colleges and universities, help students find courses, and assist schools in marketing online education.
FVC	Design team. Goal is to provide comprehensive information resources, to expand access and availability, and to respond to needs of higher education.
KYVU	Council on postsecondary education developed policies and design structure, higher education institutions consulted. Goal is student-centered coordination of delivery of distance education to meet citizen and employer needs.
MNVU	Four design committees (coordinating board, student services and design, quality in learning, and technology). Committees included administrators, faculty, student services personnel, students, and private-sector representatives. Goal is to connect learners, industry, and education as partners to build economic stability and to facilitate access, quality, partnerships, and offerings.
SLN	Board of Regents. Oversight goal is to focus on accountability and learning initiatives of the academic institutions, to provide access to students. Mission of providing increased accessibility for students.
UT: TeleCampus	Master plan, team of faculty, staff, students, and a task force.

Governance/Administration: staffing, institutional communication, technology, institutional technical support, faculty personnel issues, board oversight, union contracts, mission, planning.

Patterns in Policy Characteristics Related to the Private Industry Policy Category

An examination of the data related to the private industry policy category did not reveal any patterns related to the private industry policy category. Although a pattern did not emerge there was one noteworthy finding related to the private industry policy category. Five of the six public virtual universities did not maintain significant partnerships with private industry corporations. The CVU was the only public virtual university that maintained partnerships with private corporations; the CVU also received funding related to the partnerships from private corporations.

The role of private industry as related to the virtual university was an ongoing theme in the literature reviewed for this study. It may be an important finding in that five of the six public virtual universities examined in this study did not rely on developing or maintaining relationships with private industry beyond the relationships that they had developed with the vendors who provided the technological means for the delivery of courses and services. It may also be a useful finding that only the non-surviving public virtual university developed dynamic partnerships with private industry that had been designed to provide revenue models for the corporate sponsors and partners.

Patterns in Policy Characteristics Related to the Student Services Policy Category

Two significant findings emerged from the examination of the data related to the student service policy category. The first finding revealed that the number of references to student service that emerged from the CVU policy documents was significantly smaller than those from the documents of the other five virtual universities included in this study. The second finding revealed that four out of the six public virtual universities provided quality, comprehensive student services in a “one-stop shop” environment. The data related to this finding suggest that this “one-stop shop” format for providing student services may be critical to the success of distance-learning initiatives.

When compared to the other five virtual universities included in the policy analysis, it was evident that CVU had a less clear focus on the development of comprehensive student services. Although the CVU policy documents demonstrated intent to develop comprehensive student services, it is also clear that the development of student services was not a priority at CVU. In fact, CVU student services were not yet operational at the time of the dissolution. Comparably, the UT TeleCampus developed the student service functions of the TeleCampus before it began to provide access to distance-learning courses.

An analysis of data related to student services from the other five virtual universities demonstrated a commitment to the development of comprehensive student services and a focus on quality of services. Each of the remaining five virtual universities included in this study developed a method or means to deliver comprehensive student services to their distance-learning students.

The second finding pointed to a theme of providing access through a one-stop, single-point-of-access model. FVC was designed to "ensure one-stop shopping for distance-learning students." KYVU has a policy of "providing one-stop services on the Worldwide Web" to students. MNVU was designed to "offer streamlined access to financial aid information and services; one-stop registration and tuition services." The UT TeleCampus "worked to give the distance education student every available chance to succeed, along with the equivalent of one-stop shopping." Four of the six public virtual universities concluded that providing quality, comprehensive student services in a "one-stop shop" environment was critical to the success of their distance-learning initiative. Table 7 summarizes findings in the student services area.

Table 7: Summary of Characteristics Related to Student Services Policies for Six Selected Public Virtual Universities in the United States.

Institutions	Policy Characteristics
CVU	Planned for the development of integrated student services.
FVC	Quality, accessible, "one-stop shop" using existing resources.
KYVU	Single application, single application fee, single registration form, and "one-stop shop." Web-based support services, access to library, and academic support.
MNVU	One-stop registration and tuition services, streamlined access to services including financial aid, library and career services.
SLN	Supports the campuses working together, not "one-stop shop." Each participating campus provides student services via the SLN.
UT TeleCampus	Individual institutions maintain standards. "One-stop shop" services include admission, registration, financial aid, bookstore, and library.

Student services: availability, library services, registration, financial aid, student account, counseling, academic advising, assessment testing, test proctoring, student records, student technical assistance.

Conclusion

This study generated eight noteworthy conclusions. These conclusions are important in that they provide a better understanding of the elements of the policies of the public virtual universities when examined as a whole. These key conclusions are both independent findings generated from the study and general conclusions that can be made based on the collective examination of the findings from this study.

Conclusion 1: Application of the Wolf and Johnstone Taxonomy

The application of the Wolf and Johnstone Institutional Taxonomy provided a useful means for the classification of the 19 public virtual universities. The application of the Wolf and Johnstone Institutional Taxonomy resulted in the classification of one institution as a Virtual University/College, three as Virtual University Consortia, four institutions as Academic Services Consortia, and 11 institutions as University Information Consortia.

Conclusion 2: Faculty Development and Enrollment

The second conclusion is that there may be a relationship between faculty development resources and the success of a public virtual university. Three of the public virtual universities included in this study developed and provided opportunities for faculty development, faculty training in distance-learning methods, and access to instructional technology resources.

Conclusion 3: Funding Levels of Surviving and Non-surviving Public Virtual Universities

The third conclusion is that there appeared to be no significant difference in the funding levels of surviving virtual universities and a non-surviving virtual university. However, CVU was the only public virtual institution whose funding from the state was eliminated and which then became funded through corporate and foundation donations. The data indicated that the fiscal factor in the dissolution of CVU was not due to the lack of financial support but perhaps due to the lack of state commitment. CVU was no longer supported via hard money (state revenue supported) and became dependent on soft money (corporate and foundation supported) to continue operation. Although the data demonstrated that the amount of soft money was equal to or greater than the annual funding of comparable institutions, the requirements or constraints of soft money funding may have provided unique complications for CVU in addition to the lack of stability.

This conclusion is important in that it supports the explanation of the failure of CVU provided by the former CEO of the virtual institution, Stanley A. Chodorow. In an issue of the *Chronicle of Higher Education*, Chodorow (cited in Young, 2000) commented on the financial plan of CVU, saying, "The original plan for the CVU did not include an adequate financial structure." He went on to say that "there was a plan to raise funds from corporate sponsors, and the governor had helped to do that, but he had only gotten five or so out of 10 that were required for the original financial plan. And once the governor was out of office, these corporations were not very interested in continuing their support" (Young, 2000, p. 1).

Conclusion 4: Importance of Student Services

The fourth conclusion is that there is a possible relationship between the development of comprehensive student services and the viability of public virtual universities. This conclusion supports the argument that comprehensive student services are necessary to support the efforts of distance-learning students. In the case of CVU, the strategic plan provided for the development of online student services but these services had not yet come to fruition at the time of the dissolution of CVU. In comparison, the UT TeleCampus developed the online student services portion of the virtual university before it began to provide access to distance-learning courses.

In addition to the development of comprehensive student services, this finding also indicated that the manner in which the student services were provided can be a significant factor. Four of the six public virtual universities provided quality, comprehensive student services in a "one-stop shop" environment. Each of these four institutions argued that this "one-stop shop" format was critical to the success of their distance-learning initiative.

Conclusion 5: Funding Level and Enrollment

The fifth conclusion is that there may be a relationship between the level of funding of a public virtual university and the annual student enrollment of a public virtual university. The three public virtual universities that reported the highest levels of annual funding from both primary and alternative sources also reported the highest levels of annual enrollments. This conclusion points to a potential relationship between the level of annual funding for a public virtual university and the level of annual student enrollment at a public virtual university.

Conclusion 6: Focus on Access to Education

The sixth conclusion is that the central theme of providing access to education may be critical to the development, growth and success of a public virtual university. All surviving public virtual institutions had a focus on expanding access to previously unserved or underserved populations, as opposed to CVU, which was more focused on economic development and managing population growth.

Conclusion 7: Relationship with Private Industry

The seventh conclusion is that relationships with private industry do not seem linked to success. Five of the six public virtual universities examined in this study did not rely on developing or maintaining a relationship with private industry beyond the relationships that they have developed with the vendors who provide the technological means for the delivery of courses and services. The only non-surviving public virtual university was the only public virtual university to develop dynamic partnerships with private industry. These partnerships had been designed to provide revenue models for the corporate sponsors and partners. This finding supports the argument that the lack of hard money support from the state and reliance on corporate sponsorship may be significant in the dissolution of CVU.

Conclusion 8: Apparent Differences in Surviving and Nonsurviving Public Virtual Universities

The eighth conclusion that can be extrapolated from this study is that the failure of CVU does not appear to have been caused by the lack of primary or alternative funding sources or amount of resources provided. Neither does the failure of CVU seem to have been caused by the lack of a comprehensive strategic planning process. Based on this research study, it may be possible that the failure of CVU resulted from the model that was created by the stakeholders. When compared to the other public virtual universities included in this study, CVU was found to differ on several fundamental characteristics that the more successful public virtual universities contained.

CVU did not provide comprehensive student services. CVU did not provide comprehensive faculty training and resources. The motivation for the development of CVU was not based on a central theme of providing access to education for the residents of the state of California but rather the development of a nationally focused revenue-generating institution that would be the "Amazon.com" of the education community. CVU was forced to rely on non-state revenue for survival. In contrast, the surviving public virtual universities were based on a central theme of providing access to education via the academic and student services components of the institution. These defining elements of the policies of CVU appear to set it apart from the surviving public virtual universities.

Implications for Practice

Four significant implications for practice emerged from this study. These implications for practice can be applied independently or as a whole.

Implication 1: Development of Faculty Resources

The first implication for practice was that faculty development resources and faculty training opportunities are an integral element in the development and operation of a successful comprehensive public virtual university. It seems apparent that the creation of these types of resources for the faculty both motivates and encourages faculty members to participate in the development and instruction of online courses.

Implication 2: Student Services

The second implication for practice is that comprehensive student services that support the academic offerings of an institution are essential in the development of a successful public virtual university. As demonstrated by the institutions included in this study that provide online student services, comprehensive student services enable a student to successfully meet academic goals in an online environment. In addition, online student services that are provided in a "one-stop shop" method seemingly enhance the availability of these resources to the students. It is a logical expectation that virtual universities that allow a student to apply online, register for a class online, manage their student account, or process their financial aid application in a "one-stop shop" environment would experience success compared to their counterparts.

Implication 3: Funding

The third implication for practice is that the level of annual funding for a public virtual university may be directly related to the success of a public virtual university. This implication is critical for stakeholders in public virtual universities that are experiencing low student enrollments. It should be noted that this finding may not be isolated in that it was directly related to an institution's ability to provide faculty development resources or comprehensive student services. Therefore, it is a logical conclusion that a virtual university with increased levels of funding and state-level support would be able to provide these additional resources for students and faculty and, therefore, experience significant increases in annual student enrollment.

Implication 4: Access to Education

The fourth and final implication for practice is that each successful and surviving public virtual university maintained a commitment to the core concept of providing access to education in the host state that it served. These concepts and themes included access to technology, access to Internet resources, scholarships, policies that support learner-centered instruction, instruction models that allow students to work in small groups, and curricula organized around central concepts. The institutions that have demonstrated the ability to survive and be successful have also demonstrated a commitment to one or more of these themes and concepts. The general idea that these institutions were designed to increase access to education is seemingly fundamental to the success of a public virtual university.

Advice for Policy Makers

The findings from this study can be extrapolated to provide guidelines for educational and legislative stakeholders who are involved in the development or operation of a public virtual university. The following six recommendations are based on the findings from this study. These recommendations are presented in a manner that is applicable for the educational or legislative stakeholder who is directly involved with the development of a new public virtual university. The recommendations for policy makers are as follows:

1. Develop comprehensive student services in a "one-stop shop" environment. Students should be able to apply, register, make tuition payments, and complete the financial aid application process in a virtual student center that provides all of the same resources as a traditional student center.

2. Develop integrated faculty development resources. The faculty who develop and teach online courses should have access to training opportunities and instructional technology resources.

3. Maintain an institutional focus on providing increased access to educational resources. This theme should be present in institutional goals and mission statements.

4. Develop a financial plan that is based on state-appropriated hard money. Be careful of private partnerships and sponsors who want to participate in the operation and potential revenues from the institution. If a public virtual university is going to be successful, it will require a strong commitment from the state board of regents or legislative bodies.

5. Review the various methods for the classification of a virtual university and develop the virtual university with the intention of creating an institution that meets the needs of the constituents in a manner that is consistent with the type of virtual institution the educational stakeholders require.

6. Carefully project the annual budget for the virtual university. Remember that there is a potential relationship between the level of annual funding and the success of the institution. Projecting fiscal needs adequately can have a dramatic impact on the success of the virtual university.

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Creating an Organic Knowledge-Building Environment Within an Asynchrous Distributed Learning Context

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Organic Architecture

In architecture, “organic” refers to a philosophical approach that promotes structures for living that are harmonious to the external environment with an emphasis on spontaneity (Satler, 1999). The goal of organic architecture, according to architect Frank Lloyd Wright, was to “create a building that did more than enclose or close off possibilities.” As Satler (1999) has noted, Wright “hoped to create works that sheltered but also encouraged movement, beyond what apparently existed” (p. 54). Wright’s works were based on the destruction of the “box” that separated the individual from the world. Organic buildings attempted to create a harmonious and seamless environment where people were protected yet not isolated from life outside the walls. By moving people from structures that created a sense of isolation to structures that blended into the environment, a different type of relationship could develop between an individual and the larger whole. No longer would an individual (structure) remain in the background (subordinate to a larger whole)” (Satler, 1999 p. 54). Referring to Wright, Satler wrote, “Psychologically, this paved the way towards a view of architecture, and more fundamentally, a view of interaction, that respected and responded to both individual and collective needs (p. 52).”

This article suggests that instructional designers should consider Wright’s organic philosophy as they design and build asynchronous distributed learning environments so that a more natural learning space is created that fosters knowledge-building. In designing such environments, the goal is to foster the building of knowledge by removing the barriers that separate people from their environment. Traditional instruction, much like traditional architecture, imposes a structure on its environment. While some may argue this is necessary to control the learning process, it has resulted in obstacles that close the individual off from its human nature to learn. Constructivists assert that while most traditional instruction does well to control and manage the educational experience, it does little to maximize, and may even inhibit, natural human learning abilities (Marshall, 1997). Learners need an environment that promotes the types of transformative or generative processes needed to handle ill-structured situations, including thinking, creativity, collaboration, dialogue, and argumentation directed at solving those problems and providing continuous learning (Preskill & Torres, 2000).

Too often, traditional instruction and virtual classroom forms of distance learning do much the same: create barriers to the individual’s natural learning inclinations. What is needed are models, which like Wright’s architectural designs, that break from tradition to work with, rather than against, the natural learning instincts and abilities of human beings. One potential conceptual model is organic knowledge-building. This model leverages the technological capacity of asynchronous distributed learning (ADL) by potentially creating environments that allow for instructional models that are impractical or inefficient in a traditional classroom.

Defining Organic Knowledge-Building

This article argues that learning environments should be designed and constructed using an organic approach, so that learning is not viewed as a distinct human activity but incorporated into everyday performance.

Learning environments developed from an organic perspective help individuals construct knowledge by making available to them a wide variety of resources, experiences, and interactions to explore. As such, to make knowledge-building organic, learning is defined as a constant dynamic and purposive process in which cognitive capabilities are used to create new knowledge, as applications or solutions to problems, by first reexamining current knowledge in terms of a deeper understanding of the complexity of the information; second, by identifying novel relationships between previously-believed distinct knowledge; and, finally, by identifying unknown but required new information. Note, knowledge and information are not interchangeable terms. Information refers to facts, concepts, rules, etc., that are somewhat objective and easily transferable. Information becomes knowledge when an individual takes ownership and makes it meaningful by applying or using the information in conjunction with other established knowledge.

Organic Learning Environments

To support the previously mentioned definition, organic knowledge-building substitutes a highly asynchronous, learner-centered, technology-rich, competency-based environment for a bureaucratic or highly structured classroom model. This conceptual learning model strives to place the learner within a "space" in which learning, context, and application can co-exist (Barab & Duffy, 2000). Land and Hannafin (2000) suggest that such spaces are more learner-centered than traditional computer-based instruction. Computer or web-based ADLs can provide such spaces since they have mechanisms for easing and thus increasing the communication among learners, including reconceptualizing learning from one-shot fixed term to an on-going process that is intermingled with the actual work processes.

Learning occurs naturally and embodies many forms, sometimes taking place subconsciously and serendipitously, while at other times planned and deliberate. We can learn from reading a newspaper, speaking to a colleague, experiencing something new, or even by overhearing a conversation on the bus. At work or everyday life, individuals leverage a wide variety of resources and experiences to learn, outside the boundaries of formal education or training, about the things that matter to them. They commonly experiment with ideas, share their own knowledge with others, collect feedback, and assimilate or reject the knowledge of others. Similarly, learning environments developed from an organic perspective help individuals construct knowledge by making available to them a wide variety of resources, experiences, and interactions to explore.

In recommending an organic philosophical approach, we are promoting the concept that instruction should adapt to how people naturally learn, with the individual, rather than the group, at the center. Taking the organic concept further, we support a situated cognitive approach and argue that learning is not isolated from doing and that instruction should serve to encourage exploration, experimentation, communication, and growth. Proponents of situated cognition argue that learning takes place during the individual's struggle to solve a contextually meaningful problem (Brown, Collins, & Duguid, 1996; Lave & Wenger, 1991). We are also mindful that social constructivists, on the other hand, suggest that learning takes place in the process of communicating ideas and negotiating group meaning (Jonassen, 1999; Scardamalia & Bereiter, 1993).

To the question of whether learning takes place individually or in groups, the Organic Knowledge-Building model answers "yes." We believe that learning takes place within the individual as he or she engages in a process of solving meaningful problems and is further encouraged and supported by the group as it moves closer to a shared meaning (Brown, 2000). This edges close to what Torraco (1999) describes as skill. "Skill is not defined exclusively in terms of human capabilities; it retains features of both the performer and the work environment in which it is expressed" (p. 256). However, Torraco (1999) also states that "Skilled performance in many work environments is a function of expertise that is distributed among group members. ...and that learning is a group activity" (p. 254). Clearly, the individual who is allowed to develop to the maximum extent is a greater contributor to a larger collective learning which in turn nurtures the individual.

Components of the Organic Knowledge-Building Model

In organic knowledge-building, an instructional environment is created that utilizes the naturalistic, spontaneous, and regenerative nature of humans as it relates to learning. Although this is not a new concept, per se, we believe this model describes a design structure that can aid implementation.

There are four components in an organic knowledge-building environment: information objects, scaffolds, discourse action communities, and facilitation. The components are neither sequential nor discrete; their relationship can be characterized as inter-related, dynamic, idiosyncratic, often overlapping. In short, what makes the instruction organic is not any particular component, but rather the idea that these components are used in concert with the individual's context to create a rich and open environment that is alive with opportunities for exploration and meaning-making. Furthermore, this model is not bound by traditional theoretical constraints but adheres to a pragmatic orientation that suggests incorporating any "tool" or idea that helps the learner to accomplish the goal.

FIGURE 1: Visual depiction of the Organic Knowledge-Building Model

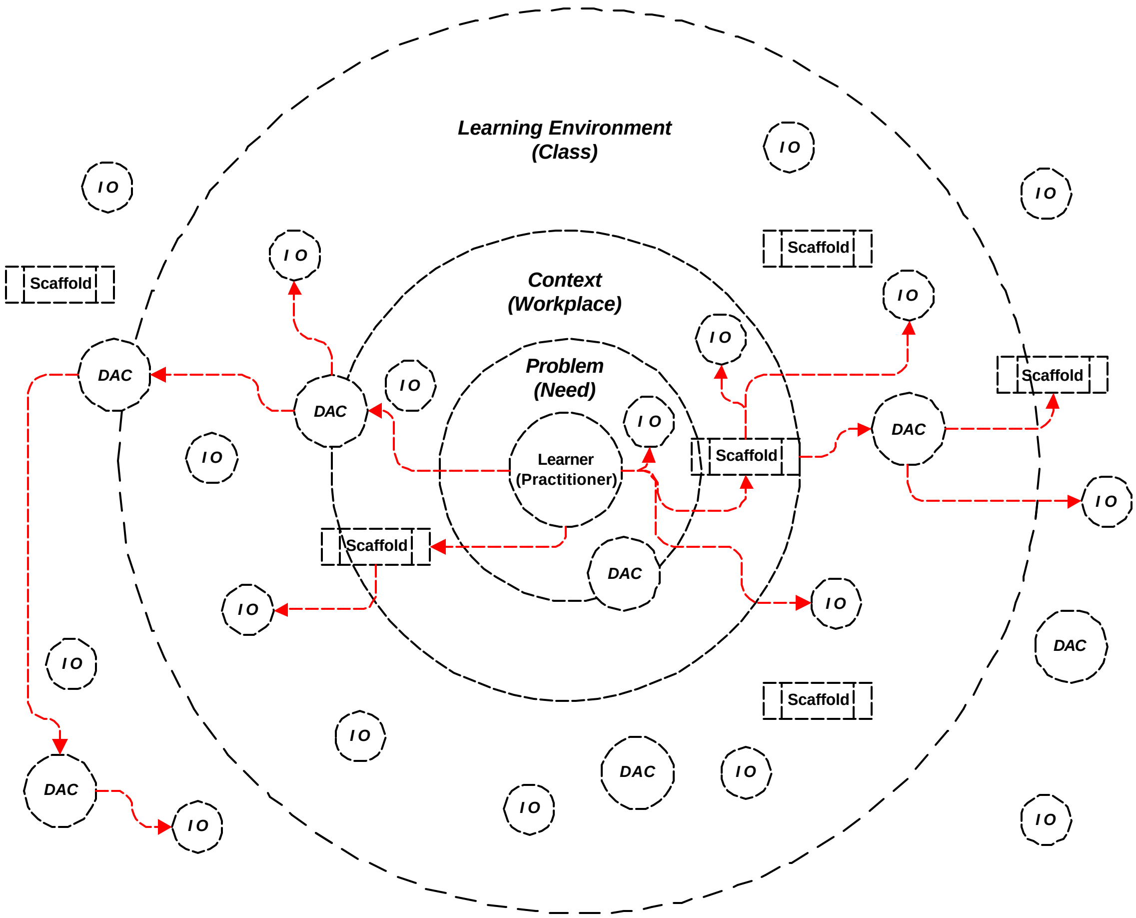

Figure 1 depicts the major characteristics of the organic knowledge-building model. The individual is central to the process and, simultaneously, both a learner and practitioner. The learner is driven by a meaningful problem within a workplace or other real-life context. The learning environment is what we traditionally think of as the conceptual boundaries of a course, curriculum, training program, etc. Note that the boundaries within this model are not solid. In an organic learning environment, there should indeed be significant overlap between the learning environment, context, problem, and learner. In organic architecture, structures are designed to blend in with the natural setting, blurring the lines between the home and its natural surroundings. Similarly, organic learning environments blur the distinction between the individual as a learner and the individual as a practitioner; between the learning context (e.g., the classroom) and the performance context (e.g., the workplace).

Another aspect of this model is the availability of resources that encourage and support the individual in exploring, experimenting, and knowledge-building. There are four general categories of resources: information objects (IOs), scaffolds, discourse action communities (DACs), and facilitation. Information objects are essentially building blocks of content. They can stand alone or they can be strung together to form larger molecules. In a traditional sense, IOs replace the lectures, handouts, and slides given to students; they are basically, the declarative (what) and procedural (how) knowledge components of instruction. Within an organic learning environment, individuals have access to a wide variety of IOs, representing not only the scope of one expert's knowledge and experience, but rather the entire available breadth and depth of multiple knowledge domains. Discourse action communities do not differentiate between learning communities or communities of practice. Learners, in their quest, communicate with other learners and practitioners sharing their experiences as well as the information objects they have encountered during their exploration. These interactions in turn lead to the discovery of other information objects within the learning environment as well as outside of the learning environment. From this ongoing exploration and discourse, the individuals form ideas, what we may call hypotheses, regarding the ill-structured problems they are trying to solve. Scaffolds, some in the form of simulators, enable the learners to experiment with their ideas within a safe environment that is closely related to their context. These experimental or virtual workspaces allow us to eliminate the traditional concept of practice. Other types of scaffolds include subject-matter experts, exemplars/non-exemplars, cases, and job aids. Together, scaffolds, information objects, and discourse action communities create a rich environment in which the learner/practitioner can explore, interact, and construct meaning. In fact, this environment is so rich and the possible paths through it so limitless that learners/practitioners may be overwhelmed by the possibilities. For this reason, facilitation is critical within an organic learning environment and should be the instructor's primary role in the learning process.

Visual 2 & 3 Samples w/content domain examples

Knowledge Objects

- Provide information
  Ergonomics
  - Physical
  - Environmental
  - Social aspects

Scaffolds

- Ergonomic checklists
- Models produced by companies who promote themselves as being ergonomically correct
- 3D engineering

Determine Ergonomics

Facilitator

- Assist in question and answers with students
- Encourage students to look deeper into their research

Learning Communities

- Students will share their research findings with other groups of students in class
- Discuss the ergonomic features of the classroom and home work areas
  - Compare the ergonomic features found similar
  - Compare the ergonomic features found different
- Construct a new checklist or add to the existing checklist

Knowledge Objects

- Information on different products/services offered within the organization
- Common objections with possible responses
- Information on the consultative sales process (general)
- Information on the most difficult aspects of the sales process (resolving objections) and tips to maximize your efficiency
- Information on tracking reports used by the organization (sales metrics) including how to complete them

caffolds

- FAQs
- Job-aid including features/benefits for each product/service
- Information on competitors' products/services
- Examples of completed reports (expense reports, booking reports, forecasts, etc.)
- Expert salespeople within the organization talking @ best practices
- Video clips of good/bad sales calls
-

<u>Sales Training</u>

New Product

Facilitation

- Provide case studies for salespeople to recommend as appropriate product service
- Role plays of possible customers

Learning Communities

- Discuss case studies and brainstorm the best recommendation for a product/service
- Salespeople involved in an online chat environment to talk @ the challenges they face/offer advice to each other
- Review metrics and plan how to do better
- Review/discuss what was good/bad

Information Objects

Information objects utilize web or computer-based tutorials or information packets to convey topics or small modules of the key portions of the content. Rather than a regularly scheduled and managed class of determined hours where learners accumulate information to be used or examined at a later time, learners directly engage the declarative and procedural knowledge in smaller chunks at a time and place the learner(s) recognizes it as needed information, which in itself is a learning activity.

Information objects, or "molecules" of information, are identified and categorized, placed in a system where the information can be quickly extrapolated and applied within a new frame of reference. When placed into a generic categorized framework, learners may access these objects by using key words to retrieve the pertinent information. Picture these "info nuggets" as pamphlets or chunks of information that contain specific components of a complete procedure or process. Learners access only the "info nugget" they need to review, rather than spending the time reviewing the full procedure.

For example, if someone wanted to learn how to change an oil filter, he or she could access the information object base for that particular chunk of information and it might show a short video demonstrating the procedure, step-by-step. But, if the objective were, instead, to understand car systems and the rules associated with them, the learner would need more structure, organization, and content. The chunks of information gathered would be more detailed. However, when the learner reached the part about learning to change the oil filter, the same video clip would be part of the program (Gordon, 1997).

Using information objects supports an organic knowledge-building environment by requiring the learner to navigate the learning process through drawing on previously formed schemata, incorporating new information into them as needed to solve a given problem or enhance dialogue within their communities. The learning object format is supported by the belief that instructional designers can create independent chunks of learning content that provide a learning experience for pedagogical purposes. The chunks are self-contained, though they also may contain references to other objects; they may be combined or sequenced to form longer learning interactions (Quinn, 2000).

This supports meaningful and useful learning by allowing the learners to actively create meaning by exploring, experimenting, testing, and applying knowledge in self-directed and collaborative ways, rather than following a predetermined format. A problem is presented to learners and they are given tools, such as case studies, information resources, or collaboration tools, with which to manipulate the information. The learner then approaches the problem at his or her own pace and from his or her chosen direction, attempting to solve the problem with the tools given (Jonassen, 1999).

The use of information objects allows the learner to explore the content in unconventional ways, following a unique path to discovering the targeted learning objective. In this particular application, context is not just provided to the learner, but rather provides cues to the learner so that he or she may explore the content in linked contexts and draw individual conclusions and meanings. The use of the Web to explore the content can be enhanced by the use of knowledge object databases to focus the search more directly, using the terminology and clues that the learner uncovers during the search process.

Developing the information objects involves choosing keywords for easy and broad retrieval, and the avoidance of an editorial voice in the information packets, which might include introductions or conclusions about the content. Additionally, they should be freestanding or modular, non-sequential, and able to satisfy a single learning object. To assist in that process, the system should use "context wrappers." Context wrappers consist of information that is associated with a learning object. One object may have multiple wrappers, providing different ways to contextualize it. In this way, the keywords would allow multiple uses and frameworks to capture the same information nuggets.

Algorithms can be used to guide the manipulation of knowledge objects into different categories and permutations, somewhat like a formula manipulates numbers in different sequences to arrive at different answers. Merrill's theory supports our knowledge-building approach by allowing the learner to control the path for his or her own learning, through choices in the program (Merrill, 1999).

The advantages of using knowledge objects as a tool for creating just-in-time training are numerous, but the need for a consistent and regulated information structure is necessary before this approach can be used globally. Gordon (1997) quotes Matlack, senior developer for Multimedia Pathways, Inc., regarding one of the concerns about chunking bits of information:

> Taking pieces of information, bit-by-bit, and pasting it together is not what training is all about. Training is about taking raw information, integrating it, and helping you develop a mental model of it. In the end, you should be synthesizing all this information and coming out with a transfer of know-how rather than a transfer of facts. (p. 32)

Scaffolding

Technology-based scaffolding involves helping learners by providing support for performance when they encounter a task or concept they have yet to perform (Jonassen, 1996). In this manner, learners are able to find help when they encounter something for the first time. This approach allows learners to ask questions, see examples or models of the process, or get expert advice on what to do next. As with other parts of our model, learners could use these tools while they are performing a new task.

An excellent example of the power of this type of computer-based scaffolding can be seen in several products developed by Schank (Schank & Cleary, 1995). Schank has developed a number of systems he dubs "ASK" systems. These ASK systems allow learners to ask questions using the program and have their questions answered in the form of video clips of experts in the field speaking about the topic at hand. For example, one such system is TransASK, developed for use by the United States military in training officers in materials management during a military crisis (Schank & Cleary, 1995). In TransASK, a trainee can input questions as he or she works through either a training scenario or an actual crisis, and the system will provide a video clip from among a database of clips containing 25 experienced officers telling their stories of how they handled a similar situation. While ASK systems are highly advanced CBT programs, even simple tutorials could provide the information and modeling a learner needs, at the time when the learner/practitioner needs to perform a specific skill. Furthermore, learning new things at the time they are needed helps learners make the knowledge more meaningful and stable in the learner's cognitive processes. This also allows for the learning process to continue unabated.

Scaffolding also should incorporate the use of virtual workspaces and simulators. Unlike a predetermined scenario, as typically found in simulations, this virtual laboratory would allow the learners to practice, experiment, or test various hypotheses, actions, and models in relative safety while still maintaining the realistic outcomes necessary in evaluating and revising knowledge. Examples of these types of scaffolding tools range from the Electronic Workbench designed to allow budding chemists to try out electronic circuits (Sadik & Cheung, 2001) to a multimedia simulation of an actual work environment (Montgomery, Campbell, & Moffett, 1994).

For example, the multimedia simulation is a goal based scenario (GBS) system, a term conceived by Schank (Schank & Cleary, 1995) and similar to the previously described ASK systems. GBS systems allow learners to simulate the work environment and receive immediate feedback on their performance. Successful implementations of these GBS systems can allow for scaffolding strategies such as coaching and feedback to be used within a simulated environment (Acovelli & Gamble, 1997).

Discourse Action Communities

One of the key principles of organic environments is that the learner should neither be isolated from nor become subsumed by the larger group. In an asynchronous organic community, a group of people are electronically linked for the purpose of learning specific materials through collaboration via computer-mediated communication (CMC). These groups of learners are typically comprised of computer-literate adults who are seeking to gain knowledge in a particular area of interest and are highly motivated to participate in all the learning requirements (Downs & Moller, 1999; Garrison 1989; Moore & Kearsley 1996).

Viewing learning as primarily a knowledge-building process requires the learner to be actively engaged in cognitive manipulation of the instructional content or information. As Moore and Kearsley (1996) point out, "learner to learner interaction is desirable for pedagogical reasons." Gay and Lentini (1995) confirm this assumption by writing "learning is fundamentally built up through conversations between persons or groups, involving the creation and interpretation of communication" (p.2). Furthermore, they argue, "conversations are the means by which people collaboratively construct beliefs and meanings as well as state their differences" (p.2). Thus, we are more able to enlarge our own beliefs and more likely to take risks when supported by a community of other learners (Grabinger, 1996).

In other words, an organic knowledge-building community is designed to facilitate learner-centered communication and increase peer interaction by first engaging the learner in tasks that require and allow for high-level thinking and reflection. These higher-order cognitive processes are prompted through the use of communication for collaborative idea generation, critical analysis, and argument construction. This organic knowledge-building discourse and action community provides the necessary intellectual and emotional support to the learner for growth of intellectual risk-taking behaviors.

Online learning is potentially a powerful tool when a community encourages learners to deeper cognitive experiences through: collaboration, debate/argument, and conflict/resolution. Collaboration is the most noted of these interactions. In 1988, Douglas Englebart at the Augmented Human Intellect Research Center of Stanford Research Institute developed *Augment*. This online learning system provides tools, like chat rooms, to support collaborative knowledge work and places "the greatest emphasis on collaboration among people doing their work in an asynchronous, geographically distributed manner" (Palloff & Pratt, 1999, p. 245). Traditional distance learning models emphasize the independence of the learner (Downs & Moller, 1999; Moore, 1986) and the privatization of learning (Keegan, 1986). Organic learning, on the other hand, is distinguished by the social nature of the learning environment that is created through community and collaborative learning (Harasim, 1990). The process of collaborating through learning communities increases engagement in the learning process. When promoted, "collaborative work forms the basis for the student's ability to engage in a transformative learning process" (Palloff & Pratt, 1999, p. 127). These transformative learning processes should include online conflicts among participants.

Controversy and conflict within a group can lead members to question their own concepts as well as seek new information and perspectives (Harasim, 1990). Conflict can facilitate learning and personal growth when it is used with the goal of reaching a deeper level of understanding (Palloff & Pratt, 1999). Additionally, Johnson and Johnson (1979) propose that conceptual conflict resolution has cognitive benefits: "Students who experience conceptual conflict resulting from controversy are better able to generalize the principles they learn to a wider variety of situations than are students who do not experience such conceptual conflict" (p. 67).

One of the concerns about conflict and resolving conflict in online learning is that, without the physical and verbal cues of face-to-face contact, many people feel less socially constrained when debating an argument. When communicating face-to-face, conflicts are resolved with what we consider to be socially appropriate behavior. (Palloff & Pratt, 1999). With a defined norm for how to deal with online conflict, a deeper and meaningful type of learning can take place (Harasim, 1990; Moller, Harvey, Downs, & Godshalk, 2000). Considering the many ways in which the Internet and online learning touch people's lives, these issues deserve further discussion.

Given that communities are formed around issues of identity and shared values rather than the traditional place- and time-based development of community, online learning provides a platform for a new, redefined sense of community (Palloff, 1996). An organic knowledge-building community, via online learning, facilitates learner-centered communication and increases peer interaction by first engaging the learner in a manner that is more active than is likely to be found in traditional learning; promotes an opportunity for meaningful learning that requires and allows for thinking and reflection; increases cognitive development through argument construction, communication of those ideas, and critical analysis of new ideas; expands the range of ideas and capitalizes on the possibilities of brainstorming or collaborative idea generation; and provides emotional support for growth or intellectual risk-taking behaviors.

Community begins to shape as the learners communicate, negotiate, and work with one another toward a common goal. In a traditional classroom, this sense of working toward a common goal and building a sense of community identity often does not occur. Bielaczyc and Collins (1998) support learning communities by stating that "…in learning communities, both the content learned and the processes of learning from outside resources are shared more among members of the community and become part of the collective understanding. A further distinction between learning communities and most classrooms is that in learning communities, both the members themselves and the collective knowledge and skills of the community are viewed as important resources" (p.4).

One significant implication of the organic knowledge-building model is that individuals will bring their challenges, experiences, and ideas, which can be the product of individual problem-centered learning activities, to a discourse and action community and then extract ideas from their discussions (and vice versa). These ideas can be used back in their workspaces and/or discussed in other learning communities. This is a natural process that people use already when they transfer knowledge to and from workplace settings, school, hobbies, and other so-called compartments of their lives. In fact, compartmentalizing one's knowledge or avoiding discussion of ideas about which one is passionate is an unnatural and self-defeating enterprise. Knowledge is not something that grows by hoarding; rather, it can flourish only in environments that enable and encourage movement of ideas. This concept is the essence of organic architecture and is at the heart of the organic knowledge-building model.

Facilitation

Given its dynamic nature, a learning environment without a facilitator is little more than a rudderless ship adrift on an ever-expanding sea of information. To support the achievement orientation of organic knowledge-building, five roles associated with facilitators have been identified (Prestera & Moller, 2001). These are the facilitator as a guide, mentor, catalyst, coach, assessment-giver, and resource-provider. Each of these roles is a form of feedback that the facilitator provides in the context of an organic knowledge-building environment.

As guides, facilitators help individuals form strategies for navigating the rich, and sometimes complex, learning environment. After all, individuals who are new to asynchronous learning environments are on multiple learning curves as they acclimate to new technology, communication, socio-cultural, and learning process issues. As mentors, facilitators model the values of the learning community. As catalysts, facilitators challenge and stimulate individuals to explore and interact.

As coaches, facilitators provide formative feedback and encouragement. As assessment-givers, facilitators create opportunities for individuals and groups to showcase their newfound skills and knowledge. Facilitators will also evaluate the individual less in terms of the substance of the individual's output and more in terms of the individual's learning process. Values often manifest themselves in evaluation rubrics. These rubrics can be written to focus on process skills as well as content skills. For example, a rubric might include an evaluation of the reflection, analysis, and collaboration activities in which the individual engaged. If one goal of education is to produce lifelong knowledge-builders, then learners must demonstrate the ability to process information and solve problems, not simply the ability to accumulate knowledge.

As resource-providers, facilitators actively support learners by making available a wide range of information objects, scaffolds, and interaction opportunities. For example, it sometimes may be appropriate to capture the experiences of expert practitioners in a variety of situations and make them available as information objects in the form of video clips. Or, one could capture the reflections of one student who struggled through a learning process and make that available as a scaffold to help other learners who will go through a similar process. Similarly, a facilitator may find it valuable to connect learners with an online community of subject matter experts who work in a contextually relevant field. In fact, an important aspect of building a community should be building links with other communities. As Brown and Duguid point out, "Isolated communities can get stuck in ruts, turning core competencies into core rigidities" (p. 6).

Facilitation plays a vital role within the organic knowledge-building model. While information objects, scaffolds, and discourse action communities give substance to the learning environment, facilitation gives it shape and form. Without facilitation, a learning community is merely the architectural equivalent of a pile of bricks.

Conclusion

Technology breakthroughs have always held the potential to improve life. However, it is only as we truly seek to understand the vast realm of possibilities available in these breakthroughs, and as we have the courage and inventiveness to utilize that technology in creative, heretofore unexplored, perhaps controversial but always challenging ways, that we can even begin to realize technology's potential to improve the quality of learning and life. Simply recreating the present in a more efficient manner seems wasteful, especially when the status quo is so ineffective. By itself, technology in learning is a benign force. However, when tools and learning strategies are combined and constructed in ways that expand our potential to learn, we give meaning to that technology.

Accessibility to technology is only half the equation. Technology has great abilities to carry and present information; however, learning is more than receiving and storing information. Information only becomes knowledge when people convert it through application. Human beings are social creatures who traditionally encourage, communicate, and share amongst themselves.

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Using Invariant Scales of Measurement and Principled Design Experiments to Increase Performance in a Domain of Learning

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Introduction

Principled design experiments are necessary to delineate a particular domain of learning. Principled design experiments are those experiments which take place over multiple cycles, and the results of previous cycles serve as controls for the next cycle (McGee & Howard, 1998). This method reduces the need for control groups. Past cycles now serve as the "control" with which future measurements can be compared (Bunderson, 2002). Knowing each learner's current status of learning (as a result of the continuous evaluation within each cycle) reduces the need for randomization. Randomization assumes equality, whereas principled design experiments know exactly where the learners are, without having to guess their current status. A domain of learning is a category such as math, science, literature, foreign language, manufacturing, etc. A delineated domain is one where we can tell within the domain what is easy, what is somewhere between easy and hard, and what is hard (Bunderson, 2002). Once a domain is delineated, we can begin to measure progress, give meaningful feedback, and instruct how to rapidly progress from lower levels to higher levels in the given category (domain). This is how principled design experiments increase performance within a domain of learning. By using principled design experiments we delineate a domain, and then efficiently increase performance within that domain by providing meaningful instruction, evaluation, and feedback. The instruction, evaluations, and feedback are all linked (connected) to the particular construct. A construct is a section, milestone, or benchmark within the domain (category of learning), and it can be either easy, somewhere between easy and hard, or hard to perform (Bunderson, 2002). These milestones are what are clearly delineated in a principled design experiment. In a principled design experiment, it becomes apparent that certain prerequisite constructs (sections, milestones, or benchmarks) must be mastered in order to progress to the next construct. Thus, in order to provide meaningful instruction, evaluation, and feedback, and ultimately to rapidly increase performance, it becomes necessary to develop "construct-linked" scales of measurement. These scales of measurement are connected to the clearly delineated milestones or benchmarks (constructs). Instruction and feedback that is linked or connected to all the skills in these construct-linked scales is meaningful and useful, and makes for efficient progress by eliminating unnecessary activities that are not tied to the construct linked scales and ultimately have no effect on an individual's progress within the domain.

In order for construct linked (benchmark-connected) scales to be useful, they must not vary or change in certain ways. In other words, they must be invariant in certain ways. By being linked to a construct, a scale already possesses one type of invariance – construct invariance. It is tied to an unchanging benchmark, instead of a statistical norm. Other types of invariance that are important are discussed in this paper. Principled design experiments, delineated domains, and construct-linked invariant scales of measurement are a powerful method to increase performance and progress in a rapid and efficient manner. This paper explains the elements that make up this powerful method by describing them in detail. Each element of this method is an essential piece, which, like a house or a puzzle, is incomplete if it is lacking.

Preliminary Steps to the Principled Design Experiment

Before beginning a principled design experiment, some important steps need to be taken.[1] A skilled teacher or trainer will readily identify these skills as those which are necessary to develop an effective course. Differences in these steps from other approaches are mainly in the depth of detail necessary for a principled design experiment and in the special attention that is paid to the ordering of tasks. The initial steps, therefore, involve collecting and ordering the information in a particular course, discipline, or sub-discipline (domain). Subject matter experts are particularly useful at this step, to aid in defining and prioritizing the information. Specifically, they can help to determine the following:

- Divide the topics into subheadings. This is the first step in completely understanding the category of learning (domain), and how to determine the levels of expertise of the students.

- Sequence the subheadings. This is necessary in order to know how to effectively instruct and present information logically and hierarchically, and to ensure that prerequisite skills are mastered and understood in order for future learning to be meaningful and effective. This step helps to determine which subheadings are easy, which are somewhere between easy and hard, and which are hard. It also becomes clear which subheadings can be taught before ***or*** after other subheadings. For example, in order to understand Calculus, it is necessary to understand algebra. The subheading (topic) of geometry, however, may be taught either before ***or*** after algebra.
- Initially place subheadings into categories. Where categories are defined as a set of subheadings that logically fit well together into a course, they need to be placed and ordered. For example, consider the course English as a second language (ESL). Subheadings should be divided up into the four categories of reading, listening, speaking, and writing.
- Develop an initial understanding of what constitutes various levels of expertise. Since the goal is to develop a robust scale of learning progress that can be re-used over and over, there must be a good initial understanding of the effort required to progress from what is easy, to what is somewhere between easy and hard, to what is hard.

In essence, the pre-principled design experiment work enables the instructor to identify the content of her course, provide a rationale for content inclusion, and outline a way to measure and improve student progress. Far too frequently in education we see a "shotgun" approach, where an instructor has a somewhat good idea of which categories should be included in the topic, but lacks the properly identified content and its rationale. In this situation, the particular instructor fails to recognize the importance of linking and ordering the skill set and knowledge base required to evaluate student learning. The pre-principled design experiment work is the first step in connecting categories to level of difficulty, and then level of difficulty to the student's achieved level of expertise.

Bethanie Newby's (2002) work-in-progress is an example of the preparation steps or the pre-principled design experiment work. Her topic is an introductory course on forced migration. This course entails people living in Third World countries who are forced to migrate due to famine, political unrest, social conflict, and/or war. After selecting this course, she created a list of content she felt would be important to include (i.e., the subheadings of the topic). With the use of the internet, she was then able to obtain additional assistance by observing the topics others teach in similar courses. Table 1 below provides a synopsis of how the topics were chosen.

Question asked of experts: *In an introductory university-level course on forced migration, what topics do you feel are important to cover? Choose all that apply.*	
Movement of people across national boundaries	Labor migration
Illegal migration	Forced migration
Trafficking	Migration changes since the end of the Cold War
Who are the migrants	Why do people migrate
Conceptualizing migration	Global networks arising from migration
Consequences of migration on sending and receiving states	Impact of migration on international institutions
Duties and responsibilities of states	Duties and responsibilities of international organizations
Policies of controlling entry	Absorption and integration of migrants
Policies concerning citizenship and nationality	Asylum policies
Definition of "forced migrants" (refugees and the internally displaced)	"Root causes" of displacement
Responses of asylum countries	Role of governments in protecting and assisting forced migrants
Role of international and non-governmental organizations in protecting and assisting forced migrants	Psychosocial needs of forced migrants
Consequences of forced migration on the environment	Consequences of forced migration on the public health
Consequences of forced migration on national security	Impact of forced migrants on host populations and governments
Coping mechanisms, survival strategies, and the psychological adaptation of affected populations	Resettlement
Vulnerable groups within forced migrant population	Physical (basic) needs of forced migrants – food, safety, shelter
Other ?	

Table 1. Newby, B. (2002). Topics for an introductory Forced Migration Course

Newby's (2002) next step was to have the experts rank the knowledge and skills required to understand forced migration, Table 2. This involved dividing the various ability levels by their respective ranking; see Table 3.

Level	Milestone
Beginning	Can explain concepts and terms. Understands scope (numbers, locations affected)
Low Intermediate	Understands causes of forced migration.
Intermediate	Can explain moral and ethical dilemmas. Can analyze and rank causes. Can analyze situations and explain their significance. Can participate effectively in a non-leadership, professional position.
Advanced	Can assess and design strategies, programs, and policies. Can make predictions of probable outcomes. Can monitor and evaluate situations.

Table 2. Newby, B. (2002). Initial ranking of forced migration constructs

B=Beginning L = Low Intermediate I = Intermediate A = Advanced

Example: B What is a refugee?

Ranking	Task
	Estimate the current, total number of forced migrants
	Identify target populations, or sub-groups, that are likely to migrate
	Describe the characteristics of a forced migrant
	Explain the differences between refugees and internally displaced persons
	Explain asylum, resettlement, and repatriation
	Discuss the "root causes" of forced migration
	What additional factors cause people to migrate?
	Describe national and international responses to forced migration
	For a given situation, analyze the causes of migration and identify the most vulnerable groups
	Identify the major players involved and discuss how their involvement affects the situation
	Volunteer at a local refugee centre to help process clients and direct them to appropriate services
	Volunteer at a local refugee centre to write press releases and news articles
	Analyze asylum policy for Country A, identify the five most common groups or types of migrants who seek asylum there, and explain the probable outcomes of their asylum requests
	Design population, health, environmental, and/or psychosocial programs or projects in the context of national and international policy
	Incorporate cultural factors in the design and management of projects/programs
	Evaluate development programs/projects in terms of their quality, effectiveness, and efficiency using qualitative and quantitative research techniques
	Research, design and promote asylum policy
	Assess critically strategic obstacles to successful repatriation programs/projects
	Use state-of-art information technologies in the design and monitoring of programs/projects
	Access and utilize effectively the programming resources of local, national, and international organizations engaged in forced migration activities
	What situations do traffickers exploit to bring themselves to profit

Table 3. Newby, B. (2002). Assignment of skill levels to tasks

Newby's final step in preparation for an actual principled design experiment with students – Table 4 – was to have the experts list the tasks from the previous step in a two-dimensional table, where columns are representative of proficiency of the person(s), and rows indicate the level of difficulty of the tasks.

	Less Proficient	More Proficient	Most Proficient
Easy			
Medium			
Hard			

Table 4. Newby, B. (2002). Ranking tasks by student proficiency and task difficulty

Upon completion of these steps, Newby is in an ideal position to begin a design experiment. Expertise can now be measured in an introductory course on forced migration.

This actual example illustrates the pre-principled design work. The efficacy of this course is borne out in the actual experiment. A live classroom setting will finally determine what needs to be changed or modified. Thus, there is an interaction between theory and data.

The Principled Design Experiment

Upon completion of defining the content of the course and its constituent subheadings, ordering the subheadings in terms of difficulty, and defining what constitutes the respective levels of knowledge, the instructor can begin the principled design experiment. This experiment's primary purpose is to delineate the domain rigorously, or map out the process of learning the course and create a *learning progress map.* As proposed by the authors, the design experiment involves unobtrusive methods for obtaining measures of progress. These unobtrusive measures come from *practice sessions with feedback.* Experimentation and research takes place in live settings in which repetitive cycles of implementation and *carefully principled design experiments* are used.

A few iterations of the design experiment may be required before the learning progress map is established. We avoid saying that the map is finished or completed because it will continue to change and evolve over time. Thus, our learning progress map requires continual and ongoing examination to ensure that it is still valid. Later sections in this paper detail this method of ongoing examination.

Once categories of the course are identified, testlets are used to check levels of understanding and knowledge gained in each milestone. Testlets are assessments of the individual benchmarks that comprise the domain. These mini-tests are directed at one milestone (construct) and are linked to each other. The instructor can readily determine, through the results of each testlet, how well each student comprehends a particular construct. Testlets are created with the following characteristics:

- Test students knowledge and understanding in only one category
- Simple to create, as there is a need for many of them in order to have continuous evaluation (an essential part of developing a domain theory of learning)
- Easily administered
- Unobtrusive
- Given many times during the duration of the course

The results of previous principled design experiment iterations, as obtained by the testlets, serve as controls for the next cycle. This reduces the need for control groups. This is possible since the process began with a solid initial model developed by subject matter experts. We use the design experiment to both observe how students compare with the model, and to see how the model holds up to the results and comments from the students. Thus, there is an interaction between theory and data. These results help the instructor perform necessary modifications of the model before beginning another iteration of the principled design experiment.

In the pre-principled design experiment phase, the instructor may have contrived, for example, a link between a category and an ability level. In the case of the course on forced migration, the consensus of the subject matter experts was that a novice student should be able to define forced migration, identify the population, list and describe distinctions, and understand the scope of the problem. This category could rightly be called "What is forced migration?" The instructor would then design a curriculum for this category, making sure to include all relevant topics, and any needed hands-on practice. At this point, the instructor would design the testlets for each topic in the category, and add more complexity as needed to capture the progression in learning. Testlet results will indicate the efficacy of the curriculum in producing the desired level of mastery, and will also pinpoint any needed adjustments. They will also show if the pace is appropriate. While design experiments are primarily geared toward the measurement of learner progress, they may also be used to strengthen curriculum development. In order to create an effective design experiment, the instructor must gather information during the pre-design phase that will address the following questions:

- What knowledge should be gained in each category?
- What cognitive links should the student be able to make with the knowledge gained?
- What behavior, performance, or functional skill should the student be able to apply upon mastering this category?

Once the curriculum has been developed using the dual model of understanding and performance (a central aspect of domain theory), the design experiment can be initiated. At this point, the instructor must then create testlets that will accurately measure the knowledge and ability each student gains in the given milestone. This is the first step in creating a valid measurement scale. The measurement scale is necessary for determining valid results and for future replication(s).

The resultant delineated domain of learning indicates which milestones are easy, which ones are between easy and hard, and which ones are hard (Bunderson, 2002). The domain theory (learning progress map with delineated benchmarks or milestones) contains a series of categories (sets of subheadings). Each principled design experiment should help us perfect the contents of each category. Thus there is repeated interaction between theory and data, as they continually refine one another. A principled design experiment helps us answer the following questions regarding subheadings:

- Do we have the proper subheadings in each category?
- Do these seem to fit together?
- Should they be divided in a slightly different way?

In addition to understanding the placement of subheadings, and their logical ordering scheme, each principled design experiment also helps us understand the amount of effort required to progress from one milestone to the next.

The Need for Proper Measurement and Invariant Scales

Throughout the principled design experiment, proper measurement is essential to improve student progress. Improper measurement can prevent progress in many different ways. False progress reports may erroneously lead an instructor to believe that certain teaching methods are effective at increasing performance, and may give students confusing and misleading results. Properly measuring the impact of teaching cannot be overemphasized.

Consider an example concerning a method of assigning numbers from 1 to 7 to people based on their abilities to swim (see also an excellent example in Fisher, 1993). The higher the number, the greater the ability. For example, the numbering system might go from (1) no fear of the water to (2) dog paddle to (3) floating to (4) somehow making it across a pool to (5) correctly performing the kick for the stroke called freestyle to (6) correctly performing the arm movements for freestyle to (7) correctly doing at the same time the leg and arm movements for freestyle. Julie might get a 7 because she can swim the freestyle stroke in perfect form. Diane might receive a 5 because she can do the leg action of freestyle, but not the arm action. Cheryl might receive a 3 because she can float on her back. Tom might receive a 1 because he is not afraid of the water, even though he would immediately drown if he fell in over his head. When the rating scale is used, the numbers are frequently recorded with equal distance between them as such:

1 2 3 4 5 6 7

This scale gives the impression that the numbers represent equal increases in ability. Is it necessarily true that adding two units of ability to Tom who was given the rating of 1 will get him up to the level of Cheryl who was given the rating of 3? Will adding two units of ability to Diane who was rated at 5 move her to the ability level of Julie, who was rated at a 7? No! They are numbers used improperly. This is an example of improper measurement, and of an error that occurs frequently. While a discussion of the fundamental theory of representation is beyond the scope of this paper, it is sufficient to say that this method of measurement violates it. Numbers are erroneously used to represent qualitative things.

Taking this example further, it may be possible that, when analyzed as the difficulty of moving from one category to the next, the numbers could be spaced as follows:

1 234 5 6 7

Adding the numbers is now meaningless. Adding them doesn't tell you anything. Perhaps you may feel embarrassed that you have done something similar. Take comfort in the fact that you are not alone. People in nearly all professions do it all the time. People who receive test scores twice as high as other people are commonly falsely assumed to be "twice as smart", and so forth. However, once it is known that the numbers in our example are not equally spaced, it not only makes no sense to add them, it also makes no sense to apply any sort of mathematics to them. Nor is it possible to perform any statistical analysis, hypothesis testing, ANOVA, etc. With improper measurement that is not calibrated to properly reflect the distance between the delineated constructs in a domain, we are left with numbers that are useless in measuring progress and improving performance.

How can this problem of measurement be solved? How can progress be measured? The following steps below explain a practical method for helping to remedy this problem.

1. Replace the numbers above with letters, so there is no temptation to do anything with them such as addition.
2. Develop a scale for effort. This will require time, as many observations of various levels of effort must be made to calibrate the scale.
3. Put the category letters on top of the newly created and calibrated scale.

You can now much more accurately measure the required amount of effort needed to get from one category to another. The end result might look something like this below:

1--|--3--|--5--|--7--|--9--|--11

A BCD E F G
1--|--3--|--5--|--7--|--9--|--11

We can now attempt to measure progress with this re-calibrated scale. A person at category level D needs to exert 4 units of ability to move to category E, while a person at level F needs to exert only 2 units of ability to progress to category G.

Proper measurement opens many doors to improvements in instruction and learning. Once measurement is occurring properly, " . . .we will be able to describe abilities, measure growth, discover interrelationships, examine rates of learning, diagnose difficulties, conduct experiments without the expense of simultaneous control groups and more effectively share and compare our experimental findings with others examining learning in the same domain (Pelton, 2001)."

As can be seen through the example above, proper measurement involves the development of a scale. The more accurate the scale, the better the results. In most cases in education, any improved scale will be better than most current measurement practices. Before we could measure progress in the example above, we needed a calibrated scale of physical ability. The development of scales for learner progress will be discussed in detail in the next section.

Developing a Measurement Scale for Learner Progress

The development of a measurement scale is a time intensive process. Nevertheless, its development is very rewarding in aiding both the instructor and the student to track and improve learner progress. It should also be fairly easy to modify over time and across situations, as circumstances and attitudes change. The scale is different for every topic or course of learning, as no one scale fits all. The example used in this section concerns English as a second language (ESL) speaking ability.

Strong-Krause (2001) developed a scale for learner progress in ESL communicative competence. Her work resulted in a process for scale development, a process which can be replicated. This process is called construct-linked scale development (CLSD). The four steps of CLSD are shown below in the ESL speaking ability example.

The first step is construct delineation, which breaks down the topic or course into various categories (constructs, subheadings, or benchmarks). It is in this stage where connections between observed phenomena are beginning to emerge, and the instructor at this point develops a possible reason for these connections. Strong-Krause broke down the ESL speaking ability course into ten task types with four variations within each task type. For example, one of the ten task types was narrating a personal story. The four variations of this task type were to tell about a recent vacation, tell about a difficult situation, tell about an experience as a child, and tell about a movie. Another task type was to give an opinion. Once these tasks or constructs were delineated, they were then able to be ordered.

Construct linked ordering – the second step of CLSD – starts when levels of expertise begin to be understood qualitatively in their logical order. Logical ordering of tasks consists of sorting physical or mental performances according to their levels of difficulty. Strong-Krause (2001) initially ordered her ten task types as follows, from easiest to most difficult:

1. Naming common objects
2. Giving personal information
3. Giving information about others
4. Dealing with typical social situations
5. Asking questions
6. Narrating a personal story
7. Narrating a story given a visual prompt
8. Dealing with a complication in a social setting
9. Telling about the future
10. Supporting an opinion

In order for the delineation and ordering to have an effect beyond one group of students, the third step must be carried out, which is developing a scale which is unchanging in certain ways: an invariant scale.

Although human emotions, intentions, desires and needs change from day to day, we can, with a high level of reliability, develop a measurement scale that won't vary much over time. We call this unchanging scale an invariant scale. Invariant scale development is the third step in CLSD. It is an essential step that must be developed. Without an invariant scale, our scale would be flimsy at best. Think of the example given earlier about swimming ability. Over time experts in teaching swimming could develop a relatively unchanging unit of effort that they could use to scale ability to swim. It could give them the measuring rod they need to measure and improve progress. If it were not relatively unchanging over time, it would be much more difficult for them to measure and predict progress in swimming. They could not accurately compare teaching methods nor rates of improvement. It would be more difficult to isolate cause and effect, diagnose potential complications, and discover interrelationships among teaching methods. A robust measuring rod helps in many ways.

When an invariant scale is developed, comparable measurements can be taken, regardless of the group of students taking the course. This is called sample invariance. Furthermore, testlets used to gauge skill level can change without affecting the scale, as long as the testlets continue to cover the same category in a similar fashion. This is called question invariance. A third type of invariance is that the scale has equal intervals. Invariance can be assured through the iterations of the principled design experiment. Each iteration will continue to help fine tune the scale.

Strong-Krause (2001) used experts in the field of ESL to develop a theoretical scale. The scale she developed is shown below in Figure 1. The numbers in the boxes coincide with those of the ten task types listed above in their order of difficulty.

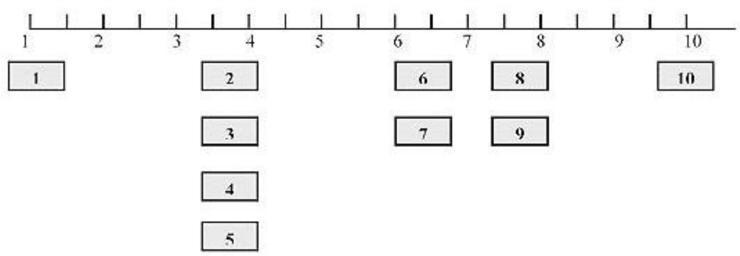

FIGURE 1. The theoretical distribution of the ten ESL task types on an equal-interval scale from 1 to 10.

The fourth step of CLSD – called construct-linked scaling – is where task difficulty is linked to level of expertise. "The development of a measurement scale provides the foundation to predict which skills are needed to complete tasks at a particular level of expertise" (Strong-Krause (2001), p 28). In the case of the ESL example, it is the relationship between the underlying language abilities and the performance on tasks, which determines the degree of mastery of those underlying language abilities that can be inferred. To continue using the example of ESL, Strong-Krause used the tasks identified above to help form a set of seven skill combinations. These skill combinations were statistically matched to a scale that rates proficiency. The seven skill combinations are listed as follows:

Skill A: Use simple structures with sentence-level discourse and most basic vocabulary.
Skill B: Use simple structures with sentence-level discourse with strong basic vocabulary.
Skill C: Use relatively complex structures with familiar tasks.
Skill D: Use simple structures with paragraph-level discourse.
Skill E: Use relatively comple x structures on a less familiar task with a solid vocabulary.
Skill F: Use relatively complex structures on a less familiar task with solid basic and some academic vocabulary.
Skill G: Use relatively complex structures on a less familiar task with a strong basic vocabulary, academic vocabulary, and specific content words.

Strong-Krause statistically linked the seven skill combinations to four different levels of examinee proficiency. This is shown in Table 5.

	Skill						
Proficiency Level	A	B	C	D	E	F	G
Beginning	40	30	25	25	25	20	20
Beginning High	50	45	45	40	40	35	35
Intermediate	65	65	60	60	60	55	55
Intermediate High/ Advanced Low	80	75	75	75	75	75	70

Table 5. Expected ratings for skill categories by examinee proficiency level.

The numbers in the table represent ratings, and have the following general interpretation: A rating close to 20 indicates that an examinee at the specified proficiency level cannot complete tasks requiring the described language skills. A rating close to 40 indicates the examinee is developing the required skills. A rating close to 60 indicates the examinee can perform the tasks that require the specified skills but with distracting errors. A rating close to 80 indicates the examinee can perform the tasks that require the specified skills with minor language errors. As can be seen, the table flows as expected. For example, an intermediate level person finds it increasingly more difficult to perform the ever increasingly more difficult skills, from Skill A through Skill G.

Thus, the end result of the construct-linked scale development is an ability to link task difficulty to the ability of the students, and to do so in a measurable quantifiable way. This takes time to perform, and usually a few iterations before modifications from one iteration to the next become minor. Over time, the process must be repeated periodically, as various factors such as traditions and levels of importance and emphasis change, thus affecting the validity of the scale – the topic of the next section.

Validity-centered Design

The model of learner progress will go through many interpretations and uses. As a consequence, it is never validated once and for all. The rationale for the model, the construct-linked scales, and the resultant findings and parameters and their uses must be validated over and over again. Validation must be at the center of the design of the learner progress model. "Validity-centered design as we currently understand it is the beginning of a principled [i.e., rigorous] design process for designing and developing improved [models], the construct-linked scales associated with them, and documenting the evidence for a validity argument" (Bunderson, 2002, p 12; see also Martinez, Bunderson, and Wiley, 2000). Validity-centered design consists of three major categories.

Category I is the design for usability, appeal, and positive expectations. If the overall learner progress model doesn't look good and feel good to the instructor and the students, it might become suspect. They might question whether or not it actually does what it's supposed to do. Suspicion about a learner progress model will begin to have a negative impact on the model itself. Nonetheless, this category is not verified in a rigorous method of statistical analysis, it is a more qualitative examination.

Category II is the design for inherent construct validity. Construct validity is the link between reality and the scores or measures produced by the instructor. If this link between reality and scores has been modified, then tests for construct validity should pick it up. Suppose that through the process of time changes in society or human nature or whatever cause a shift in the purpose for the course or the points that the course should emphasize. Then, it won't be valid anymore for its original purpose, and will need to be recalibrated before it can become valid again. These recalibrations reflect changes in the milestones or constructs in the domain.

Category III is the design for reliability and evidence of criterion-related validity. We try to answer questions such as the following: Can our results be generalized to a different gender mix, racial group, local group, etc.? Are there external evidences for the established learner progress model? Do we in fact see over time the results we anticipated? Once validity is established to a certain degree, and we are measuring progress over time more properly, we will likely encounter yet another phenomena while progressing in the domain of learning. Performance may actually dip before it gets better. This is a normal occurrence known as the "J" curve of implementation.

The *J*-curve of Implementation

An interesting consequence of implementing a new model into an existing course is that we frequently experience a dip in the outcome. This is a natural thing to expect, so we shouldn't be surprised. There are many reasons for this, but most can be summarized under the need for the team of teachers, assistants, students, and administrators to learn the new system and to make the new process gel. We call it the *J*-curve effect because – like the shape of a capital cursive *J* – outcome might go down first before it starts to pick up. See Figure 2.

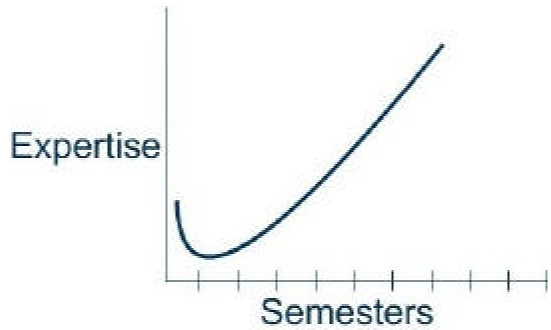

FIGURE 2. The J-curve of Implementation

An example of this occurred to Vic Bunderson several years ago while implementing a new process at Brigham Young University (BYU) called Time-Shared, Interactive, Computer-Controlled Information Television (TICCIT). The English Grammar and Composition course that was on TICCIT was used in several sections of English to prepare students to take the university-wide general education writing exam. Surprisingly, there was only one standard measurement system at BYU for all sections in the particular domain of English Grammar and Composition. The baseline average was 55% across the university. After the first semester, only 45% of those who followed the instructor using the TICCIT approach passed the General Education (GE) exam.

The team of developers and researchers, working with the English instructor who was using TICCIT, developed better implementation plans for the second semester. At the end of the second semester 72% of the class following the TICCIT method passed. Further implementation changes made between the second and third semesters lead to 84% of that semester's group of students in the TICCIT section passing the GE exam. At the end of the 4th semester 93% of this new group of TICCIT students passed the two-part GE exam. See Figure 3.

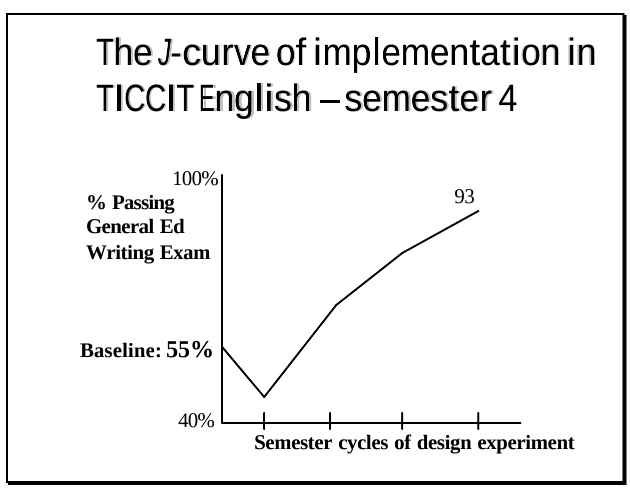

FIGURE 3. TICCIT design experiment results over four semesters.

Conclusion

In this paper, we have shown that principled design experiments are necessary to understand the levels of difficulty in a particular domain (area or subject) and also what those levels entail in terms of their constructs (milestones, benchmarks or key tasks). Because principled design experiments take place over multiple cycles, and the results of previous cycles serve as controls for the next cycle, this method reduces the need for control groups as past cycles now serve as the "control" with which future measurements can be compared. This method also eliminates the false assumption of equality, which happens when learning experiments attempt to utilize randomization. Principled design experiments know exactly where the learners are, without having to guess or assume their current status.

We have shown that once a domain is delineated (a particular subject or area is understood in terms of its levels and what those levels entail in terms of their key tasks), we can measure progress, give meaningful feedback, and instruct how to rapidly progress from lower levels to higher levels in the given category (domain). Principled design experiments increase performance within a domain of learning by providing meaningful instruction, evaluation, and feedback. The instruction, evaluations, and feedback are all linked (connected) to the particular key task or milestone at a given level in the domain. These milestones are either easy, somewhere between easy and hard, or hard.

In order to provide meaningful instruction, evaluation, and feedback, and ultimately to rapidly increase performance, it becomes necessary to develop "construct-linked" scales of measurement. These scales of measurement are connected to the clearly delineated milestones or benchmarks (constructs). Instruction and feedback that is linked or connected to all the skills in these construct-linked scales is meaningful and useful, and makes for efficient progress by eliminating unnecessary activities that are not tied to the construct linked scales and ultimately have no effect on an individual's progress within the domain.

We have shown that in order for construct-linked (benchmark-connected) scales to be useful, they must not vary or change in certain ways. We identified key types of invariance such as construct and invariance. Finally, we identified a phenomena known as the *J*-curve of implementation, which commonly occurs as we introduce principled designed experiments. As progress initially dips after the designed experiments, it will usually far surpass initial learning in an efficient fashion. Thus, although a dip in performance may initially be observed, principled design experiments with their resultant delineated domains and construct-linked invariant scales of measurement, prove to be a very powerful and effective way to increase performance and progress in a rapid and efficient manner.

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The Effect of Question Type and Grouping Strategy on Learning from a Multimedia Database

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Abstract

This study investigated the comparative effects of adjunct questions, student self-generated questions, and note taking on learning from a multimedia database. High school students worked individually or in cooperative dyads on a computer-based multimedia unit using a study guide to answer either adjunct questions, generate self-questions, or take notes to accomplish a learning task focusing on the events of the civil rights movement in the United States.

One hundred seven students attending a high school in the Southwest were the participants for this study. Prior to the beginning of the study, each student was randomly assigned to one of the six treatment groups. Materials in this study included a multimedia database and a Student Packet , which included a study guide listing relevant resources to review and a questioning or note-taking strategy to assist students in learning the material from the database.

There were two criterion measures in this study, a posttest and an attitude survey. Other data collected included informal observations, student interviews and review of the student study guides.

The dependent variable was achievement as determined by posttest score. Analyses were conducted using both traditional Analysis of Variance (ANOVA) techniques as well as hierarchical linear modeling (HLM). Results of the ANOVA indicated that students in the note-taking treatment condition performed significantly better than students working in the self-generated question treatment condition. However, because of the dependency of scores of students working in pairs, it was determined that HLM techniques were more appropriate. Results of these analyses did not yield significant differences in posttest scores among the treatment conditions, although the correlations of posttest scores of students working in pairs seemed to indicate possible levels of cooperation. Student interview responses and review of student study guides seemed to provide indications of how students utilized the questioning or note-taking strategies while working in this environment. Implications for the design of instruction are discussed.

Introduction

The explosive growth in computers and related technologies has led to the development of a variety of innovative learning approaches. One aspect of this technological advancement has focused on an increased use of open-ended learning environments (OELEs). Incorporated in many of these environments is a focus on providing the learner with control of the learning process (Hannafin & Land, 1997). The responsibilities of the learner often include asking relevant questions, pursuing needed knowledge, and evaluating the learning experience. These types of learning processes require the learner to use various cognitive and metacognitive strategies (Hannafin, Hill, & Land, 1997).

Results of previous research have suggested that some learners may meet the cognitive and metacognitive demands of learning in these types of environments, however, many do not (Hannafin, Hill & Land, 1997; Land, 2000). Very often, OELEs are developed with a variety of tools and resources the learner could use to facilitate and enhance the learning process. Regardless of the apparent power and usefulness of the tools, however, it is unlikely that learners will automatically use them if they do not understand how they can be of assistance (Land & Hannafin, 1996; Scardamalia, Bereiter, McLean, Swallow & Woodruff, 1989). Some learners continue to rely on, or even to prefer, externally-directed methods for leaning (Land & Hannafin, 1996), therefore, prompting them can perhaps induce greater reflection on the learning process and determination of their own level of comprehension (Brush & Saye, 2000; Pressley, 1995).

Student monitoring of their learning and comprehension can be facilitated by utilizing various techniques during the learning process. In their review of the research on comprehension monitoring strategies, Dole, Duffy, Roehler, and Pearson (1991) indicated that students who are asked to determine importance, summarize information, draw inferences, and answer teacher-generated as well as student-generated questions recall and retain more information from text passages. Therefore, to assist students in learning more effectively in these types of environments, various learning and instructional strategies may be employed. The learning strategies that may be effective include adjunct questions, student self-generated questions and note-taking and the instructional strategy of grouping.

Adjunct Questions

Within open-ended learning environments, it is necessary for students to be actively engaged in their learning. In order to accomplish learning activities, students need to analyze the learning task, then determine the manner in which they will accomplish the task (Brush & Saye, 2000). Since many students are not able to successfully manage these responsibilities, learning can be facilitated by the use of adjunct questions (Hamilton, 1992). Adjunct questions are usually found in textbooks following text passages or are developed by teachers to focus students on a specific learning task (Andre & Anderson, 1978-1979).

In a review of the research, Hamaker (1986) analyzed 61 published experiments that focused on the effects of adjunct questions on comprehension. Findings from this review indicated that inserted postquestions seem to enhance comprehension by facilitating the mental processing of text information. Postquestions seem to enable the learner to develop a sense of attention to the particular type of information being questioned. This increase in attention appears to influence performance on all types of test questions, even those not directly related to the adjunct questions.

Student Self-generated Questions

Though results of many studies have shown that providing students with adjunct questions to answer while reading text can improve their recall of information, development of appropriate questions may be dependent upon extensive work done by instructors prior to instruction. But where such teacher-generated questions are not available, students can still monitor their learning and comprehension through the use of self-questioning (Andre & Anderson, 1978-1979). During self-questioning, learners can monitor their understanding of the lesson content by asking and answering questions for themselves (King, 1991).

Generating self-questions while reading appears to have an influential effect on comprehension due to the activation of various cognitive processes. In order to construct questions, students must encode all of the textual information to make a decision about what is and what is not question-worthy information (Frase & Schwartz, 1975). This entails a deeper semantic analysis of the text than simply reading the text (Andre & Anderson, 1978-1979). By posing questions for themselves, it is necessary for students to control their cognitive processes such as focusing attention on the content to be learned, and determining the organization of ideas (King, 1991).

There has been considerable research on the effects of self-questioning on student comprehension. In her review of 27 studies on the use of self-questioning as a reading comprehension strategy, Wong (1985) found that students using self-questioning during reading generally comprehended more than did students who used other strategies.

Note Taking

Because multimedia databases use ill-structured design, students working with these do not simply respond to the systems, but become an integral part of them (Land & Hannafin, 1996). While working in these environments, students need to determine what information is relevant and necessary to successfully achieving the learning goal.

One strategy that has been found to assist students in selecting important information from instructional materials is note taking. Note taking is an activity that is almost automatic for many students since it is so prevalent. There has been considerable research focusing on the effects of note taking on student learning (Fisher & Harris, 1973; Kiewra, 1989; Kulhavy, Dyer, & Silver, 1975). Results of these studies seem to indicate that during note taking, students are actively processing the learning material. Through this active engagement with the learning material, students are better able to encode new information. The encoding function of note taking suggests that through the process of recording notes, students may have increased attention, they may elaborate more on specific ideas, and may even reorganize new information and put it into their own words (Fisher & Harris, 1973; Kiewra, 1989).

Cooperative Learning

While utilization of these learning strategies may effectively improve learning, social interaction with others can also be valuable. Individually and socially mediated monitoring are complementary and are both important for helping students learn to reflect upon their learning (Lin, Hmelo, Kinzer & Secules, 1999). Often the reflection process can be improved by comparing and contrasting one's learning to others. In this sense, social interactions may point to new ways of thinking about learning (Johnson & Johnson, 1986). Cooperative learning techniques are typically used in education to encourage this type of social interaction.

Despite considerable research that has been conducted on the effects of these strategies, there are still gaps in our knowledge. Still to be investigated are the comparative effects of adjunct questions, student self-generated questions, note taking and grouping on student achievement in multimedia-based learning environments.

Purpose of the Study

The purpose of this study was to investigate the effects of question type (adjunct questions, student self-generated questions and note taking/control) and grouping strategy (individuals and pairs) on learning from a multimedia database.

Method

Participants

One hundred seven students attending a high school in the southwest were the participants in this study. There were 57 male and 50 female students. All participants were enrolled in an American Government class.

Materials

Materials in this study included *Decision Point!*, a multimedia database relating to the African-American civil rights movement (Brush & Saye, 2000; Saye & Brush, 1999). The database featured primary print documents in the form of newspaper and magazine articles, political and editorial cartoons, and personal accounts as well as video new footage, interviews, and music. Students were also provided with a Student Packet that consisted of a task sheet providing brief background information about the lesson content, a study guide listing relevant resources and a questioning or note-taking strategy, instructions for completing the lesson using the study guide, and a job aid to assist in navigation of the database.

Procedures

The study took place during regular class periods over three consecutive days. During the first two class periods, students worked with the *Decision Point!* database completing their study guides. On the third day, students completed the posttest and attitude survey. Each class period lasted 52 minutes.

Prior to the beginning of the study, each student was randomly assigned to one of the six treatment groups. Students who were assigned to one of the three cooperative dyad treatment conditions were then randomly assigned to a partner. Students in the cooperative dyads worked with the same partner during the two class sessions using the database.

Criterion Measures

There were two criterion measures in this study, a posttest and an attitude survey. The posttest was a paper-and-pencil instrument designed to measure student achievement on the lesson task using the *Decision Point!* database. The posttest was worth a total of 16 points and included 13 multiple-choice items, worth one point each, and one short answer item, worth three points.

A 12-item attitude survey was administered following the posttest. The first ten items were Likert-type items using a four-point scale ranging from Strongly Agree (4) to Strongly Disagree (1), and the last two items were open-ended response type items. The ten Likert-items were based on four themes; two questions asked students to rate their preference for working with a partner or working alone, four questions asked students to rate their preference for working with computer-based lessons, three questions asked students to rate the impact the study guide had on their learning of the material, and one item asked students to rate their effort in working through this lesson. The open-ended response items asked students to provide at least one thing that they liked the most about the lesson and one thing that they liked the least about the lesson.

Other data collected included informal observations, student interviews and review of the student study guides. Informal observations were conducted during the two data collection days. Student questions and comments regarding the lesson were recorded. After completing the lesson posttest and attitude surveys, two students from each treatment condition were randomly selected to participate in an interview with the researcher. The interview followed a scripted protocol. Student Study Guides were also collected and reviewed by the researcher to determine whether students followed specific treatment directions in working through the lesson.

Design and Data Analysis

The experimental design for this study was a posttest-only, control group design with random assignment of students to treatments. It was a three (adjunct questions, self-generated questions, note taking/control) by two (individual, informal cooperative dyad) factorial design. The dependent variable was achievement as determined by posttest score. Analyses were initially conducted using Analysis of Variance (ANOVA) followed by Hierarchical Linear Modeling (HLM).

It is expected that posttest scores of students working in cooperative pairs may be more similar than scores of students between pairs. The similarity may indicate a correlation or dependency in the scores. Analysis did indicate that dependency did exist between the scores of students within the cooperative pairs. Traditional ANOVA is not robust to a violation of the dependency assumption, consequently, analysis of variance using HLM was conducted.

Hierarchical linear modeling is similar to traditional ANOVA in that the major interest is in determining main and interaction effects. HLM directly assesses the correlation of scores of students within cooperative pairs and takes that into consideration in determining significant main and interaction effects. These correlations provide interpretable information and may indicate cooperation between students working in pairs. A positive correlation may indicate cooperation between students working in pairs; zero correlation may indicate lack of cooperation or indifference between students working in pairs; and a negative correlation may perhaps indicate competition between students working in pairs. The result of HLM analysis is likely to differ from traditional ANOVA to the extent that dependency does exist.

The HLM model used to analyze the achievement data was the least restrictive, in that it allowed the variances and covariances to vary across all three cooperative groups. This model also allowed for different variances across all six treatment conditions.

Attitude data were analyzed using both analysis of variance (ANOVA) and HLM. For simplicity, the same HLM model that was used to assess the two main and interaction effects for the achievement data was used to analyze the attitude data. Open-ended item responses were analyzed and categorized by discernable themes. The frequency of responses in each thematic category was then calculated.

Notes from the informal observations were compiled and summarized. Interview question responses from 12 students were summarized by treatment condition.

All Study Guides were reviewed to determine whether students completed the lesson following the specific directions provided in their Study Guides. Evaluation was based on the appropriateness of the responses, questions generated, and notes for each resource reviewed. For the Study Guides from the adjunct question treatment conditions, the student responses to each of the adjunct questions were reviewed to determine whether the response written down pertained to the particular resource. For the Study Guides from the self-generated question treatment condition, both the questions and responses were reviewed to determine whether the question and response were related to the resource. For the Study Guides from note taking treatment condition, student notes were reviewed to determine whether the notes included information found in the particular resource.

Results

Results are reported below for posttest performance and review of the student study guides only. Results from informal observations, and interview responses will be provided in the full research report to be published at a later date.

Posttest Achievement

The means and standard deviations for posttest performance as a function of the two factors are presented in Table 1. In the sample, individual treatment mean posttest scores were highest for students in the adjunct and note-taking treatments. The mean score for students in the adjunct treatment was 10.84 (SD = 2.52) and for students in the note-taking treatment the mean score was 10.63 (SD = 2.59). The mean score for students in the self-generated question treatment was 9.41 (SD = 2.85). A similar pattern occurred with mean posttest scores in the sample cooperative dyad treatment conditions. Again, the highest mean posttest s cores were for students

Table 1 Posttest Means and Standard Deviations by Question Type and Grouping Condition

	Adjunct Question	Self-generated Question	Note Taking	Total
Individual	M = 10.84 SD = 2.52 n = 19	M = 9.41 SD = 2.85 n = 17	M = 10.63 SD = 2.59 n = 19	M = 10.33 SD = 2.67 n = 55
Informal Cooperative Dyad	M = 10.22 SD = 3.32 n = 18	M = 9.25 SD = 3.53 n = 16	M = 11.44 SD = 2.23 n = 18	M = 10.35 SD = 3.13 n = 52
Total	M = 10.54 SD = 2.91 n = 37	M = 9.33 SD = 3.15 n = 33	M = 11.03 SD = 2.42 n = 37	M = 10.34 SD = 2.89 n = 107

Note. Maximum score = 16.

participating in the adjunct and note-taking treatments. The mean score for students in the adjunct treatment was 10.22 (SD = 3.32) and for students in the note-taking treatment, the mean score was 11.44 (SD = 2.23). The mean score for students in the self-generated question treatment condition was 9.25 (SD = 3.53).

A 3 x 2 traditional Analysis of Variance (ANOVA) and Hierarchical Linear Modeling (HLM) were conducted to evaluate the effects of the three question type conditions and grouping on posttest performance. Table 2 provides an ANOVA summary table for posttest performance scores. The traditional ANOVA indicated a significant main effect for question type, $F(2, 101) = 3.25$, $p = .04$, partial $?^2 = .06$, but no significant effect for grouping, $F(1, 101) = 0.00$, $p = .98$, partial $?^2 = 0.00$ and no significant interaction between question type and grouping, $F(2, 101) = .61$, $p = .55$, partial $?^2 = .01$.

Table 2 ANOVA Summary Table for Posttest Achievement Scores

Source	*df*	*F*	Partial $?^2$	*p*
Question Type	2	3.25*	.06	.04
Grouping	1	0.00	0.00	.98
Question Type by Grouping	2	.61	.01	.55

Note: $^*p < .05$.

Follow-up tests were conducted to evaluate pairwise differences among the means. Because the sample variances among the three groups ranged from 4.97 to 12.46, it was assumed that the variances were not homogeneous and post hoc comparisons using the Dunnett's *C* test were conducted. Dunnett's *C* is a test that does not assume equal variances among the groups. Results indicated that there were significant differences in the means between the note-taking treatment condition and the self-generated question treatment condition at the .05 level. The students in the note-taking treatment condition earned a significantly higher posttest mean score than did students in the self-generated question treatment condition. The results of these tests, as well as the means and standard deviations for the question type treatments, are reported in Table 3.

Table 3 Differences Among Posttest Scores for the Question Type Treatment Conditions

Question Type	M	SD	Adjunct Question	Self-generated Question
Adjunct Question	10.54	2.91		
Self-generated Question	9.33	3.15	NS	
Note Taking	11.03	2.42	NS	*

Note. NS = nonsignificant differences between pairs of means, while an asterisk (*) = significance using the Dunnett's *C* procedure, p < .05.

Posttest scores between students working in pairs may be similar and results from ANOVA may not be reliable in these situations. Though much of the previous research investigating the effects of cooperative grouping on learning has been analyzed using ANOVA techniques, it was determined that hierarchical linear modeling may be a more appropriate type of analysis to utilize (S. Green, personal communication, February, 2002). While the results of the HLM analyses are interesting, they should be viewed with caution due to the small sample size of this study.

In analyzing the data for the current study, multiple mixed models were conducted. All models included the main and interaction effects for question type and grouping, but differed in the estimation of variances and covariances within cells. The most complex model allowed for different residual variances among the six cells and different covariances between pairs in the three cooperative learning conditions.

After thorough evaluation, it was determined that the first model should be considered the best model for the data since it was the most conservative, allowing for the fewest assumptions. In this model, the variances and covariances were allowed to vary. Based on this, results of hierarchical linear modeling indicated no significant main effect for question type, $F(2, 75) = 2.60$, $p = .08$, no significant main effect for grouping, $F(1,75) = 0.00$, $p = .99$, and no significant interaction between question type and grouping, $F(2, 75) = .61$, $p = .55$. Results of this analysis are presented in Table 4.

Table 4 HLM Summary Table for Posttest Achievement Scores

Source	*df*	*F*	*p*
Question Type	2	2.60	.08
Grouping	1	0.00	.99
Question Type by Grouping	2	.61	.55

Note: *$p < .05$.

Review of Student Study Guides

All of the student study guides were reviewed to determine whether students used the question or note taking strategy provided in their study guides, and for indications as to how they may have used the particular strategy. Review of the study guides for the adjunct treatment condition found that students answered the questions, though the thoroughness of the written responses varied. Some students provided short, one sentence answers and others wrote out lengthy responses including several short paragraphs. Study guides of students participating in the adjunct treatment cooperative dyad treatment condition revealed mostly identical responses written by both members of the dyads.

Review of the study guides for students in the self-generated question treatment condition found that students generally used the study question starters provided. Most of the questions they wrote, however, were not related to the lesson objective, but focused instead on unimportant details found in the resource documents. Study guides for students participating in the cooperative self-generated question treatment condition included questions created using the study question starters, but again, many questions were unrelated to the lesson objective. The questions and responses written by students within the dyads were typically identical.

Review of the study guides for students in both the individual and cooperative note-taking treatments found lists of bulleted items, matrices of information, columns of information with headings, and arrows pointing from one note to another. For many students in the cooperative dyads, the notes recorded by one student were not the same as those recorded by their partner, and sometimes the amount of information recorded varied as well. Overall in comparison, it appeared that generally students in this treatment condition wrote down more information than students in the two question-type treatment conditions.

Discussion

Overall Achievement

Results for achievement indicated that variations in question type and grouping strategy yielded similar effects on student performance on the unit posttest. The level of student achievement was fairly low and there were not significant differences in scores among students in the six treatment conditions. Nevertheless, the results of this investigation provide important findings useful for improving learning in multimedia-based environments.

Overall, there seem to be several factors that may have contributed to the general tendency of these results. During the design of this investigation, conversations with the high-school teachers revealed that most of their instruction was expository in nature. Students had not used any type of computer-based instruction (CBI) in their social studies courses and it was unlikely that they had used CBI in any of their other high-school courses. Students participating in the study were also not familiar with the events of the civil rights movement in the United States. The content information and lesson included as part of this investigation were to serve as an introduction for their instructional unit on civil rights, which was to begin the week following data collection. Therefore, both the *Decision Point!* database and the events of the civil rights movement were unfamiliar to the students. The novelty of the learning experience in terms of both multimedia-based instruction and lesson content may have limited student achievement levels. Other researchers have noted the importance of these two elements in influencing learning from multimedia learning environments (Hill & Hannafin, 1997; Land & Greene, 2000).

Another factor that may have contributed to the low achievement scores may be the students' lack of skill in critical reasoning about social issues. From their previous social studies classes, students were accustomed to expository instruction in which they were told what was important to learn. During data collection, several students commented "How do I know what is important?" and "All the documents are saying the same thing." Questions and comments such as these seem to indicate students' unfamiliarity in working not only in an ill-structured learning environment but also with an unstructured subject domain such as social studies (Scheurman & Newmann, 1998; Wineburg, 1991). These findings are similar to those from previous research utilizing the *Decision Point!* database (Brush & Saye, 2000; Saye & Brush, 1999). In their investigations, students also complained about repetition in the database documents and the lack of capsule summaries. These researchers suggested that students were confused by the messiness of the raw data and were not adequately prepared to interpret, synthesize, and evaluate the primary documents found in the database. Brush and Saye (2000) suggest that in order for students to work more successfully in these types of environments, they need more experiences in problem-based discovery methods and perhaps more structured support throughout the learning process.

Individual versus Cooperative Grouping

Achievement as indicated by posttest scores of students participating in the cooperative dyads was similar to the achievement of students in the individual treatments. Other researchers investigating the impact of cooperative grouping on learning in computer-based environments, too, have not always found significant differences between individuals and cooperative groups (Cavalier & Klein, 1998; Crooks, et al., 1996; Crooks, et al., 1998).

There may be several possible reasons that cooperative grouping did not have significant effects on learning in this study. Previous research on cooperative grouping has outlined components critical to the effectiveness of this instructional strategy in computer based learning environments (Johnson & Johnson, 1986; Johnson & Johnson, 1996; Johnson et al, 1986). These components include positive interdependence, individual accountability, shared leadership, shared responsibility for each other's learning, and the processing of group effectiveness. The absence of any these elements may prevent the beneficial effects of cooperative learning.

Random assignment was used to compose the cooperative dyads. Because of this, students may have been working with a partner that they did not know prior to this lesson. This unfamiliarity may have inhibited the manner in which students worked together. Even though students were given detailed instruction sheets describing how they should work with their partner to review the various database resources utilizing their particular questioning or note-taking strategy, the instructions may have been deficient in providing explanation of the other elements critical to effective cooperative learning. In a review of research on the effectiveness of cooperative grouping on achievement in computer-based instruction, Susman (1998) suggests that students may not truly understand how to work with a partner or may be lacking in the skills necessary to interact effectively. Her review found that when researchers included training on the key elements of cooperative learning, student achievement was higher.

The present study represents a departure from previous methodologies in that this study compared the effects of question type and note taking on student achievement on a multimedia-based lesson. Researchers in earlier studies have often compared the effects of a particular learning strategy condition to those of a control group condition not utilizing a learning strategy. For example, in previous research focusing on the effects of adjunct questions on student learning, many of the studies finding significant effects compared adjunct questioning treatments to control groups receiving no questions (Hamaker, 1986). The current study, however, provides insight into the effectiveness of three various strategies on student learning in a multimedia environment.

Adjunct Questions

In the current study, the adjunct question study guide provided students with a resource to review and a related question to answer. From the format of the study guide, students were able to read the adjunct question prior to reading the related document. Student responses to the interview question asking how they utilized this questioning strategy indicated that they would read the question first then search the document for the answer. Previous research on adjunct questions has suggested that when allowed to review the text after encountering the question, students are less motivated to study the entire text, but process the text superficially, searching for the response to the question (Hamaker, 1986).

In the Brush and Saye (2000) investigations described earlier, categorizing questions were provided within the *Decision Point!* database to help students organize and synthesize information about a particular event. Students initially ignored the questions, and even after being prompted to use them, they simply filled in the spaces without thoughtful reflection of the material reviewed and the possible connections to the learning goal (Brush & Saye, 2000; Saye & Brush, 1999). The lack of requisite content knowledge may have inhibited the effectiveness of the adjunct questions.

The amount of prior knowledge a student has can affect his or her ability to learn new information. Without prior knowledge, it may be difficult for students to understand the significance of new material, to select main ideas, and to disregard unimportant details (Brown, Campione, & Day, 1981). In order to comprehend new information, it is necessary for students to actively generate relationships between the new information and previous knowledge and experiences (Shuell, 1988; Wittrock, 1990).

While the effects of the adjunct questions on learning were similar for both the individual and cooperative grouping treatments, the results indicate other interesting findings. Analysis of the posttest scores for the cooperative dyads utilizing the adjunct questioning strategy indicated a fairly strong correlation between the scores of the individuals within the dyads. Review of the student study guides found that student responses to the adjunct questions were similar in some cases but identical in most. This may indicate that students worked together to formulate the answers to the questions.

Answering questions perhaps promotes more student interaction, thereby facilitating learning. This finding is similar to those of previous research studies focusing on student interaction in cooperative groups (Webb, 1982a; Webb, 1982b). Results from Webb's studies indicated that giving and receiving explanations had a positive effect on learning. By giving explanations, students need to create verbal associations from the information being reviewed and may involve generating new elaborations. Receiving information from another student may enhance learning because students tend to use language that other students understand and tend to recognize each other's nonverbal cues about whether they comprehend the material.

Other research has found that generating solutions to questions embedded in a lesson and explaining how a solution was determined was positively and significantly correlated with success (Hooper, 1992). Students who generate solutions to questions and who form mental elaborations by explaining lesson concepts to their partners may process lesson content at a deeper level and demonstrate higher achievement than would more passive students. An important goal, therefore, may be to promote active learning in cooperative groups.

Student Self-generated Questions

Much of the previous research on student self-generated questions has focused on the effects of student learning using self-generated questions from text -based lessons (Andre & Anderson, 1978-1979; Frase & Schwartz, 1975; Wong & Jones, 1982). Other research has focused on the effects of student self-generated questions on lecture comprehension (King, 1989). The use of student self-generated questions to enhance learning in a multimedia environment is a new consideration.

The creation of questions while working through a lesson was a novel learning strategy for the students in the current study. Students participating in this treatment condition were given a study guide indicating relevant resources to review along with ten possible question starters and detailed written explanations for generating questions.

Review of the student study guides indicated that students used the question starters that were provided. Many of their questions, however, focused on unimportant details found in the database documents, and not information that was relevant to the lesson objective - to determine where the civil rights activists were more successful at achieving their goals. Some examples of student generated questions included, "What is the significance of June 13, 1963?", "Compare and contrast the NAACP with SNCC.", and "How many people were arrested on April 6?" The inability of students to generate questions focused on the lesson objective may also be due to lack of prior content knowledge.

Lack of prior knowledge may lessen the students' ability to generate topic-related questions (Wong, 1985). To be able to ask a question, a student needs to have an optimal amount of prior knowledge for the particular subject matter. This may be particularly important when working in a multimedia database because of the unstructured nature of this type of learning environment and the vast amount of resources available to the student (Greene, 1995; Saye & Brush, 1999). Generating questions does not directly lead to comprehension of information, but the process of generating appropriate questions and searching through the database for answers may help students combine new information with their prior subject knowledge (Rosenshine, Meister, & Chapman, 1996).

Generating questions that are either too broad or too narrow has been described as "question drift" (Land, 2000; Land & Greene, 2000). Question drift exists when a student asks a question and then attempts to find information that has something to do with that topic. If the student does not find information related to their question, they may change directions and reformulate their question to match the information they have found.

Similar to the findings from those in the adjunct treatment condition, analysis of the posttest scores for the cooperative dyads utilizing the self-generated questioning strategy indicated a fairly strong correlation between the scores of the individuals within the dyads. Review of the student study guides indicated that both the questions and the responses for each student in the pair were typically identical. Again, this seems to indicate that students worked together to create the questions and the answers. Similar to the findings for the individual treatment condition, the students used the question starters, however, many of their questions focused on unimportant details found in the database documents, and not information that was relevant to the lesson objective.

Though other researchers have found student self-generated questions to have a positive effect on the posttest performance of high-school students (King, 1991; Wong, 1985), many of these studies included extensive self-questioning training programs. In the current study, however, students were successful in using the question starters to generate questions. Their inability to generate questions that focused on the lesson objective may be attributable to the students' lack of prior knowledge and their inexperience in interpreting content information that is presented in an unstructured manner. This seems to indicate that students primarily need more support in interpretation of original source documents, and secondarily support in generating questions relative to the goal of the lesson.

Note Taking

In the current study, students in the note-taking treatment achieved the highest posttest scores, though the differences were not significant. Students in the note-taking treatment were given a study guide indicating relevant resources to review. A blank area was provided after each resource listed for students to record important information.

Results from previous research indicate that note taking can be an effective study strategy (Dyer, Riley & Yekovich, 1979; Kulhavy, Dyer & Silver, 1975). Findings from these studies have shown that students taking notes while reading were able to focus their attention in a selective manner on certain parts of the material. Through the process of note taking, students are able to reorganize the data and put it into their own words. This transformation process appears to assist students in the encoding process that is critical to effective learning (Fisher & Harris, 1973).

Review of the student study guides from the note-taking treatment produced several interesting findings. When recording information, many students created bulleted lists, and organized information into columns with headings. Other students created diagrams to organize material found in the database and some used arrows which seemed to indicate cause-effect relationships between situations described in the documents. The use of these types of elaboration and organizational techniques may enhance student learning (Weinstein, 1988). By paraphrasing and creating schemes to organize information, students are actively involved in their attempt to learn the material. Adding some sort of symbolic construction to new information seems to make information more meaningful to the student and may enhance learning and recall of information.

Another advantage of note taking as a study strategy seems to result from the time students spend studying the material (Kulhavy, Dyer & Silver, 1975). Results from previous research found a positive relationship between achievement of students taking notes and study time. The researchers speculated that the high performance of students taking notes may be due to the fact that they spent more time with the material. Though time on task was not tracked in the current study, review of the student study guides in the note-taking treatment shows a quantitative difference from the other two treatments in the amount of information written down. Since students in the note-taking treatment recorded more information than those students in either of the other two questioning treatments, perhaps they read more of the document which may have facilitated their learning. Student responses to the interview question asking them how they utilized the note-taking strategy found that all of them read the document while writing down information that they found to be important.

For many students, note taking is a study strategy that they are very familiar with and commonly use. In a previous study investigating the study strategies used by students in a computer literacy course, students were asked to describe the study strategy they used the most for learning the material in that course and all of their other courses. The majority of students indicated that in both situations reading the textbook and taking notes was their most preferred method of study (Niemczyk & Savenye, 2001). In the current study, in response to the interview question asking students how they learn the best, several students stated that taking notes was their most effective learning strategy.

In contrast with the results found in the adjunct question and self-generated question treatment conditions, posttest scores for the individuals within the dyads in the note-taking treatment had a negative relationship. Within some of the dyads, the posttest score for one student was high, while the posttest score for the other student was low.

Review of the study guides for the students participating in the cooperative dyad treatment condition found, that for some dyads, the information written down was similar, but for others, it was different. This seems to indicate that students were writing down information that they determined was personally important to them. The lack of similarity also seems to indicate that students in this treatment condition may not have had as much interaction as did students in the other two treatments.

Another interesting finding from review of the study guides revealed that for some dyads the amount of information written down appeared to diminish as the students progressed through the study guide. Within these dyads, the study guide for one student contains a comprehensive set of notes, while the other student's notes seem to decrease and even stop in some cases. This may be attributable to students' lack of skill and understanding of the elements necessary to effective learning in cooperative groups. Previous research has yielded similar findings in that one student may interact directly with the computer while the other student watches (Susman, 1998). When one student is interacting with the computer and the other student is watching, they are not acting as a team and may therefore not receive the benefits of cooperative learning. For learning to be successful, students need to be active in the processing of information (Brown, Collins & Duguid, 1989; Shuell, 1988).

Implications

The results of this study have implications for the design of instruction using multimedia databases. Though previous research has found adjunct questions, student self-generated questions and note taking to be effective strategies in text and lecture-based lessons, they may not be adequate in assisting student learning when working with multimedia databases. Because of the unstructured nature of multimedia databases, students may need more explicit instructional support in problem solving and critical thinking skills (Saye & Brush, 1999). It may also be necessary to provide students support in monitoring their learning and understanding when working in a complex environment. Managing these processes can be especially challenging for learners with little prior content knowledge and lack of experience in working with unstructured learning environments (Hannafin, Hill & Land, 1997; Land, 2000).

By design, multimedia databases provide students with vast amounts of resources in an unstructured manner. Because of the open-endedness of the learning environment, it may be necessary to provide students with instructional support that is appropriate for their particular learning situation, making the need for the support to be dynamic. It may therefore, be beneficial to incorporate more teacher-student interactions when utilizing these databases. Other researchers (Land, 2000; Brush & Saye, 2000) have suggested that when using OELE's, teachers could provide students with guiding questions and encourage discussions explicitly aimed at promoting deeper understanding of the lesson content.

Conclusion

As the incorporation of technology and multimedia databases continues to increase in use in classrooms, it is important to determine how they might be used most effectively in enhancing student learning. This investigation was the first study to focus on the comparative effects of adjunct questions, student self-generated questions and note taking on student learning in these environments. It was also determined through this study that hierarchical linear modeling techniques may be most appropriate in analyzing data from studies focusing on the effects of cooperative grouping. Results from these types of analyses may provide indications of the levels of cooperation among students working in cooperative pairs. It is important that researchers consider the results of this study and continue to investigate methods that may assist student learning from multimedia-based lessons.

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Faculty Perceptions of Web-based Distance Learning: Implications for Adoption of Related Technologies

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Abstract

Web-based distance education has evolved as one of the most innovative and potentially rewarding segments of the higher education market. Among its attractions are the opportunities it provides academic administrators to use faculty in ways that reach new learner markets, overcome constraints of time or space, and capitalize on evolving learning technologies. For administrators to be effective in the new higher education environment, they must continually monitor, among other things, changes occurring among faculty involved in distance education. In particular, as institutions continue to expand their curricula to distance learners, they should, likewise, assess faculty adaptation to challenges of teaching online. Such assessments enable administrators to identify gaps between where the faculty is, and where it ought to be, all things considered. Furthermore, the assessments provide valuable input in managing faculty involvement in distance learning and promoting overall institutional success in this area.

Introduction

In the last two decades, many educational institutions have actively sought to integrate computing technologies into the classroom in part because the society demanded it, and students expected to learn with it. The World Wide Web (the Web) in particular, has increasingly become a principal medium of reaching students in remote locations. The strength of the Web lies in its ability to promote interactivity, a key component in the transmission of knowledge. Thus, while the educational media of the past demanded the passive attention of the user, the Web requires active participation. The appeal of the Web for learning also lies in its other characteristics such as unlimited distribution capacity and relatively inexpensive production capabilities.

Historically, technology has often been perceived as a burden rather than as a facilitator of teaching and learning. This has led to skepticism and disagreements about the need and role of technology in teaching and learning. On one hand, some scholars have lamented that instructors are continually required to train just to master new technology, maintain it and become familiar with how to incorporate it effectively in the classroom. Such training, they argue, has taken away faculty commitment of time and effort in mastering their respective disciplines and contributing to the respective knowledge bases. The faculty, in other words, finds itself caught in the position of dual pressures from the discipline and the technology. At the same time, it has been argued that many institutions lack focus in the professional development opportunities they provide to faculty who need to learn new technologies or upgrade existing ones.

Today, the number of institutions of higher education engaged in distance learning continues to grow. Many are also investing heavily in computing infrastructure (Massy & Zemsky, 1996) to support their growing computing initiatives. Among the challenges that are facing these institutions is that the faculty continue to question the value of technology in teaching and learning. Research shows that faculty often view technology as too impersonal and a threat to the quality of instruction (Rice & Miller, 2001). The truthfulness of this perception is, however, suspect. Although traditional methods of teaching such as the lecture often fail to promote closer contact between instructors and students (Oblinger, 1995), it is assumed that newer modes of instructor delivery could only be worse. To add to the skepticism about technology, a study of 248 research reports from 1982-1996, (Russell, 1996) found no significant differences between the learning outcomes achieved through traditional instruction and those obtained through a variety of distance learning technologies such as teleconferencing, videotape, satellite and computer-assisted instruction (Rice & Miller, 2001). Technology enhanced distance education, nonetheless, remains a powerful mode of reaching non-traditional learners who cannot attend the traditional classroom but need alternative means to fulfill their educational needs. The faculty, again, is implicitly expected to respond to that need by developing even more distance learning courses.

This case study investigates the needs, concerns, self-assessments and other perceptions of faculty who, with limited or no prior experience in using the Web for instruction, taught Web-based distance education courses. The study first looks at the above issues from the perspectives of individual faculty members. It then looks at the same issues from the faculty as a group. The study finally contrasts faculty perceptions with those of the administrator in charge of the academic unit (school) from which the participants were chosen.

Context of the Case

In the fall of 1999, a southern medium-sized, historically black university decided to extend its distance-learning program by offering courses through the World Wide Web. The institution was committed, by its land grant status, to providing broad access to higher education. One unit of the university, the School of Technology, was particularly considered a pioneer in distance learning. It had been offering classes through its extension programs in satellite campuses since the early 1980s. Faculty at this School were eager and willing to try a new way of reaching students who would otherwise not be able to attend classes on campus. The school had a ready client base already in place. Hence, the faculty easily focused on developing and conducting distance-education classes via the Web. The client base mainly comprised of high school teachers who needed to update their subject matter knowledge, pursue graduate degrees or renew credentials for certification. All faculty members who wished to teach a Web-based course were invited to do so. Only five agreed to experiment with the Web-based distance learning. These were seen as the innovators and early adopters of Web-based distance education.

This research was carried out, with the cooperation of the dean of the School, in order to learn about the experiences of select faculty members as they embarked on a new way of delivering instruction, and resolving the related challenges. He supported the study on the belief that it would provide valuable information for administrators who must determine how to motivate and support faculty who choose to integrate technology in their teaching.

Research Questions

This study sought to answer three main research questions: (a) How did faculty perceive their Web-based distance learning needs? (b) How did faculty perceive their capacity to conduct Web-based distance learning? And (c) What were the key faculty concerns in adopting Web-based distance learning?

Review of the Literature

Most studies in distance learning focus on students' perceptions and attitudes (Freitas, Myers, & Avtgis, 1998), technologies (Saba, 1999; Smith & Dillon, 1999), and fiscal implications (Feenberg, 1999). The experiences of the of the instructors have not been thoroughly examined, therefore there is a need for studies that focus more on this area. Faculty perceptions of teaching technologies are influenced by the perceived educational effectiveness of the technologies, their ease of use, personal orientation, and the institutional environment. In order enhance the learning outcomes for students, higher education institutions must ultimately resolve the issue of how faculty adapt to and use educational technologies. Much of the literature on educational technology adoption by the faculty features early adopters more than any other group. Geoghegan (1995), states that these individuals (a) favor revolutionary change and are (b) visionaries; (c) strong in their technology focus; (d) risk takers; (e) experimenters, and, (f) largely self-sufficient. Their perceptions of distance learning, however are also, influenced by the larger environment in which they work.

Higher education is becoming more competitive. Member institutions are paying keener attention to the changing demographics that show large numbers of older students, displaced homemakers, single parents and people in need of continuing education opportunities. These individuals, also referred to as non-traditional students, wish to further their personal and/or career educational goals without the time restrains of class schedules. Higher education institutions have responded by launching courses for delivery at a distance with the help of new communication technologies such as the Web (Hanna, 1999, p. 19).

Web-based instruction (WBI) offers a new way of exploiting current technologies and shifting higher education from an instructor-centered model to a learner-centered model. WBI, however, is only a vehicle for providing a learning environment and delivering knowledge. Although it has the potential to revolutionize how learning takes place, not all students or courses are suited for this mode of instruction (Clark, 1994).

The adoption of new learning technologies in teaching and learning presents new challenges and concerns for faculty. Some of the most frequently mentioned challenges are: decreased live face-to-face interaction with students (Berge, 1998; Clay, 1999); lack of time to plan and deliver courses online (Berge, 1998; Clay, 1999); and the lack of support in planning and delivering courses online (Berge, 1998; Clay, 1999). Other concerns include time investment by faculty members to learn the medium (Rockwell, Schauer, Fritz & Marx, 1999); inadequate compensation and incentives (Rockwell, Scheuer, Fritz & Marx, 1999); a heavier workload (Rockwell, Scheuer, Fritz & Marx, 1999) and slow computer access. Earlier studies found similar findings (Dillon, 1989). Now, over a decade later, many institutions of higher education are still struggling to integrate and utilize distance education technologies (Dooley & Murphrey, 2000). Wolcott reported that rapid technological change will "dramatically reshape faculty members' roles and their work environment," and that the faculty reward system will have to consider innovativeness and technological change (Wolcott, 1997, p. 3). "The view of distance education as an innovation provides the impetus for researching the phenomena, particularly from the perspective of those upon whom its acceptance depends: the faculty" (Dillon & Walsh, 1992, p. 6).

The preceding review suggests that research concerning faculty perceptions, although crucial to understanding the diffusion or adoption of distance learning technologies in institutions of higher learning, is very limited. Hence, there is a need for exploration of just how the faculty perceive this phenomenon and more significantly, how they assess the pedagogical soundness of this medium (Reeves & Reeves, 1997).

Methods

Participants

The participants included the dean and five faculty members from The School of Technology. The faculty members were, at the time, novices at teaching Web-based distance learning courses. The faculty members were familiar with the online course delivery platform known as e-College. They were selected through an initial interview with the dean of the school.

Data Collection

The qualitative data gathering techniques used in this study included interviews with individual participants, an online survey consisting of open-ended questions, electronic artifacts and a focus group. All the interviews were semi-formal. This approach was employed to provide flexibility and overcome time constraints of the research .

The interviews centered around the following questions: (a) How did you become involved in distance learning? (b) What do you perceive to be the limitations of Web-based distance learning? (c) How do you perceive your capacity to conduct a Web-based distance learning course? (d) What administrative policies would help you to become an effective Web-based distance learning instructor? The interview protocol was designed with the assistance of an interdisciplinary team of experts. Specifically, a distance learning administrator, an instructional designer, and a specialist in interviewing procedures provided input in the design, testing and revision of the protocol. They also oversaw the interviewing process. The first interview was conducted with the administrator (dean). This approach provided the researchers with an ”empowered” entry into the school and helped them to understand the background of its culture. Data from the preliminary interviews were used in shaping the online survey instrument. This instrument had four sections: a) questions dealing with perceptions of WBI in general; (b) statements dealing with faculty capacity to use technology; (c) questions dealing with non-technical concerns and d) questions about demographics. A focus group was used to encourage participants to interact with one another in articulating concerns and perceptions of WBI. This meeting was recorded on audiocassette, then transcribed word-for-word. During the focus group, the moderator asked the participants probing questions in an effort to reveal subtle sentiments. The moderator sometimes repeated questions to triangulate results and verify information.

During each aspect of the study, the researchers followed the predefined protocols as much as possible. In addition, they kept reflexive notes, extensive audit trails of correspondence, interview schedules, logistical information, insights, methodological decisions and participant codes and other documentation.

Data Analysis

Substantive analysis of the collected data involved sorting, summarizing, consolidating, interpreting and identifying themes and characteristics. An independent reader was included in the analytical process as a precaution, to assure objective interpretation of the data. During the analysis, all responses corresponding to each question were summarized to provide a holistic and accurate view of each content area. In addition, individual items were coded and categorized into groups of similar answers. The categorized data were then analyzed for specific patterns and compared across questions to identify consistent, repetitive threads in quality and content. Stable or persistent patterns were noted and reported.

Findings

General Findings

The interview with the administrator (dean) revealed fundamental background of the school. It also put in perspective, how the participants and the school and the institution came to be involved in distance learning.
In the process of data collection, it became clear that faculty had difficulty getting students to participate in online chats or threaded discussions. Further, some of the faculty did not believe in synchronous chats because they were viewed as hindering the flexibility of class participation which distance education is meant to promote. It was therefore impossible for the researchers to observe virtual chat sessions as previously planned. The faculty members and the administrator perceived Web-based distance learning as potentially more effective than the traditional classroom in reaching diverse segments of learners. This view was aligned with one of the institutional goals, which was, to provide convenient access to education. Faculty members were concerned about the additional time required to develop and implement online courses. They wanted explicit incentives to offset the commitments of their time.

One individual's reaction to the time demands summed the general sentiment of the faculty on this issue: "…Personally, I bit off more than I could chew…in terms of the number of courses I am teaching…but I also bit off more than I could chew in departmental service, university service, and professional service. And so I didn't enjoy the course like I know I could enjoy it…but if I had a regular load, or whatever, I bet I would have enjoyed it".

Faculty members felt that their continued success as distance learning providers had to be balanced by the following incentives: monetary compensation, lower course loads, release time, release from other institutional responsibilities, support of colleagues, and institutional support through teaching assistants. Faculty members, for the most part, did not perceive the smaller class sizes that they had in distance learning courses as significant inducement to continue teaching via the Web. They were quite satisfied with the training and technological support that they were getting, but strongly felt that they needed more support especially from peers to continue their involvement in distance learning. They also expressed the need for policy changes at departmental, and institutional levels. These are addressed in detail under the relevant individual questions that were posed in the study.

Findings About Specific Questions

The responses to the question, "How did you become involved in distance learning?" indicated that individual faculty interest in exploring new ways of teaching was the single common deciding factor. Although the opportunity to teach was extended to all faculty members in the school, only a few accepted the challenge. There were salient differences in the perception of the faculty and the administrator about the reasons for engaging in distance learning. These reasons are shown in Table 1.

Table 1: Faculty and Administrator Reasons for Engaging in Distance Learning

Reason	Respondent
Convenience to both faculty and students	Faculty and Administrator
Ability to serve more students	Faculty and Administrator
Increased flexibility in working hours and location	Faculty
Reach a wider range of students	Faculty and Administrator
New avenue to compete for students	Administrator
Add value and prestige, particularly in the eyes of accrediting bodies	Administrator

The responses to the question, " What do you perceive to be the limitations of Web-based distance learning?" indicated that faculty concerns about adopting Web-based distance learning were frequently linked to the current limitations of the technology. Despite these limitations the faculty members were unanimously optimistic about the future of distance learning. In addition, they expected continuous growth and institutional support. The faculty, however, remained skeptical about the suitability of the Web for delivering certain types of courses. Table 2 represents details of the perceived limitations of distance learning.

Table 2: Faculty Perceptions of the Limitations Of Distance Learning

Limitation	Impact on learning	Implications for course delivery
Lack of tools to support hands-on tasks	Students are limited to learning only the theoretical aspects of the discipline.	Since certain courses are unsuitable for online delivery (e.g. courses with laboratory components), students would have to attend the traditional classroom to meet some of their degree requirements. Courses requiring hands-on experience are less likely to be considered for delivery on the Web.
Oratory and presentation skills	Lack of opportunity to demonstrate practical skills (e.g. classroom teaching; theatrical presentations.	Such courses should not be offered online since it would be difficult to assess some core requirements in an online environment.
Physical isolation	Limited socialization, even when online discussions/chats are used.	Alternative methods for promoting a sense of community may be inconvenient to the distance learner.
Engaged supervision by instructor	Lack of self-motivation can impede progress for a distance learner. Dropout rate can be high.	Develop strategies to keep learners motivated. Perpetual office hours are already burdensome to the instructor Administrator favored graduate over undergraduate courses.
Technology is not transparent to the learner	Concentration shifts from learning to mastering technology. Frustration if technology hinders learning.	Course progress is hindered by the adverse feelings that students may have for the technology.

The responses to the question, "How do faculty perceive their capacity to conduct Web-based distance learning?" indicated that faculty members in general, did not find technology complex; all of them easily adapted to it. One participant summed up the technology challenge as follows: "The problem is not technology; it is the lack of time to use it to its fullest". While the majority had adequate technology resources and were very comfortable using them, they identified several other problems related to technology that threatened their success in online learning. These are summarized in Table 3.

Table 3: Faculty Perceptions of Technology Challenges or Barriers and Remedies to Distance Learning

Technology Challenges/Barriers	Remedy/Comments
Student proficiency in using technology (the Web, email, FTP, etc.).	Mandate student orientation prior to taking an online class.
Threaded discussions, e-mail and chat do not replace the face-to-face interaction. The nuances of speech, facial expressions are absent. Everything can be taken literally in that environment, and, at times, misinterpreted.	While the entire faculty acknowledged the importance communication in the online classroom, the majority of them perceived synchronous chat as an unfavorable requirement in DL because it requires that all students meet at a designated time. This, in a sense, imposes class time on students who wanted to have a flexible schedule.
System failure.	Select an online platform that is reliable and responsive to ensure continuous service.
Timed logouts that are inconsistent with course tasks.	Select an online platform that is flexible and adapts to evolving user needs.

The responses to the question, "What administrative policies are necessary for you to become an effective Web-based distance learning instructor?" indicated that faculty responses often differed from those of the administrator. They ranged from compensation to increased support for developing online courses. The faculty perceived monetary compensation, as a very important issue while the administrator did not, citing release time and course load reduction as the most important incentives.

Although none of the faculty had large online classes, most felt that as the popularity of online classes grew, it was important to have a policy in place limiting the number of students per class to assure quality in instruction. One participant suggested a class size of 15 while another suggested an even lower number. The latter found it difficult to manage an online class with only a few students. He, therefore, favored further reduction in future class sizes. The faculty members unanimously agreed that online classes required a lot more time to manage than they had anticipated. They also agreed that they needed relief from institutional activities as well as reduced course loads in order to have more time to develop and teach online courses. The proposed limit on the class size may have been in direct conflict with the broader institutional goal, which was, to increase enrollment through distance learning programs. Paradoxically, faculty who were adamant about limiting class size had smaller classes than those who had larger ones. A summary of the findings follows in Table 4.

Table 4: Faculty Ranking of Administrative or Policy Changes Required to Enhance Distance Learning

Rank	Suggestions for Administrative/Policy Changes
1 (Top)	Release time
2	Compensation (monetary, load reduction)
3	Limit of class size
4	Enforcement of rules and consequences (registration, communication and observation of deadlines)
5	Need for more support to develop new online courses
6	Need for continued support after courses are developed
7	Need for technical resources

Discussion and Implications

This study examined faculty perceptions of Web-based distance learning and offers insights of how one institution's distance learning program should be approached by administrators, faculty and support staff in order to succeed. Although the nature of qualitative research impedes the generalization of the findings to a larger population, the study presents some challenges about distance learning that may be universal. These challenges ought to be considered to improve distance learning at least in the institution in which the research was conducted. The role of early adopters in technology adoption can be pivotal in getting other faculty involved in using technology in the curriculum. While it is likely that early adopters may continue to be involved in Web-based distance learning in spite of their existing concerns, their sustained involvement could eventually be jeopardized by a lack of interest in addressing those concerns. Faculty perceptions of distance are influenced by multiple variables including their interaction with technology, interaction with the students, interaction with the support systems and their own experiences. Administrators should make every effort to support early adopters, as a means to assure them of their commitment to technology integration and the success of distance learning programs. This may in turn positively influence the rate of adoption of future instructional technologies not only among early adopters but also across all other categories of potential technology users.

Administrators need to reexamine how the introduction of new technologies impacts faculty workload and the other structures that support those technologies. Administrators should create scenarios that encourage faculty to adopt technology. These may include support for incentives that the faculty value, continual training, support for peer-led information sessions and presentations by experts on the pedagogical benefits of using technology. The level of commitment to technology by the administrators ultimately determines the long-term success of the adoption of new technologies by the faculty.

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Effects of Web-based Self-regulated Learning Support Tool in a Post-Secondary Course

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Introduction

Recently, much attention has been focused on identifying and developing the methods to use the information technologies to support and facilitate learning in non-traditional learning environments. Efforts to apply a paradigm change from the objectivist view of learning to the constructivist view of learning into educational practice lead the change in what and how to teach in school and learners' role. This transition can be accelerated by recent technological developments. In fact, information and communication technologies offer transformed approaches to learning and teaching as well as opportunities for enhanced and more flexible access to information (Lajoe, 2000), provide the new ways of interaction for students, especially time independent and place independent way of communication, and thus enable learning to be more flexible to students (Khan, 1997). As students gain more opportunity to learn in their own time and own pace, the more self-regulated learning ability of the students comes to be needed (Ley & Young, 1998). This study focuses on how to support learners in constructivist learning environments by using Web technology as a cognitive tool.

Background

As we move further into the knowledge era, what to teach in school has continued to evolve. Unlike the industrial era when skills needed in their jobs or what to teach in school were relatively standardized, today's employers have growing demands for continually customizing skills. People must be able to seek out, analyze, and use information by themselves to adapt themselves to the ever-changing role of their jobs as the amount of information continues to grow at an exponential rate. The goal of education may, therefore, be focused more than ever on the acquisition of the necessary skills so that workers can renew their knowledge by themselves. To meet the needs of this fast changing society, learning should stretch out across a lifetime beyond the formal education system (Fisher, in press). People should, therefore, be lifelong learners. Universities as a part of the changing world are being called to play a critical role in helping students to become lifelong learners.

How to meet the needs of the lifelong learner is an area in need of further exploration. However, some research has been undertaken that gives insight into what is needed for lifelong learners. One of the most important abilities of lifelong learners is self-regulated learning ability. Pintrich (1995) argued that lifelong learners, whether inside or outside of the classroom, self-regulate their own learning. Self-regulated learning is known to contribute to learning achievement and, at the same time, it can be the outcome of the learning (Pintrich, 1995). In addition, he argued "it is not a characteristic that is genetically based or formed early in life" (p. 5). That means self-regulated learning can be improved through the intentionally designed learning experience. Therefore, self-regulated learning has gained a great deal of interest among academic researchers and practicing educators because it appears to be a worthy objective for students of all ages in all disciplines (Paris & Paris, 2001).

Parallel with this societal change that emphasizes lifelong learning, the paradigm shift from an objective view of learning to a constructivist view of learning accelerates the change in what and how to teach in school and also impact the learners' role. A discussion about the constructivist learning environments and the role of learners within that context follows in the next section.

Constructivist Learning Environments and the Role of Learners

Constructivist learning environments put learners in the center of learning and emphasize the active role of learners in their learning (Duffy & Cunningham, 1996). To be more successful learners in the constructivist learning environments, students should be more expert self-regulated learners.

Jonassen (1999) distinguished objectivist conceptions of learning and constructivist conceptions of learning. According to him, "objective conceptions of learning assume that knowledge can be transferred from teachers or transmitted by technologies and acquired by learners" (p. 217). On the other hand, "constructivist conceptions of learning assume that knowledge is individually constructed and socially coconstructed by learners based on their interpretations of experiences in the world" (Jonassen, 1999, p. 217). With the advent of the constructivist concepts of learning, the learning is in transition from teacher-centered to learner-centered.

A myriad of learning theories based on the constructivist view of learning has emerged in recent years, including open learning environments (Hannafin, Land, & Oliver, 1999), problem-based learning (Hmelo, 1999), anchored instruction (Cognition & Technology Group at Vanderbilt, 1992), cognitive apprenticeships (Collins, Brown, & Newman, 1989), reciprocal teaching (Palinscar & Brown, 1984), and goal-based scenarios (Schank, Berman, & Macpherson, 1999). Although somewhat varied in their scope, and methods, these approaches share similar key epistemological foundations and assumptions about the nature of learning.

In these constructivist learning environments, the roles of both students and teachers change differently from those in objectivist learning environments: students move toward more self-reliance and peer coaching and teachers function more as facilitators than as lecturers. Constructivists emphasize the process-oriented learning environments rather than content-oriented learning environments (Bannan-Ritland, Dabbagh, & Murphy, 2000). In the process oriented learning environments, learners are usually required “to examine thinking and learning processes; collect, record and analyze data; formulate and test hypothesis; reflect on previous understandings; and construct their own meaning” (Crotty, 1994, p. 31) in a variety of content areas (cited in Bannan-Ritland et al., 2000). These skills are closely related with self-regulated learning.

However, students, especially less expert learners, are likely to be using passive learning strategies and they are not likely to adopt more active learning strategies (Land & Hannafin, 2000). Those passive strategies are remarkably persistent and enduring because students may have a lifetime of experience in passive learning environments. These learners do heavily rely on knowledge being delivered to them in terms of lectures and presentations and are not able to learn from new situations without someone there to package the new knowledge for them.

More expert learners, on the other hand, use a variety of cognitive strategies and self-regulation procedures to plan and pursue goals, integrate new knowledge with existing knowledge, formulate questions and inferences, and continually review and reorganize their thinking (Bereiter & Scardamlia, 1989; Scardamalia, Bereiter, McLean, Swallow, & Woodruff, 1989). Given that not all students are expert learners, it is important to assist learners with the strategies and procedures that can assist with learning process. Supporting and facilitating self-regulated learning may lead to more satisfactory and rewarding learning experiences.

Higher Education and Self-Regulated Learning

To date, research and development efforts related to self-regulated learning have focused primarily on K-12 students. However the need for self-regulated learning with adult learners has gained an increased focus. College students need self-regulated learning because they have more freedom than secondary students (Paris & Paris, 2001). Research has indicated that new students in particular experience difficulty in balancing the social demands versus the educational demands of the higher education experience (Zimmerman, Greenberg, & Weinstein, 1994). Burd (1996) estimated that one third of the students who enter colleges and universities will be under-prepared or lack the skills needed to be successful learners (Ley & Young, 1998). “About three fourths of the higher education institutions that enrolled freshmen offered at least one remedial reading, writing, or mathematics course in Fall 1995” (U.S. Department of Education, 1996. p. 1). Ley & Young (1998) argued that the issue is not a question of whether or not to accept under-prepared college applicants any more, but how to identify those students and assist them.

An easy way to help less expert learners in universities is to offer a how to learn course or a learning strategies course (Hofer, Yu, & Pintrich, 1998). Weinstein, Husman, and Dierking (2000) suggested that an adjunct course approach is necessary, especially at the college level, where it is very unlikely that college faculty will be able to teach general learning and self-regulatory strategies in their discipline-specific courses. This implies that it is very hard to implement the integrated course at the college level, where instruction in learning strategies is embedded in the context of a regular disciplinary course (e.g., chemistry, history, sociology). Although it may be easier to implement an adjunct course than an integrated course at the college level, one of the main drawbacks to an adjunct course relates to the transfer of learning (Hofer et al, 1998). Therefore, researchers emphasize the importance of applying the strategies learned in the adjunct course into other courses. An integrated course at the college level, however, still faces the same problem of transfer strategies learned in one context (e.g., a chemistry course) and to other disciplinary courses (Simpson, Hynd, Nist, & Burrell, 1997). How to support the less expert learners at the college level in various courses still needs to be investigated.

Another population that could benefit from self-regulated learning skills are graduate students. With the needs of renewing and deepening their knowledge and skills, many adults return to school to take graduate courses. However, for these graduate students, adjunct courses may not be an appropriate option. One possible approach to this issue is to provide learners with cognitive tools that are designed to support the process of self-regulated learning within a specific context. A discussion about the cognitive tools follows in the next section.

Definition of Self-regulated Learning

The key issue defining self-regulated learning is not whether learning occurs as a socially isolated event, but rather whether the learner exhibits personal initiative, perseverance, and adaptive skill in pursuing it (Zimmerman, 2001). This means that self-regulated learning does not have to be limited to the application to the solo cognition (Anderson, Reder, & Simon, 1996, 1997). Self-regulated learning can be applied to the learning based on the situated learning theories that emphasize the social nature of cognition and meaning (Greeno, 1998; Resnick, 1987). This view is also supported by the Vygotskian view (McCaslin & Hickey, 2001), social cognitive view (Shunck, 2001), and constructivist view (Paris, Byrnes, & Paris, 2001) of self-regulated learning.

Self-regulated learning is a form of learning that places great emphasis on learners' active role and control of their own learning. Self-regulated learning involves the conscious awareness and modification of cognitive as well as affective processes that are required for success in an educational environment (Corno and Mandinach, 1983). It can be contrasted with passive learning, a form of learning whereby learners are assumed to absorb information presented to them by a lecturer or some form of media such as a film.

Proponents of self-regulated learning espouse that it is more effective than passive learning. They also believe that it is more important because learners who only know how to receive information passively from others won't be successful as lifelong learners in real world situations where the knowledge to be gained is not neatly packaged for them.

Although each theory in the literature about self-regulated learning (e.g., operant, phenomenological, information processing, social cognitive, volitional, Vygotskian, and constructivist views) has a different view to explain learning itself, most of them share some aspects in explaining about self-regulated learning. Pintrich (2000) proposed four assumptions about self-regulated learning that can be found throughout the theories. Pintrich's assumptions on self-regulated learning include: (a) that is an active, constructive process, (b) that learners have potential for control, (c) that learners establish goal, criterion, or standard, and (d) that mediators (e.g., teachers, computer based tools) play an important role. From these common assumptions, Pintrich (2000) defined self-regulated learning as "an active, constructive process whereby learners set goals for their learning and then attempt to monitor, regulate, and control their cognition, motivation, and behavior, guided and constrained by their goals and the contextual features in the environment" (p. 453). This definition does not explicitly tell about planning, through which learners select and manipulate the strategies necessary to achieve the goals and come up with the paths to follow. However, various models of self-regulated learning (e.g., Winne & Stockley, 1998; Zimmerman, 1998) have planning in their models and described about it explicitly. If a planning is added to this definition, in the simplest sense, self-regulated learning is an active, constructive process whereby learners set goals for their learning, plan how to achieve the goals, and then attempt to monitor, regulate, and control their cognition, motivation, and behavior, guided and constrained by their goals and the contextual features in the environment.

According to this more elaborated definition, a process of self-regulated learning can be described as following. Self-regulated learners know when to engage in learning, set goals for learning, plan to achieve the goal through which learners select the strategies to use and decide orders to follow. As they move toward the goals, learners monitor their progress, cognition and motivation. If they find their progress toward goal does not follow their plans or encounter obstacles, learners try to modify the plans or even give up the initial goals, to manage motivation and adjust their strategies for making progress.

Computers as Cognitive Tools

Jonassen and Reeves (1996) offered the following definition of cognitive tools: "Cognitive tools refer to technologies, tangible or intangible, that enhance the cognitive powers of human beings during thinking, problem solving, and learning. Written language, mathematical notation, and most recently, the universal computer are examples of cognitive tools" (p. 693). One of the rationales for using cognitive tools is that a portion of the cognitive power used by an individual resides in other people, artifacts, or tools created by the larger society (Pea, 1993; Salomon, 1993a). A lot of computer cognitive tools have been developed starting with the Taylor's (1980) conception of computers in education as "Tutors, Tools, and Tutees," to more sophisticated cognitive tools as described by Lajoie (2000).

With the technological developments, such as multimedia and the Internet, various Web-based cognitive tools have been developed. Even many successful non-Web based systems are going "online," making their tools and resources accessible via the Web (Sugrue, 2000). The Web has great potential as a cognitive tool with its inherent characteristics: easy access to the vast amount of information distributed throughout the Internet and asynchronous and synchronous communication tools that can enhance communication between learners and learners, learners and teachers, and teachers and teachers.

One of the roles that can be supported by computers as cognitive tools is similar to the roles played by peers, mentors, experts or teachers in more traditional teaching-learning environments. For example, a cognitive tool can be developed to provide guidance and hints that provide just enough support for a learner to move from one stage of a learning task to another. With this point, computers as cognitive tools can support self-regulated learning. Schunk and Zimmerman (1996) emphasized the importance of the social source to support self-regulated learning. Learners can acquire self-regulatory knowledge and skill from this social source through modeling, verbal instruction, physical guidance, corrective feedback, social structuring, supervision and monitoring, peer teaching, cooperative learning, and reciprocal teaching. Therefore, how computers as cognitive tools can support self-regulated learning is worthwhile to be investigated.

Methodology

This study focused on how to facilitate self-regulated learning within the higher education by using the Web technology as a cognitive tool. For this purpose, this study examined students' use of the SRLS tool in a post secondary course, with particular interest in how the use of the SRLS tool influence their self-regulated learning, and the factors that influence the students' use of the SRLS tool. A pilot study was conducted to determine the feasibility of implementing a SRLS tool within the context of a course and to identify any problems. Throughout data collection and analysis, this study was guided by the following questions:

1. In what ways does the SRLS tool affect students' self-regulated learning?
2. What factors influence the students' use of the SRLS tool?

Design of the SRLS Tool

Social sources are essential to help students self-regulate their learning (Schunk & Zimmerman, 1996; McCaslin & Hickey, 2001; Schunk, 2001). Social source includes parents, coaches, teachers, siblings, friends, and classmates. Learners can acquire self-regulatory knowledge and skill from this social source through modeling, verbal instruction, physical guidance, corrective feedback, social structuring, supervision and monitoring, peer teaching, cooperative learning, and reciprocal teaching. Learners also need to have chances to rehearse and develop the self-regulated learning on their own (Schunk & Zimmerman, 1996). Learners cannot fully self-regulate their learning unless they exercise personal choice or control. How social support and self-directed practice are arranged in teaching and learning environments still needs to be investigated. This research focuses on social support where the students are given the chances to have self-directed experiences. One possible approach to this issue is to provide learners with cognitive tools that can support the process of self-regulated learning.

Salomon (1993b) argued that the computer as a cognitive tool can become a partner with the novice learner by providing guidance or a scaffold as the novice undertakes a complex task. However, it should be students not the computers to set the learning goals, plan to achieve the goal, monitor their progress towards the goal, and reflect the whole process. The role of computers should be to promote and facilitate students to maximize use of their intelligence and knowledge. And the design of the tool will focus on both "effect of" technology and "effect with" technology (Salomon, 1993a). In other words, this tool design will try to provide quality scaffolding that entails metacognitive guidance to facilitate students learning (the "effect of" technology) and also support for off-loading and task dividing that try to ease students' cognitive burden (the "effect with" technology).

The SRLS tool has built-in scaffolds as the form of a template with guided questions to help students with self-regulatory activities. Duffy and Cunningham (1996) defined scaffolding as any type of support for learning. This includes not only the support of other individuals but also "any artifacts in the environment that afford support" (p. 183).

When students are answering the guided questions, it is expected that they would engage in self-regulatory activities comparable to metacognitive processes involving goal setting, planning, monitoring, evaluating, and reflecting. These activities can be divided into two phases. The first phase is focused on goal setting and planning. And the later phase is focused on monitoring, evaluating, and reflection.

The main point to design the goal setting and planning phase is to help students set a learning goal that is specific enough to guide their learning and let the students make a plan to achieve the goal. For this purpose, a template with guided questions will be used. The first question asks students to set a short-term and specific learning goal. Although the question cannot guarantee if the students set a goal specific enough to guide their learning, the following questions will play a role to guide the students to specify the goal to guide their learning and make a plan to achieve the goal.

The template with guided questions provide the structure and play a role of prompts that facilitate students to engage in the targeted activities such as goal setting, and planning here. The template supports the function that Lajoie (1993) described as sharing "the cognitive load by providing support for lower level cognitive skills so that (cognitive) resources are left over for higher order thinking skills" (p. 261).

The following guided questions were used with a template for goal setting and planning.

- What are my new specific learning goals?
- What is the target date for the goals?
- What are my actions or steps that I will take to accomplish these goals?
- How will I know I have accomplished my goals by?
- What are Possible blocks, both personal and external, that may interfere with accomplishing these goals and how can I overcome them are?
- Who can I go to for help with my goals?
- How confident am I that I will accomplish these goals?

These goal setting and planning activities are also expected to improve students' self-efficacy. Setting short-term goals involving specific performance standards is likely to lead to successful performance, and so to enhance self-efficacy and positive self-reinforcement because short-term goals look more manageable to students and specific goals provide a clear and specific guide for the type and amount of effort needed to accomplish the goals (Bandura, 1986; Schunk, 1990). Completing a series of short-term goals often requires fewer steps, and results in fewer errors, than trying to devise and implement global plan for reaching the long-term goal.

The main point to design the monitoring and reflection phase is to help students to monitor their progress towards the goal and reflect what and how they did for it. For this purpose, a template with several guided questions will be used as in the goal setting and planning phase. These questions are intended to prompt students to engage in metacognitive activities so that they can monitor and evaluate their learning progress and have an opportunity to reflect what they did. And notification messages that let students know what they need to do in the tool when they log in and email messages will be sent to the student when they have to monitor and evaluate.

Metacognitive processes can be supported when the students can have a chance to recap their problem-solving steps by reviewing the artifacts they created as a representation of their internal thoughts. And when such physical representation provides opportunities for the learners to inspect and reflect on their solution strategies, generalized metacognitive awareness is prompted (Lajoie, 1993). The SRLS tool can help students to be involved in these processes by storing their artifacts such as the goals, plans, and reflections from the beginning.

The following guided questions are the possible questions that will be used with a template for monitoring and evaluating. These will also be modified through an interview with a course instructor or a pilot test.

- How satisfied am I with my previous goal accomplishment?
- What were the reasons for accomplishing or not accomplishing my goals?
- What is your general reflection?

Implementation of the SRLS Tool

This study employed a case study approach. The case was the course that provided the introduction to computer to pre-service teachers in spring, 2002. Forty one students were enrolled. The students used a SRLS tool for their final project which was to create a Web-quest for their future students. The students spent approximately 3 weeks finishing the projects. The students were required to set goals for the projects 4 times and to reflect on the goal achievement 4 times through the SRLS tool.

Data Collection and Analysis

At the end of the course, participant opinions regarding the tool use through an open-ended questionnaire. It asked the participants such things as what they did and did not like about the elements of the tool, what helped them, what did not help them, whether they felt that a SRLS tool-related activities that were required of them were appropriate for their needs, what changes they would make if they could, and whether they felt they attained the objectives. Thirty six students among forty one students volunteered to responded to the questionnaire. Constant comparative method of analysis (Strauss & Corbin, 1998) was chosen as a method of analyzing transcripts of the questionnaires in searching for common themes that emerged from the data.

Findings

Results from the pilot study indicated that the SRLS tool played the intended role for supporting the learning despite some negative opinions from some of the students. One of the positive remarks about the tool was that it helped motivate the students to get the task done. The tool informed them of their accomplishment through monitoring and evaluating activities and it helped them continue to complete their tasks. This finding is in parallel with the literature on self-efficacy. The experience of successful performance enhances self-efficacy and it helps the students maintain motivation for the task (Schunk & Ertmer, 2000). It is also important to notice that the short-term goals helped students because completing a series of short-term goals often requires fewer steps, and results in fewer errors. One commented:

> It helped] divide one big thing into small parts. It also informed my accomplishment, thus motivate me to get the task done.

Another positive remark is that it helped time management of the students. Students indicated that continuous planning and monitoring helped keep them on track. It helped the students organize thinking into priorities by facilitating the students to divide one big thing (long-term goal) into small parts (short-term goals) and to order them to achieve the big thing. The tool also helped the students' reflection on the project process. Through the reflection, some of the students reported they tried to figure out why they did not do good jobs this time and how to improve next time.

Two important factors that are regarded to affect the students' perception about the effectiveness and efficiency of the tool are the characteristics of the task and the individuals' motivation level. Some of the students among those who showed the tool was not necessary reported that the project was too easy for them and three weeks were short enough not to use the tool. This implies that using the tool may be bothersome to the students if the task is too easy to them or needs short period to finish it. Another negative remark was from those who felt that they were well motivated. They mentioned that they were motivated enough to complete the projects themselves without using the tool.

The findings from this pilot study influenced the sampling for the case in the future study. The case should have a long-term project that needs enough periods to use the SRLS tool. The pilot study also supports the necessity to investigate the interaction between the individual difference, the tool, and other factors like task characteristics.

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Teachers' Beliefs about Student-Centered Learning: A Case Study

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Abstract

Teachers' implementation of technology-enhanced student-centered learning environments will be affected by their beliefs about effective practices, particularly their beliefs about student-centered learning. In order for student-centered programs to be used as intended, designers must be aware of the key issues that will shape their implementation and the beliefs teachers hold about these issues. This case study examined 15 teachers' beliefs about student-centered learning as they implemented Alien Rescue, a computer-based program for middle school science that was designed to create a student-centered learning environment in the classroom. Considerations for the design of similar programs are offered.

Student-Centered Learning Environments

Concurrent interest in learning guided by a constructivist perspective and advances in computer technology have led to a renewed interest in student-centered learning (Land & Hannifin, 2000). Student-centered learning environments (SCLEs) differ from teacher-directed instructional activities in their assumptions about the roles of both the student and teacher in learning (Hannifin, Hill, & Land, 1997). Learning in SCLEs is driven by a problem or project (Jonassen, 2000) in which the learner must develop a solution or product that meets certain specifications. Students control their process as they work toward this goal, determining what their learning needs are and how they will meet them. Teachers facilitate student work rather than directing it.

Though interest in student-centered learning spanned much of the twentieth century, it largely failed to take root in schools. Cuban (1983) noted "a seemingly stubborn continuity in teacher-centered instruction despite intense reform efforts to move classroom practices toward instruction that was more leamer centered" (p. 160). Hannifin and Land (2000) argue that the impending ubiquity of powerful technologies make the transition to student-centered learning inevitable, but the same reasons for the resistance Cuban noted may still apply and in fact be exacerbated by technology. Implementation of technology enhanced student-centered programs requires that teachers simultaneously integrate technology and embrace pedagogical approaches that may be unfamiliar to them. Both research done on the barriers to technology integration (Ertmer, 1999) and teachers' resistance to pedagogical change (Richardson, 1990) suggest that the double-barreled innovation that technology enhanced student-centered learning environments represent may prove intimidating for teachers.

Teachers' Beliefs

When confronted by novel situations in which they lack knowledge structures and cognitive strategies, people fall back on their beliefs to guide the decisions they make (Pajares, 1992). This may be especially true in teaching, which Nespor (1987) describes as an entangled domain because of the numerous situations teachers encounter which have overlapping but not completely analogous characteristics with other situations, thereby requiring teachers to frequently make decisions in the absence of certainty about outcomes. For this reason, researchers have argued that a greater understanding of teachers' beliefs is essential to the improvement of educational practices (Fang, 1996; Lumpe, Haney, & Czerniak, 1998; Tobin, Tippins, & Gallard, 1994).

Teachers implementing a technology enhanced student-centered program are likely to rely on the educational beliefs they have developed during their experiences both as a student and a teacher to navigate the process. These beliefs will shape the way in which a program is implemented, and ultimately student outcomes. Designers who assume that teachers will conform to guidelines published in a teacher's manual or alter their practice to fit the theoretical underpinnings that guided the design of an educational program may find themselves seriously mistaken. For example, Guskey (1986) found evidence that in the absence of commitment to an instructional innovation, teachers often altered the practice to the point that it was no longer effective. Even teachers who are aware of the designers' intentions may disregard them if they are at odds with their own beliefs. Nespor (1987) argued that beliefs are far more influential than their knowledge in determining how people define problems and that they are much better predictors of their behavior. Therefore, the effective design of student-centered programs will need to take into account teachers' beliefs about student-centered learning, and how these beliefs are likely to shape their implementation of programs that are designed to be student-centered.

The purpose of this study was to identify key issues in the implementation of a computer-based program designed to support student-centered learning and to examine teachers' beliefs about those issues. The findings can help designers recognize some of the factors that can affect how teachers implement student-centered programs, which can inform both the design of these programs and professional development workshops that focus on student-centered practices. This study can also bring to light issues to be considered in future investigations of teachers' beliefs about student-centered practices, how these beliefs guide the implementation of student-centered programs, and in turn, how implementation variables affect student performance and motivation.

Method

This paper reports a case study of teachers who implemented *Alien Rescue*, a computer-based program designed to support student-centered learning. Fifteen middle school science teachers participated. The number of years of teaching experience of these teachers ranged from one to twenty-five. Most of the teachers who participated in this study had students who received special services, including resource, content mastery (CM), and classes for the emotionally disturbed, but were mainstreamed for science.

These teachers used *Alien Rescue* with their classes. This computer-based program presents students with a complex problem to solve. In order to save the lives of six species of aliens, students, working as scientists aboard a space station, must find new homes in our solar system for each species. All resources that students need to develop a solution to the problem are contained within the program. These include informational resources on the aliens, the planets and large moons of our solar system, and related science concepts; and tools students can use to acquire and organize information, including a simulation in which students can design and launch probes to gather data about our solar system (Pedersen, Liu, & Williams, in press). *Alien Rescue* is aligned with the national standards for science education and requires approximately fifteen 45-minute periods to complete. Previous research suggests that students express greater intrinsic motivation for their work within *Alien Rescue* than they do for their normal class activities (Pedersen, in press).

The teacher's manual for *Alien Rescue* offers guidelines for teachers on how to implement the program so as to encourage student ownership over their problem-solving process. An underlying assumption of our design of *Alien Rescue* was that the role of the teacher is critical to students' success and learning. Teachers are expected to promote the social construction of knowledge by encouraging students to collaborate with their peers, help students to connect science concepts in *Alien Rescue* to their prior knowledge and other areas of the curriculum, and probe individual students' thinking as they are engaged in the problem so as to promote reflection and identify misconceptions. The teacher's manual contains extremely detailed suggestions on how to accomplish these tasks over the course of the program. However, *Alien Rescue* is flexible enough for teachers to adapt it to the particular needs of their students and curriculum, and this very flexibility makes it possible for teachers to disregard suggestions made in the teacher's manual. Implementation of *Alien Rescue* is, therefore, quite dependent upon the decisions of the classroom teacher.

Data sources included interviews, observations, the first author's reflexive journal, and focus groups. Nine teachers participated in two interviews each – one before they used *Alien Rescue* with their students and once after their classes completed the program. Interviews ranged from 25 to 90 minutes, with an average duration of 55 minutes. Approximately twenty-five hours of observations were conducted in seven teachers' classes. These observations were used as a springboard to question teachers as to their reasons for implementing the program as they did. Two focus groups of teachers each met for approximately 75 minutes to discuss a preliminary version of the findings of this study. These focus groups provided a vehicle for member checking and an opportunity for teachers to react to and expand upon each other's points.

The study was conducted over the course of one academic year with data collection and analysis overlapping for much of that time. Data analysis was consistent with the constant comparative method (Lincoln & Guba, 1985).

Results

Teachers' Definitions of Student-Centered Learning

A difficulty we anticipated in examining teachers' beliefs about student-centered learning was the lack of a common definition for this approach. Our interviews with teachers showed that our concern was valid. As shown in Table 1, four different definitions of student-centered learning emerged from the data.

Table 1: Teachers' Definitions of Student-Centered Learning

	In Student-Centered Learning…
Definition 1	The teacher considers the interests and needs of the students in the class, and then provides instruction based on them. The teacher tries to make sure that students acquire the information and understand the concepts presented before moving on to more difficult material. The teacher takes into account individual differences and makes adjustments to accommodate individual students.
Definition 2	The teacher prepares an activity that requires students to be actively engaged. These activities are often "hands-on" and collaborative, but they do not need to be. The teacher explains the steps students need to go through in the activity, and helps to redirect students if they have trouble following the steps.
Definition 3	The teacher presents students with a complicated activity but does not tell students how to complete it. Students must figure out what to do, which means that they sometimes try things that don't work. The teacher questions students about their thinking, but do not solve their problems for them or tell them what to do. When students encounter difficulties, they turn to their peers for support; therefore collaboration grows naturally out of student-centered learning.
Definition 4	The teacher presents a topic students are supposed to learn about, then allows each student to investigate whatever aspect of that topic interests him or her. This means that students are often working on widely different projects that they themselves have developed. If students have difficulty choosing what to investigate or finding materials, the teacher helps them by asking questions, but does not tell them what to do or provide a model or detailed expectations for a product. The teacher questions students about their work and students present what they learn to their classmates.

Definition 1 is evocative of child-centered learning, in which teachers and schools are charged with providing developmentally appropriate educational experiences in a safe environment so as to promote the overall well-being of all students (Manning, 2000). This definition was evident in comments such as this:

I try to think of my planning as student-centered. You know, whenever I write a lesson plan, I hope that it's student-centered. I mean, I make it so that the objective is that the student will be able to…etc., you know. So I don't know what you mean by that because I think everything I do is student-centered.

Definition 2 suggests that some teachers view any activity in which students are active and work with their classmates as student-centered. Several teachers described the science "labs" (activities) they teach as student-centered because students use a variety of materials, work in groups, and write their own conclusions. However, the teacher typically decides which labs to use, provides students with a step-by-step process for the lab, structures students' time and format for their conclusions, then reviews students' conclusions in class to make sure they reached the "right" ones. While students are actively engaged, most of the labs teachers described were teacher-directed and allowed students little control over their activity, process, or outcome.

Most teachers held either definition 3 or 4, and in a focus group, teachers agreed that student-centered learning was broad enough to encompass both definitions. It was useful to separate these two definitions however because two teachers who originally held definition 4 had a negative opinion of student-centered learning. They believed that the lack of an established goal implied in definition 4 made SCL too difficult and potentially frustrating for students this age:

I think student-centered learning…it would have to come from the students. In sixth grade, they don't know enough for it to…where to go look for something. Student-centered would be more for a child that's ready to take off on his own and go investigate everything. They're so basic in sixth grade. I mean, they're just learning science and a lot of the students never had such an intensive program as they're having now. And so, they want to learn, but it's a while before they can go off on their own. I do believe there is a place for student-centered learning within our curriculum, but they're not ready.

These teachers both thought *Alien Rescue* was effective in large part because it provided a clear goal, which helped to focus students' work. Their experience with *Alien Rescue* seemed to have broadened these teachers' definitions of SCL to include activities that, like *Alien Rescue*, have established goals.

Because of the varied definitions teachers held of student-centered learning, after the first round of interviews, we did not use this term in the abstract. Instead, we discussed "programs like *Alien Rescue*" and "student-centered learning environments like *Alien Rescue*." We did this so as to ground the discussion in one common experience that teachers could reflect upon, and so that we could examine and compare the role of their beliefs in this one type of environment.

The Teacher's Role

Most teachers used the term "facilitator" to describe their role both during their regular classes and during *Alien Rescue*. However, the activities teachers described doing in this role differed somewhat. Table 2 provides a compilation of the tasks that teachers said they normally perform in each of the two settings.

Table 2: Teachers' activities in different settings

	Normal class activities	*Alien Rescue*
Planning	Plan lessons and establish procedures for carrying out tasks during those lessons Establish objectives Make sure supplies are available	Establish checkpoints or deadlines by which students must complete certain steps
Instruction	Get students excited about science topics Demonstrate processes Lead discussions Relate new knowledge to students' prior knowledge	Ask questions about science concepts to find out how much students have learned, then provide mini-lectures on science concepts to enhance students' knowledge Lead discussions to get students to share their findings
Motivating Students	Praise students Grade students to motivate them and hold them accountable for homework	Praise students
Behavior	Redirect students who get off task Prevent children from being mean to each other Prevent students who misbehave from disturbing their classmates	Redirect students who get off task
During activities	Answer students' questions Make sure students are not struggling and provide help to those who are Make sure students practice safety procedures	Interact with students one-on-one to ask questions about their science knowledge Interact with students one-on-one to ask questions about their process Encourage students to work together Check students' work in order to make sure they are progressing at an appropriate pace Give feedback on students' products in time for them to make revisions

Though teachers differed in the tasks they identified and in some cases disagreed about whether certain tasks were important, the lists in Table 2 suggest that teachers identify more tasks in which they have control for their regular class activities than for environments like *Alien Rescue*. For example, for normal class activities, several teachers said that answering students' questions and helping students who were struggling were important tasks for the teacher. For *Alien Rescue*, teachers talked more about asking questions to gauge student thinking and encourage reflection. As another example, though all the teachers graded students during *Alien Rescue* (see section on Grading below), none of them listed this as an important aspect of their role during the program, while several teachers identified this as an important task during their regular classes. While the data is too open ended to draw any strong conclusions, it does raise the question that, though teachers frequently refer to their role as that of a facilitator, that what they actually do fluctuates based on the activity in which their students are engaged, and that in many cases their "facilitation" actually involves providing a great deal of direction and structure.

During a focus group, teachers were given the compilation of tasks teachers said they performed during *Alien Rescue* (as shown in the right column of Table 2) and asked to rank them in order of their importance. Two patterns were seen in their responses. First, some teachers ranked establishing checkpoints for students and checking students' work to make sure they are progressing as the most important tasks for the teacher during programs like *Alien Rescue*. A second set of teachers saw interacting with students one-on-one to question their process and knowledge as the most important tasks for the teacher. In other words, some teachers believed that structuring the experience was the most important responsibility of the teacher, while other teachers believed supporting higher order thinking was the most important. The limited number of participants in this study makes it difficult to establish clear patterns, but this contrast merits further investigation.

Collaboration

Teachers generally believed that collaboration is a valuable component of any educational approach, not just student-centered learning. Interestingly, most teachers said that the reason for having students collaborate was so that they would develop skills in working together that they would need throughout their lives and believed that complex activities like *Alien Rescue* could promote the development of collaborative skills. In other words, they saw collaboration as an end in itself: students should collaborate so that they learn how to collaborate better. Only two teachers expressed additional reasons for collaboration; these were better problem-solving through social negotiation and enhanced communication.

Grading

Almost all the teachers expressed the belief that it is essential to grade students during student-centered learning activities like *Alien Rescue*. They offered two reasons for this. First, most teachers argued that grades are necessary to motivate students to do their best work, and that this incentive in turn helps students to learn more. Several teachers said that they believed grades are only necessary to motivate students who are not self-motivated, but because the teacher must be consistent and fair, all students need to be graded. Second, several teachers reported that parents and administrators expect grades and that teachers have to justify the grades they give on report cards by being able to show grades on tasks students have performed throughout the marking period.

Contrary to research findings that suggest that grading can undermine students' intrinsic motivation (Butler & Nisan, 1986; Harter, 1978), only one of the teachers interviewed believed that grading during student-centered learning could be detrimental. Teachers argued either that most students did not mind grades or that they in fact wanted to be graded. The latter, several teachers argued, was especially true for higher achieving students.

Standardized Tests

Some teachers argued that student-centered activities like *Alien Rescue* are not necessarily helpful in preparing students for standardized tests. Teachers were concerned that these tests ask specific factual knowledge questions about a wide range of topics. This presents two problems. First, teachers believed that student-centered programs like *Alien Rescue* were effective in helping students to develop problem-solving skills, but that they would not necessarily be effective at helping students to learn factual knowledge. In fact, one suggestion made in a focus group was that a component be added to *Alien Rescue* that tests students' acquisition of factual knowledge, such as a game with multiple-choice questions so that it reflects the type of questions students are likely to encounter on standardized tests. Second, most teachers believed that for the amount of concept learning that occurs, student-centered activities are more time-consuming than teacher-directed ones. They would therefore use only a limited number of student-centered activities in a year, and be less likely to use these activities during periods when they are preparing students for a standardized test. However, in a focus group teachers discussed potential changes to the standardized tests their students would take in the near future. They had been informed that the new tests would focus less on factual knowledge and more on problem-solving. However, they remained cautious and said this change may make student-centered activities more viable.

Students' Motivation

The teachers who participated in this study generally believed that student-centered activities are likely to support intrinsically motivated behavior on the part of students. As evidence of this, teachers reported that during *Alien Rescue*, students stayed engaged throughout the three-week program, were rarely off task, and that absenteeism and behavior problems were down. Several teachers also noted that students who are typically unmotivated during science were more motivated than usual. One teacher commented, "If you have a good student-centered learning project, you're not going to have any problem with motivation."

Though teachers agreed that *Alien Rescue* supports students in adopting an intrinsic motivational orientation, they disagreed about the reasons. Several teachers attributed students' motivation to qualities of student-centered learning. For example, teachers believed that the active, hands-on nature of the program was key to students' engagement, and that establishing a goal for them to work toward helped to motivate them. Others believed that students were motivated by the fact that they had control over their process, though in a focus group was split over this topic with some teachers arguing that student control over their process was not an essential ingredient of intrinsic motivation.

In contrast, several other causes to which teachers attributed students' motivation had little to do with the qualities of student-centered learning. When a focus group was asked to rank order the factors that they felt most contributed to students' motivation, teachers overwhelmingly ranked the reasons given above as less important than another factor: the computer-based delivery medium. Almost every teacher commented that students were motivated by the opportunity to use computers for an extended period of time. Several teachers said that the rich media and science fiction premise made students feel as though they were playing a game or solving a puzzle rather than working and learning. These comments suggest that teachers believe that the delivery medium and the sheer novelty of the experience may account in large part for students' enhanced interest and intrinsic motivation.

Students with Special Needs

One of the concerns mentioned by most teachers pertained to the appropriateness of programs like *Alien Rescue* for some students with special needs. Teachers described two problems that can make student-centered programs like *Alien Rescue* problematic for many of these students. First, for students who read below grade level, it is difficult for them to use rich text resources independently. They are unable to find the information they need without support. Second, a few teachers believed that some special needs students do not want to take control over their learning or make decisions about their process. As a result, they will not develop ownership of the problem or task that is considered essential in student-centered learning. They want teacher direction, and when teachers do not tell them what to do they simply remain passive or aimlessly look through program resources.

Other teachers argued that, despite these difficulties, student-centered programs are appropriate for students with special needs. Several teachers said that these students had been more motivated during *Alien Rescue* than during their normal science classes. They believed that these students may not achieve as great an understanding as other students, but that they get more out of these activities than they do out of activities that are more teacher-directed.

Most teachers believed that, with extra support, inclusion students could participate in student-centered activities. Teachers primarily offered supports that could be provided within the classroom, such as greater direction from the teacher, one-on-one or small group help from a special education teacher, and pairing inclusion students with regular education or gifted peers. Some teachers felt that the latter works well, though one teacher pointed out that this could lead to some resentment when the peer feels that the inclusion student is not doing his or her share. Teachers did suggest one modification to *Alien Rescue* might be useful in similar programs. They suggested that audio recordings of text passages be provided for those students who have difficulty reading independently, and that the teacher be able to turn this option off for students who should read without assistance.

Floundering

Programs like *Alien Rescue* present students with difficult problems that take a long period of time to solve. Because the problem is complex and so much information is available, some students flounder at various points in the program, either pursuing an unproductive plan of action or failing to develop a plan of action at all. Most of the teachers who participated in this study believed that this is not necessarily a problem, and that the difficulties students encounter eventually lead them to rethink their plan of action. Some teachers pointed out that floundering may even benefit students in three ways. First, students are later able to explain why they had difficulties, and this reflection helps them to become better problem solvers. Second, students learn to deal with some of their frustrations and eventually become more self-reliant and capable of handling other student-centered activities. Finally, initial missteps give students a better understanding of the nature of scientific inquiry. These teachers generally believed that they could help students who flounder by questioning them and getting them to explain what they are doing rather than directing the students to work in particular ways.

However, not all teachers expressed this level of tolerance for students' floundering. A few feared that when students flounder, they waste time or can become frustrated, and these teachers felt responsible for fixing problems that block student progress.

Community Reaction

The teachers who participated in this study believed that the adults with whom they work – administrators, parents, and other teachers – would be mostly supportive of their use of student-centered learning activities. In particular, they believed that most administrators are quite supportive of student-centered learning, and in some cases administrators even actively encourage student-centered approaches. They argued that administrators no longer expect to see students in their seats, and prefer to see students talking to each other and doing hands-on activities. However, administrators are concerned about test scores, so teachers have to be able to convince them that whatever approach they use will be effective at helping students do well on standardized tests.

Teachers also believed that most parents would be supportive of their decision to use student-centered learning activities. However, two teachers did express a concern that some parents may complain that their children are just playing rather than actually learning science, particularly if the activity were computer-based. This concern could actually discourage some teachers from using student-centered activities.

Discussion

Teachers are more likely to use computer-based student-centered programs in ways consistent with the designers' intentions if these programs are designed with their beliefs in mind. The issues raised by teachers participating in this study provide the grounds for some suggestions for designers to consider as they create these programs and for professional development workshops focusing on student-centered learning.

Considerations for Designers

Computer-based programs designed to support student-centered learning in the classroom are still relatively rare, and the many different forms these programs can potentially take makes generalizing from our work on *Alien Rescue* to the design of other programs a task for a high degree of caution. The beliefs teachers expressed in this study have raised a variety of design considerations, but like any qualitative study, we leave it to the readers to determine the transferability of our findings (Lincoln & Guba, 1985) to their work. Given this, we would like to offer three considerations for designers that we believe are pertinent to student-centered programs.

Provide scaffolds for students with special needs. Though teachers are accustomed to modifying materials and providing extra support for students with special needs, computers are capable of sharing this responsibility. The teachers in this study recommended one modification, the inclusion of audio recordings of text passages. However, designers of computer-based programs should explore other scaffolds as well. Some scaffolds may be unnecessary for many students, and if given access to them, these scaffolds may oversimplify students' work. Therefore, designers may want to consider allowing teachers the opportunity to select which scaffolds will be active for each student.

Support factual knowledge acquisition. One concern teachers raised in this study was that student-centered programs may not support students' acquisition of the body of factual knowledge that up until now has been the focus of standardized tests. This concern has been raised previously in the literature on student-centered approaches (Williams, 1993), and teachers' comments about it here suggest that it is an issue that must be addressed by designers. Even if these tests change, teachers are likely to still judge the effectiveness of instructional materials based at least in part on how much factual information students acquire, even though this runs counter to constructivist views of learning, where learners are expected to acquire facts only as they become useful to the task at hand. Still, there is no reason why student-centered learning should not lead to factual knowledge acquisition. SCLEs are typically rich in factual information and the task presented in these environments can be designed to require the acquisition and application of many facts. However, the facts students learn in an SCLE may not be easy to assess through standardized tests. Students may not all acquire the same specific facts within an SCLE and they may be unable to apply their newly acquired knowledge to respond correctly to objective questions as used in standardized tests. Designers of student-centered programs should consider identifying a core set of "facts" that students should learn while engaged in the program, and provide support for their acquisition. How this is to be done without engaging students in activities that are not meaningful within the SCLE is problematic. For example, the suggestion that teachers offered in this study, that multiple-choice style questions be included in the program, is one option, but it is an awkward one. Such questions typically detach facts from contexts in which they are meaningful, which is at odds with the theoretical underpinnings of constructivism and student-centered learning. Still, this issue proved to be important enough in this study to affect several teachers' satisfaction with the program, so designers need to consider possible methods for addressing it.

Capitalize on the multimedia affordances of computer technology to create new learning experiences for students. *Alien Rescue* is rich in its use of media. The program incorporates text, graphics, audio, video, 3D images, and animation throughout, which enhances the presentation of the program content. A consensus from the teachers in this study is that the rich media and the novel experience as created by hypermedia technology is an important factor for students' enhanced interest and intrinsic motivation in using *Alien Rescue*. Though the development of media-rich programs is expensive, the cost may be justified by its impact on students' motivation. Also, for the near future, this may mean that CD ROMs offer a better delivery option than the Web simply because of issues associated with bandwidth and download time for rich media.

Suggestions for Professional Development

Our experience with *Alien Rescue* has suggested a need for professional development opportunities for teachers prior to their use of computer-based programs designed to support student-centered learning. Our interactions with teachers during this study offer a number of insights for the design of professional development workshops:

Avoid the use of the terms "student-centered learning" and "facilitator," or carefully build a common definition with teachers. Our findings suggest that teachers do not all define these terms in the same way. Their different definitions may lead to miscommunication and discrepancies between the teacher's implementation of student-centered programs and designers' intentions. A better approach would be to anchor discussions of pedagogy in specific examples of facilitation strategies useful within a given program, tying these strategies to a theory of how learning occurs within the environment.

Address the many benefits of collaboration. The teachers who participated in this study obviously valued collaboration, but primarily as an end in itself, that is, so that students develop skills for working with others. Professional development workshops can help teachers to recognize benefits that impact learning, such as students' development of an understanding of the role of collaboration in scientific inquiry, the opportunity to identify misconceptions during collaborative exchanges, or the value of peer modeling for students on both ends of the dialog.

Future Research

Finally, a number of the beliefs teachers expressed in this study deserve further examination before suggestions about them can be offered.

Assessment practices. Teachers' assumption that grading during student-centered learning activities would benefit rather than undermine motivation and learning merits further investigation. Perhaps by the time students reach middle school they have been trained to value grades, especially in a setting where they believe they are performing well. Even so, the practice may still focus students' attention on working for a grade rather than learning so as to satisfy their own interests and desire for mastery.

Factors affecting motivation. The factors to which teachers attribute students' motivation are likely to be the ones they nurture, while factors they deem irrelevant may be unthinkingly discarded. For example, teachers who believe that students are motivated by time on computers may skip activities such as whole class discussions, even though these discussions support collaboration and problem-solving skills. Similarly, teachers who do not believe students' control over their process to be a factor in their motivation may disregard the student-centered nature of the program entirely and direct students' work. For this reason, it is essential that researchers identify the conditions under which students are most motivated to take ownership of their work, as well as those classroom factors that can undermine motivation, and communicate their findings to teachers in support materials for these programs.

Floundering. By their very nature, student-centered learning environments create opportunities for students to pursue unproductive courses of action. This means that teachers must make moment-to-moment decisions about how to respond: whether to direct students, question students to help them reconsider their efforts, or to permit students to pursue these paths until they recognize a need to try something different. Teachers are likely to have to make such decisions numerous times in the course of a single class. Most of the participating teachers expressed a fairly high degree of tolerance for floundering and believed that it could benefit learning. However, considering the frequency and speed with which teachers must make decisions related to this issue, further investigation is necessary to determine if teachers' stated beliefs actually match their actions. Also, a better understanding of effective practice around this issue is needed in order to inform preservice teacher education and professional development programs.

Belief Systems. The results reported here can provide some groundwork for future investigations of the relationship between teachers' beliefs, their actions while implementing programs designed to be student-centered, and student outcomes. For example, our data suggested that participants differed in which of two conceptualizations of the teacher's role they held. If patterns like this can be established and compared in terms of student outcomes, this research could help to inform preservice and inservice professional development about best practices.

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Attitudes About Computer Use Among Preservice Teachers

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Abstract

Over 1000 preservice teacher candidates have participated in this research effort that contributes to the development of a model for the infusion of technology within preservice preparation programs. This paper specifically focuses on the initial analyses and findings from the attitudinal, anxiety, and computer use data that have been collected to meet one project goal of a PT^3 implementation grant. Four attitudinal factors related to computer use were explored and data are reported for computer anxiety and computer use.

Introduction

During the Fall of 2000, a mid-sized university began a research effort ultimately focused on the development of a technology infusion model for preservice teacher education, one of five project initiatives funded by a PT^3 implementation grant. The theoretical basis of the hypothesized infusion model is that for preservice teacher candidates to effectively infuse technology within their future classroom settings, they must develop and practice personal, professional, and pedagogical skills related to technology use during all phases and experiences of their preparation program. Luetkehans and Robinson call for teacher preparation programs to view the "responsibility for teacher preparation as shared among a triad: preservice teacher—inservice teacher—and college faculty" (2002, p. 15). The five project initiatives of the PT^3 grant project, together, are aimed at that very target.

We hypothesize that the attitudes and values systems of preservice candidates regarding technology and their role as future teachers will influence their likelihood of developing technology-infused future classrooms. Hill and Schrum support this hypothesis, "Each of these elements— beliefs, theories, and curriculum—help to shape the methods or strategies we use for teaching" (2002, p. 25). In addition, we hypothesize that preservice candidates' attitudes are influenced by their exposure to technology infused instruction (both in higher education and K-12 field experience settings) during their teacher preparation programs. This hypothesis is supported by the National Council for Accreditation of Teacher Education (NCATE) in the expectation that accredited schools of education "provide adequate access to computers and technologies, and expect faculty and candidates to be able to use technology effectively as a teaching tool" (NCATE, 2002, p. 3). Unfortunately, there is continuing evidence that many teachers resist using technology and do not have the knowledge or skills necessary to effectively integrate these tools into their teaching (Cuban, 2001; Molenda & Sullivan, 2002).

One piece of this research effort has been the collection of attitudinal, anxiety, and computer use data from 1084 preservice teachers over six consecutive semesters beginning in the Fall of 2000. The class rank of participants ranged from sophomore to senior. Analyses reported here combine elementary, middle grades, and secondary preparation programs. All data used in these analyses were collected at the very beginning of the semester. The data collection is continuing and will culminate in the Spring of 2003. Attitudinal data along with self-reports of anxiety and average hours of computer use per week are collected from each preservice candidate at two points during their preparation (ET 24X and ET 34X) to provide a baseline for these variables and to allow comparison/growth analyses. Initial analyses of the data collected thus far are reported here.

The ET 24X curriculum is designed to ensure mid- to high-level skill development with a variety of computer-based applications. The course is heavily project-based using constructivist principles and allowing for practice opportunities that match the students' academic and career interests. Preservice candidates typically complete ET 24X during their sophomore year while concurrently participating in lengthy field experience requirements that are mostly observation and tutorial in nature. ET 34X is designed to focus on integration strategies and the application of technologies to support and enhance instruction. This course is a combination of basic instructional design and case study practice. ET 34X is typically completed in the senior year just before student teaching and is coupled with extensive field experience requirements that are generally characterized by lesson planning and the teaching of mini-lessons. Both courses are lab-based, instructor-led, but supplemented with extensive web-based materials. Both courses are also required in the elementary, middle grades, and secondary teacher preparation programs.

Instrumentation

The Attitudes Toward Computer Usage Scale (ATCUS), developed by Popovich, Hyde, Zakrajsek, and Blumer (1987), was the instrument used to collect attitudinal data. This instrument was designed to "…assess how people react to using computers and computer-related mechanisms" (Popovich et al., 1987, p. 262). The authors of the ATCUS instrument conducted two studies to test the internal consistency test-retest reliability for the initial 40-item scale and a second 20-item scale. In the first study, correlating the ATCUS with two other measures of computer attitudes tested the convergent construct validity of the instrument. The resulting internal consistency for the ATCUS was reported as .88. The test-retest was reported as .84. Additionally, significant correlations were reported between the ATCUS and the other two measures of computer attitudes used to test convergent construct validity ($r = .62$, $p<.001$ and $r = .52$, $p<.001$). The second study used the 20-item scale that excluded redundant items identified in the first study. The reliability for the 20-item scale was reported as .84 with the test-retest correlation reported as .91.

The revised ATCUS includes four sub-scales: negative reactions to computers, positive reactions to computers, approval of computer use in education, and comfort with familiar computer-related mechanisms. The third and fourth sub-scales were reworded slightly from the Popovich et al. (1987) original descriptions to clarify the directionality of respondent's reactions toward computers. The description of sub-scale three was changed from "computers and children/education" to "approval of computer use in education"; the description for sub-scale four was changed from "reactions to (familiar) computer-related mechanisms" to "comfort with familiar computer-related mechanisms." Items were not modified. Ranges for each of the sub-scales (factors) are provided in Table 1.

Additionally, two self-report items were added to the survey instrument that asked preservice students to estimate the number of hours per week that they use a computer for any purpose and to rate their anxiety level (on a scale of 1 to 5, with 1 = "very anxious" and 5 = "not anxious at all") related to using computers and computerized machines.

Table 1. Ranges for ATCUS Factor Scores

Factor 1: Negative reactions to computers [range: 7 (low) to 49 (high)]
Factor 2: Positive reactions to computers [range: 5 (low) to 35 (high)]
Factor 3: Approval of computer use in education [range: 5 (low) to 35 (high)]
Factor 4: Comfort with familiar computer-related mechanisms [range: 3 (low) to 21 (high)]

In this study, the scoring of ATCUS was inverted, where appropriate, to be consistent with the factor descriptions. Popovich et al. (1987) commented about the ATCUS instrument, "In order to make it compatible with the previously developed Zoltan and Champanis scales, higher scores on the ATCUS indicate more negative reactions to computers" (pp.263-264). The descriptions of Factor 2, Factor 3 (as reworded), and Factor 4 (as reworded) suggest the respondant's degree of positive reaction toward computers -- not negative, as specified by the instrument authors. In an effort to clarify the meaning of high and low scores for each of the factors, the scoring of the following questions was inverted: 1, 3, 6, 8, 9, 10, 11, 14, 17, and 19. For those questions, the Likert-scale responses of 1 to 7 were inverted by multiplying the value by -1, then adding 8.

Analyses

Mean scores for each of the factor sub-scales were calculated by semester for ET 24X and, separately, for ET 34X (see Table 2). Means for each factor are graphically depicted in Figures 1 to 4. This paper reports data for a total N of 1084 preservice teachers; 583 for ET 24X and 501 for ET 34X. A mitigating variable that requires further statistical exploration is the impact of the extensive curriculum revisions that have been implemented in both courses. Implementation of the heavily revised ET 24X curriculum began in the Fall of 2001. This became a major pilot effort and significant curriculum revisions were made again before delivery in the Spring of 2002. Implementation of the revisions to the ET 34X curriculum were phased in with about half of the re-designed course implemented in the Summer of 2002 and the fully re-designed course implemented in the Fall of 2002. Fall of 2002 is also serving as a pilot delivery of this redesign with additional revisions planned for Spring of 2003.

Analysis of the mean data show few differences across semesters or between ET 24X and ET 34X. Mean scores for Factor 1 are clearly on the high side of the range for negative reactions to computers indicating an overall negative affect related to computers. Additional analyses considering other demographic variables (e.g., age, major) and potential impact of curriculum revisions are necessary before drawing conclusions about the significant decreases observed in the Spring of 2002 for ET 24X and for both ET 24X and ET 34X during the Summer of 2002 that indicate a much lower agreement with a negative affect.

Conversely, the mean scores for Factor 2 are on the high side of the range for positive reactions to computers indicating an overall positive affect about computers. Mean scores are not significantly different across semesters for either course.

Mean scores for Factor 3 indicate an overall positive attitude toward the use of computers in education. This factor is particularly stable across courses and across all six semesters of data collection.

The mean scores for Factor 4 indicate a moderate comfort with familiar technology. Means are not significantly different across semesters or between courses. This is interesting given the types of "familiar technology" addressed in the ATCUS items (e.g., grocery scanning, automatic teller banking).

Table 2. Means of ATCUS Factor Scores by Semester

Semester	ET Level	Factor 1	Factor 2	Factor 3	Factor 4	N
Fall 2000	24X	38	30	26	12	142
Fall 2000	34X	38	31	28	12	96
Spr 2001	24X	40	31	28	13	127
Spr 2001	34X	39	30	28	13	146
Sum 2001	24X	43	30	28	12	15
Sum 2001	34X	39	31	27	10	14
Fall 2001	24X	37	30	26	12	112
Fall 2001	34X	39	30	27	12	129
Spr 2002	24X	15	31	28	13	170
Spr 2002	34X	39	30	28	13	88
Sum 2002	24X	16	31	27	12	17
Sum 2002	34X	17	30	29	14	28

Figure 1. Negative Reaction to Computers

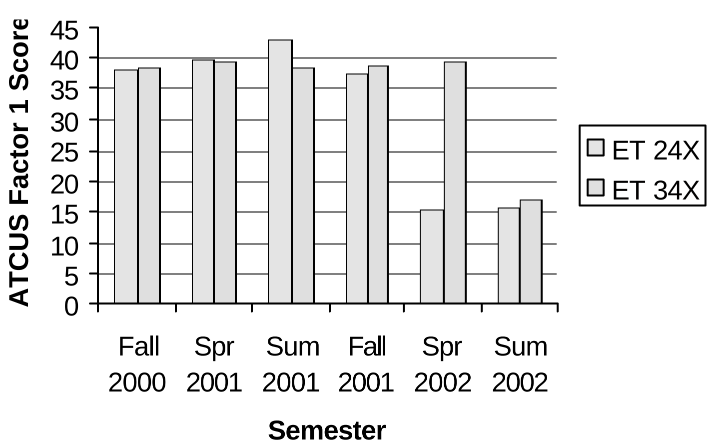


Figure 2. Positive Reaction to Computers

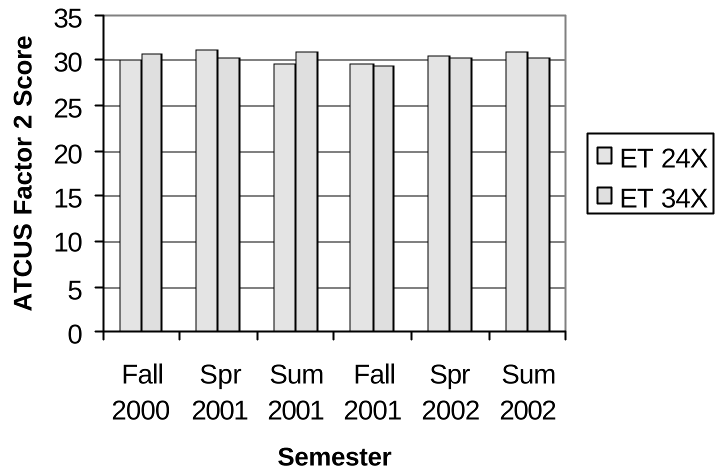
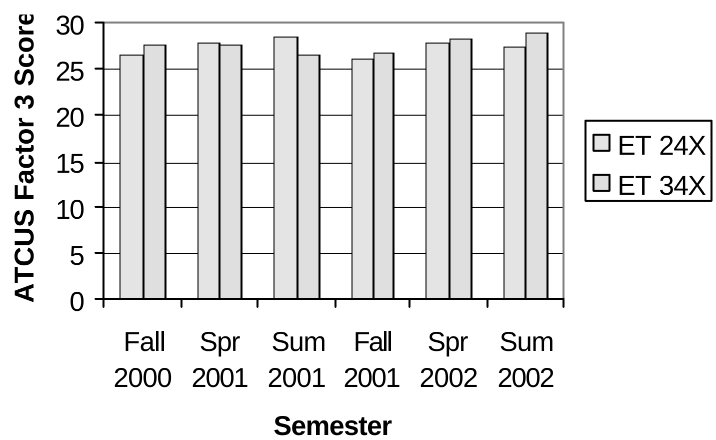
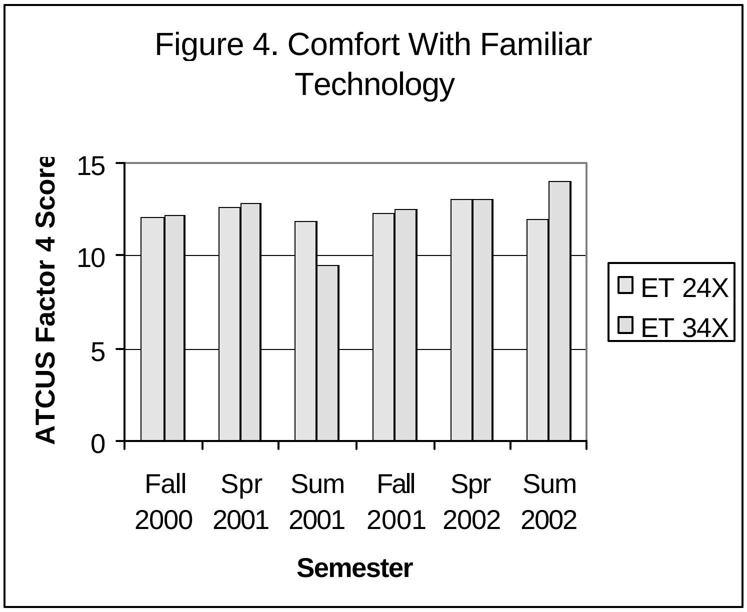


Figure 3. Approval of Computer Use in Education





Computer Use and Anxiety

Participants in this study were asked to estimate the total number of hours per week that they used a computer for any purpose during a typical week. Mean values are reported in Table 3. N-values differ due to no response. Again, these means are quite stable over the six semesters of data collection and across courses.

Candidates were also asked to give a Likert-scale rating to their anxiety with using computers. Mean scores are reported in Table 4. N-values differ due to no response. Mean scores are only slightly above the middle of the scale, tipping toward the "not anxious at all" end. The stability of these means also lends support to the resilience of attitudes and anxieties with technology regardless of skill development and curriculum.

Table 3. Average Computer Use in Hours Per Week

	Fall 2000	Spr 2001	Sum 2001	Fall 2001	Spr 2002	Sum 2002
ET 24X	8.7	8.4	7.3	8.4	10.5	7.6
N=	139	125	15	112	164	16
ET 34X	8.7	8.9	8.4	9.1	7.8	8.5
N=	92	144	14	125	84	25

Table 4. Average Computer Anxiety Self-Rating

	Fall 2000	Spr 2001	Sum 2001	Fall 2001	Spr 2002	Sum 2002
ET 24X	3.8	3.7	3.4	3.6	3.8	4.3
N=	139	115	10	93	169	17
ET 34X	3.6	3.9	4.0	3.7	3.8	3.8
N=	92	125	10	116	87	24

Conclusion

The tendency for the traditional pedagogy to be maintained is legendary in our observation that most often we teach the way we were taught. If we are to achieve any level of reform in pedagogy to institutionalize the infusion of technology within classroom practice, these results indicate that the affective issues of attitude and anxiety related to technology use must be considered in the complexity of teacher preparation. Technology integration as part of teacher preparation cannot continue to be about exposing candidates to best practices and skills development, but must re-focus on infusing technology integration strategies and skills into the knowledge base of pedagogy. While we generally accept that social conditioning occurs through modeling, there are discrepancies between the curricula of most preservice instructional technology courses and what is the typical practice of teachers in American schools (Betrus & Molenda, 2002). Initial analyses of these data support serious consideration of the effect of attitudes and anxieties on technology use that is directly related to the adoption of such tools within pedagogy. To meet the standards of performance and accountability that are set for the preparation of future classroom teachers and to impact the true infusion of technology within teaching, we must incorporate the affective domain within the design and delivery of our curricula and field experiences.

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The Influence of an Instructional Technology Course on Future Teaching Practice: A Qualitative Approach

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Introduction

Rapid advancements in computer technology have had a profound impact on what happens in the 21st century classroom. There are increasing demands for teachers to use technology in their classrooms (Chambers & Stacey, 1999). Studies have concluded that classroom students get more enjoyment of subject matter and motivation is increased when technology is added to the instructional strategies of the classroom (Pugalee & Robinson, 1998). Even with these findings, Moursund and Bielefeldt (1999) discovered a number of national reports indicating that instructional technology was not frequently integrated into classroom instruction. With 2.2 million teachers expected to be hired in the next decade, Moursund and Bielefeldt also point out that this is a great opportunity to infuse new ideas, philosophies, and practices of using technology into the 21st century classroom.

Effective use of technology can have positive effects on teaching practices (Pugalee & Robinson, 1998). The literature indicates that technology can improve teaching quality and have positive effects on student achievement ("Teachers Speak Out on Technology in the Classroom. Instructor Survey Results," 1991). However, teachers must be competent computer users themselves in order to impact students' proficiency with the technology (Barker, 1994). Results from a 1999 study suggest that a single course in instructional technology cannot provide adequate preparation for preservice teachers to integrate technology into their classrooms (Willis, Thompson, & Sadera, 1999). This research was intended to discover if intentions about future teaching practice are influenced even if the teachers do not have the necessary skills to fully integrate technology.

This qualitative case study investigates the following research questions: How do preservice teachers understand the effect of an instructional technology course on their future teaching practice? And secondly, how do preservice teachers experience the effect of the instructional technology course? This study was designed to explore the effect an instructional technology (IT) course would have on the ideas, philosophies, and identities of these future teachers by examining their perceived affect of the course on their future teaching practice. A part of the investigation is designed to gain some understanding of how preservice teachers experience the effect of the instructional technology course.

Teachers who have positive experiences with computers are more likely to implement technology-based lessons in their own classroom. Preservice teachers need an assortment of opportunities to use technology in order to enhance their own learning opportunities and instructional technology development is critical to their preparation programs (Brennan, 2000). It has been noted, however, that future teachers often come into a teacher training program ill-prepared in basic technology skills and don't feel any pressure or need to learn it (Willis et al., 1999), ultimately it is up to the faculty to model effective technology infusion and instill the importance of the use of K-12 classroom technology.

> There is an ironic and costly contradiction in the attempt to integrate technology into education. While evidence of the educational benefits of technology abounds and investment in hardware and software has dramatically increased, relatively few teachers use technology regularly in their teaching and the impact of computers on existing curricula is still very limited. (Zhao & Cziko, 2001, page 22)

Review of Literature

Instructors who incorporate computer technology into their classroom teaching can serve as role models for preservice teachers and increase the likelihood that they will consider technology as an option for their own classrooms, "strategies to enhance teacher experience with computer technologies could contribute to the formation of positive attitudes and self-efficacy, and in this way positively influence teacher adoption, use, and modeling of computer technologies" (Pepper, 1999).

If teachers are to incorporate the use of technology into their everyday teaching practice, then they must expand their technical skills, increase their competence, and learn how to incorporate computers into everyday classroom teaching (Halpin & Kossegi, 1996). Courses such as the basic introduction to instructional technology are just a stepping-stone for students to reach the necessary competency levels and have a positive impact on students.

In order to guide educational leaders, The International Society for Technology in Education (ISTE) has proposed a list of National Educational Technology Standards (NETS) for all preservice and in-service teachers. All classroom teachers, ISTE states, should be prepared to meet the standards and performance indicators, which include the ability to demonstrate a sound understanding of technology operations and concepts; plan and design effective learning environments and experiences supported by technology; implement curriculum plans that include methods and strategies for applying technology to maximize student learning; apply technology to facilitate a variety of effective assessment and evaluation strategies; use technology to enhance their productivity and professional practice; understand the social, ethical, legal, and human issues surrounding the use of technology in PreK-12 schools and apply that understanding in practice. (ISTE, 2000) The challenge for teacher preparation programs and K-12 school leadership is to find cost effective ways to provide technology professional development that will improve educational technology skills with the expectations of positively effecting student achievement.

"A typical school spends just 0 to 5 percent of its annual technology budget on in-service training; therefore odds are that teachers must learn a lot on their own or informally from colleagues" (Geisert & Futrell, 2000). Thus suggesting that teachers must achieve basic computer skills in the teacher preparation program. School communities are investing in computers for the classroom but it would appear that they are only recently becoming aware of the need to educate the teachers on effective ways to infuse technology into classroom learning. Computers are not the end but the means, they are just tools to help to improve student learning.

Technology in the Classroom

Technologies are developed by humans as a way of adapting to the world and are invented to solve a problem The key to helping teachers to use technology in the classroom is to help them first, see that there may be a problem (possibly deficient student learning) and next, that the computer may be a tool that can help adapt teaching methods to meet the needs of the students.

"The word technology derives its meaning from the root work technique. Making wise choices about the use of technology, then, depends on recognizing the ways in which it facilitates the things that humans can do. The tools that a society uses structure the techniques that are available to humans to shape the world in which we live." (Norton & Wiburg, 1998)

"A defining technology is a technology that results in fundamental changes in how people see themselves and their world. A defining technology serves as a filter, structuring and directing people's interpretations of their experiences…Today's defining technologies are the electronic technologies. Thinking 'through' the electronic technologies, we are presented with alternate means of communicating, informing, and knowing" (Sheingold & Hadley, 1990, 5-6).

For the purposes of this paper, technology will refer to the three areas of technology that directly affect education; computers, multimedia and the information infrastructure (Internet, superhighway) (Schwartz & Beichner, 1999).

Using technology in the classroom is not 'new' for students or teachers. Record players, tape recorders, filmstrip projectors, televisions, VCR's and overhead projectors have been a staple of the American classroom for decades. Computers have been in schools for twenty years or more and billions of dollars have been spent. It has not been until the late 1990's that the average classroom teacher was expected to use the computer in his/her own classroom. Until recently, the computers were housed in a special computer room and supported by an educational technology specialist. Student computer use was limited to a special lab time or a computer class much like physical education or music. The message, early on, was that teachers didn't need to know how to use the computer, just as they don't need to know how to play the piano or run around the track, these were all things that students would learn from 'specialized teachers'.

Fast forward to the 21st Century and much has changed. Budget cuts and community pressure have often removed the 'specialized' educator and placed more demands on the classroom teacher. Computers are at the forefront of the revolution. Computers have been moved from the individualized lab and placed into classrooms. Teachers who once could avoid the electronic machines are no longer afforded that luxury. Educational technologists now play an advisory role, frequently in a number of schools within a school district, and they often do not take responsibility for teaching students directly. The age of technological innovations has been brought into the safe-haven of the average classroom.

Willis et al. (1999) suggest that most teacher education faculty have positive attitudes toward technology in education, moreover, they agree that an infusion program can be an effective way of modeling technology integration. The common problem in the preservice teacher preparation program is that the faculty members don't have a strong background in actually integrating technology into the courses that they teach, thus perpetuating the inadequate teacher preparation (Willis et al., 1999). Faculty and classroom teachers may be frustrated and unmotivated to use the classroom computers, possibly because they have not had time to adjust to the innovation and how it will affect the their use of time and impact their beliefs and philosophy of education.

Sheingold and Hadley (1990) presented a report about teachers in grades 4 through 12 accomplished at integrating computers into their teaching. The researchers discovered that many of these teachers devoted their own time to learning how to use computers and received local support for using them. The researchers concluded that teachers who can effectively infuse the use of computers in the elementary classroom are more likely to challenge their students with more complex materials and encourage more independence in the classroom (Sheingold & Hadley, 1990).

Methods

This research employs the case study method, however, there are many types of case study techniques ranging from purely qualitative, non-generalizable techniques to others that can assume some degree of quantitative reliability through statistical methods.

Creswell (1998) defines a case study is "an exploration of a "bounded system" or a case over time through detailed, in-depth data collection involving multiple sources of information rich in context. (Creswell, 1998, p. 61). The descriptive case study presents a detailed account of the case study, not "…guided by established or hypothesized generalizations nor motivated by a desire to formulate general hypothesis" (Merriam, 2001, p. 38). Qualitative research is not designed to test concepts, hypotheses, and theories, but rather build and describe that which is being researched (Creswell, 1998).

Five preservice teachers from a large university participated in the descriptive case study. They were all female ranging from 19 to 44 years of age. Four of the participants are Elementary Education majors; the fifth participant is focusing on Adult Education. All of the students were enrolled in an introduction to instructional technology course meeting twice per week for one academic semester.

The students are all preservice teachers with different class standings, ranging from a sophomore to a graduate student. They all have a variety of backgrounds working with children and in schools. The students with more experience were better able express their ideas about student learning and their personal philosophies. Those with less experience may not have had opportunity to consider the questions in the past and they had a tendency to give more generalized answers.

The course is taught by two different instructors as a 2.00 or 3.00 credit course. Both instructors were helpful in providing access to their classrooms and their students. The five participants volunteered to partake in the investigation after a brief in-class presentation introducing the purpose of the study. The course goals and objectives were the same, the sections were each taught in the same classroom, and similar material was covered in all sections.

The course syllabus indicates that the course is intended for students interested in educational applications of the microcomputer (i.e., lesson plans, presentation tools, course supplements) and is not designed to teach web development, spreadsheet, database, the Internet, and World Wide Web in the absence of this context. Students must have completed a prerequisite course in educational psychology. The introductory course introduces the microcomputer and its educational applications; instruction will be based on the premise that participants are novices. The goal of the course is to teach preservice teachers how to operate microcomputers as well as develop skills needed for the appropriate application of microcomputers in education. Students must become familiar with the range of educational computing issues, which includes the use of computers as teaching devices, presentation tools, learning environments, as well as developing and evaluating Internet resources (course syllabus, 2002).

Over the course of several months classroom observations were supplemented by a series of interviews with the five participants to focus on questions related to their current philosophy, teacher identity, beliefs about how children learn, and the influence the IT course may have on their future teaching practice. Student work was examined to determine the level of progress the participants gained during the semester.

Results and Discussion

The interviews were transcribed and coded in search of common themes and ideas. From a review of the interviews, observations, and student work there were several themes that began to emerge. The respondents were very helpful and had many interesting things to say about student learning and their personal philosophy of education. The preservice teachers showed a great interest in student learning styles and making children feel at ease in a learning environment. I tried to probe into their ideals to determine if they believe technology has a place in their teaching and learning philosophies.

Theme 1: Participants' expectations focused on skill level despite the course goal of educational integration.

In the first interview most of the participants had a focus on basic skills. Although skills should be considered as important to personal success in the course, they are not listed as a prerequisite. This instructional technology course is not as much about computer skills as it is about integrating technology into the classroom. It seems students, however, approach the course in a different way. Many of the opinions of the respondents seemed dependent on their perceived strength of computer skills and discussion often centered on this perceived self-efficacy despite the stated course goals.

Mary, a graduate student in Adult Education stated, "I think computer skills are more important to get the most out of the class, the volume of what we are learning in this class is introductory, it does not depend on if you know Maslow's theory or you know chunking or any of those kinds of things."

Janet, a senior elementary education major was excited about learning the skills, "I know a lot of stuff and I think this class is helping me learn it. I take a lot of notes [on how to make the databases and the different things] and hopefully that will help me, at the end I will have this resource to refer back to." She indicated that little of what she wrote was related to education; it was mainly about the technical issues.

As they look ahead in the semester, students are more concerned with the technological skills they are going to learn than the ways in which they can apply their learning. Nancy indicated her excitement about web page development; "I think we design something we put on the Internet, a web page or something. I think that I would like to do that because I don't know how to design a web page."

Mary is a highly competent computer user. Her resume includes many hours of computer instruction to returning adults and university faculty. She is looking for some skill development to fill gaps in her own knowledge, however she was able to see the opportunities to apply the information exists. "Even if it is technically lower than what I need there are little fundamentals that you miss out on if you don't take those introduction things." She admits the biggest help to her is being on the other side of the computer, "I have learned to give students smaller bytes of information and more white space on the page." But she quickly returns to a focus on computer skills. "There are a lot of things I enjoy about his class but they are mostly the technical things, like the artistic things because I am always looking for those ways to make something look more appealing to the person that's reading it."

As an interviewer I was aware of the course goal of focusing on the educational integration, I asked Ellen if she thought computers changed the way people learn and in turn would change the way she taught children in the classroom. Her response was mainly skill related with less emphasis on implementation, "I learned things that can help me as a teacher, like today we learned about the database and which definitely you can use, you can make up a database for all your students that's actually kind of interesting and helpful, we did transparencies, I am sure we are going to learn PowerPoint." Her thoughts seem more specific about what applications they were going to learn and more general about using the computer technology as a classroom tool.

Ellen is a self-proclaimed computer-illiterate. She lacks many of the basic techniques and is using this course as a method to learn the computer skills. "I can type a paper but that is about it." I got the impression from our conversations that Ellen was much more concerned about controlling what students did on the computer than actually learning to use the computer for the benefit of the class.

> I am hoping to take what I have learned in this class to help me understand what the kids are doing, I am sure they know a lot more than I will ever know. So when I get into class I want to be able to understand that hey, she's talking to somebody else in Social Studies right now and I want to be able to correct that and I also want them to be able to use that computer as an extra tool or to find things that may enhance what I am teaching.

The course syllabus recommends that students attend workshops offered by the computer center to supplement their skill development. None of the 5 study participants attended those workshops, in fact, some were not even aware that they were available. When Ellen was told that the workshops were offered she replied, "Really? I didn't even know about that. I guess I could go but it would depend on when they had them, my schedule is pretty packed right now."

The struggle will continue between developing student skills and modeling technology integration. Moreover it appears that preservice teacher ability with technology can adversely effect the teacher's perception about the need for technology integration. Studies continue to find that university faculty in programs that prepare teachers are unsure of what to teach their future teachers or how to use technology in their instruction (Gillingham & Topper, 1999); thus adversely influencing their beliefs about the way to students learn and the best way to meet their needs.

Theme 2: Participants recommended that all preservice teachers take this course.

There continues to be debate among professionals as to whether preservice teacher programs should offer stand alone courses in educational technology or implement a model that demonstrates the integration throughout preservice training (Carbone, 2000). To that end, many colleges and universities are removing the course from the offered curriculum and replacing it with the infusion model. The technology infusion approach places a variety of technological aspects within each course in a teacher-preparation program. “The positive aspects of technology infusion include long-term exposure to technology and technology modeling within subject-matter courses. The negative aspects of technology infusion include inconsistent implementation; inability to calculate faculty load, provide faculty instruction, or faculty support; and the invisibility of technology knowledge on student transcripts” (Gillingham & Topper, 1999). The teacher preparation program in which these students are currently enrolled does not require any computer course, this IT course is offered in another department as an elective course.

In general all the participants found the course a satisfactory experience and felt that other colleagues would also benefit from the course. Janet describes it this way:

> Yes this has been a pleasant experience and yesterday in my other class I told everyone to take it so obviously I am an advocate of this class, it is not required for me I just taking it, my concentration is in math and science and I asked and they passed if for me for it can count as math…I think it should be required now-a-days – I think there should be more publicity for this class.

Similar comments from Mary and Nancy, “I really like [the instructor’s] class a lot” and “this is a really good class” reinforce the positive attitudes. Further discovery shows that the experience was not dissimilar for novice computer users or the more experienced, each was able to find the benefits of the class. The syllabus indicates that the course will be directed towards the novice computer user but it appears to be able to challenge even the more experienced computer users by requiring a number of independent projects.

If technology courses are not required in the preservice teacher course of study, I was interested to know how students perceived the integration of technology through their methods courses. Nancy responded:

> They always emphasize integrating technology but I think maybe in each of my methods classes we go to the technology lab once and that’s it, and we see websites and things, actually one class I am taking this semester, we have gone to the internet quite a few times and looked a different educational websites and looked at them at home… I think they emphasize you to use technology and they take you to the computer lab once. One of my classes actually uses technology but the majority of classes we don’t actually hands on use technology in the class, they always say, well we welcome it if you do it and you can do a project with it but its never like this is how you can teach a lesson with technology.

Wanda is a sophomore elementary education major. Her background in educational theory and practice is weak, as would be expected of a so student early in her program. She is seeking a minor in instructional technology,

> This is a class I have to take for that [her minor] and it is the only class I look forward to every week, I learn so much in that class, every single thing that he does in that class seems to relate to what you are going to do as a teacher someday and I just think that the stuff he has taught us is really, really important. More teachers should take this class.

Their suggestion that more teachers take this course raises some concerns. Mainly it must be examined as to whether it is the computer skills that are more important to the student or the ability to apply them in the classroom. It has been indicated that teachers who know how to use computers are more likely to integrate them into their teaching practice, thus it appears to be a circle. Those that take the class improve their skills, thus improving the likelihood that they will integrate technology use in their own classroom; the modeling done by the instructor becomes secondary. Although students are more likely to implement technology use when it has been modeled for them, the lack of the basic skills can undermine any enthusiasm to actually try it on their own.

Theme 3: Parental involvement.

The message that involving parents with their children’s daily lives in the classroom can have a positive effect on student achievement is being sent loud and clear to these future teachers. Including parents with email and web pages were just a few of the suggestions they made. Typically parents are included in bake sales, fund raising efforts, shuffling papers, and word-processing chores. Jones (2001) indicates that these common parent activities traditionally associated with parent involvement are not likely to have much impact on student achievement. She suggests that parents must be further engaged in specific academic activities, such as tutoring and direct student interaction, in order to have a positive effect on student learning.

Family participation in well-designed at-home activities appears to provide the greatest impact on student achievement (Jones, 2001). The participants in this study were very interested in involving the parents in their classroom activities yet none of the preservice teachers were aware of the importance of the at-home connection. Keeping parents involved in the daytime class activities was their main focus. Janet was asked about parental involvement in the classroom,

> I am a strong advocate of parental involvement, even if the parents can't come in, then maybe grandparents, or aunts and uncles, just somewhere where a lot of people can help and volunteer in the classroom and I think a lot of parents are looking for that. If parents work all day they can [become involved] through letters or possibly where their more in charge of making sure that the party is planned and they don't necessarily come in for the party but at night when they are home they can call the different parents and make sure that Tommy's mom has the cups, that way they are in involved that way.

Janet was clear about her beliefs about including families in the classroom activities but she was unclear about the benefits of using technology to help her. There is little doubt that parental involvement can help improve school-family relationships, which can positively affect student-school relationships. New teachers are being taught to think about all kinds of families, socio-economic levels, and cultures. This is a very positive trend, yet they are not being shown ways to communicate effectively with these families using a variety of mediums.

In a University of Minnesota study conducted by professor Joe Nathan (2001), 1,100 Minnesota principals and superintendents were asked how well new teachers were prepared for the realities of their work, only 25% said new teachers were well prepared or very well prepared to deal with parents; in contrast, 73% reported new teachers were well prepared or very well prepared in content areas (Jones, 2001).

Wanda is aware of implications of parents helping their children, yet technology does not seem to affect how she thinks about communicating and interacting with parents.

> I think the home environment definitely influences how they learn in school, you know the kids who come home and their parents don't ask them what their homework is and don't help them at all they obviously are going to learn a lot less, their learning will be less reinforced than kids whose parents sit with them at night and help them with their homework and everything like that, I think knowing kids' background is really important.

Including parents in student learning is a talent that many teachers build with experience. Parents can be intimidating, demanding, and frustrating, but they can also be helpful, excited, willing participants in the classroom. It is important for preservice teachers to consider their inclusion in their teaching practice and also note the ways that technology can assist in this process.

Theme 4: Although students were provided with a number of skills and ideas it is still questionable as to whether these teachers will use computers in their own classrooms.

There is a concern among educators that the preservice teacher training programs are not sufficiently teaching students about the effective use of technology in the classroom. Student attitudes toward working with computers while in training are important indicators of their eventual use in their professional classrooms (Pepper, 1999). The goal of this IT course is to ease those concerns. With the wide range of student computer ability and the variety of disciplines represented in the class population, it is no wonder that the goals are difficult to achieve.

There are about 18 students enrolled in the course, study participants indicated that only a few, approximately 7, are education majors. There is a small population of computer science majors and business majors as well. Several interviewees expressed that these non-education majors have better computer skills than the future teachers. Studies indicate that previous computer experiences correlate highly with student attitudes towards using computers (Pepper, 1999). Those interviewed indicated that their experiences in this class thus far had been extremely positive and their skills had improved, however, the focus is on the skills not eventual classroom implementation.

Mary indicated, "I might use some of the things we learned in class." But there appears to be little improvement for Ellen, "I still hate computers, well, I don't hate them but I get so frustrated sometimes that I don't know how to do things or that I lose it and I don't know where it went and I don't know how to get it back."

When participants were directly asked what they would do to incorporate computers into classroom instruction many stumbled. Janet states: "I think if somebody asked me like what would you do, I might say like type their work and make it look nice and put it outside or maybe build a book or something like that and more formatting stuff."

Ellen also echoes with, "You can type papers, I can give you time to write a journal or something, like I made a movie on a zip-disk, I could have them look-up, well, I am trying to think of something else, there has to be more things."

Teachers have a whole schedule of things to do during the school day. The frustration of not truly knowing what to do with computers, accompanied by an attitude that they may not be necessary, often leads a teachers to spend their time elsewhere. Ellen has an older brother who is currently a classroom teacher. He took this same IT course a few years ago but displays a noticeable lack of computer skills. Ellen did not seem concerned, "He [my brother] is a good teacher and I don't think that not knowing technology puts him at a disadvantage, he will just have to go to another source to get the information."

Research has indicated that teachers struggle to transfer their personal computer skills into their classroom teaching (Cesarone, 2000). If teachers model the teaching behaviors they have observed then it is up to the instructors of the teachers to become more proficient at computer integration.

During classroom observations I spent time watching the interaction of students with each other and the instructor. I was not concerned with the content of the lesson as much as I wanted to see how technology use was integrated into the classroom instruction and what kind of modeling was demonstrated. I found that the majority of the time was focused on skill development mainly working on an assigned project. Thus the eventual conclusions that students drew from the experience, such as skill development is more important than integration, was most likely a direct response to that which was witnessed in the classroom and the actions of the instructor.

Two groups of three and four members respectively, completed the work I evaluated; only one member of the group was involved in this project. It was difficult to determine what kind of influence the participant had in the preparation of the project. In one case in particular, I know that the group contained at least two computer science majors with greater computer experience and skills that may explain the complexity of the project. The only projects that I reviewed done by one person was produced using a word processing product, which cannot give me a true sense of what she can do with technology integration.

During the interviews Ellen expressed concern on a number of occasions that her work was not as well done as her computer science classmates. She was showed a serious concern over the quality of her work and contributed her lack of skill to her apprehension to use the technology in a classroom. "I see their projects and whoa, I can't do that, I don't think I can ever do that. When students see that kind of stuff, like on video games and stuff, why would they be impressed with just a bunch of colored words on the screen? No, I have a lot to learn yet." If teachers don't feel the urgency to learn more complex techniques it seems they often ignore the technology option opting to spend their time on other things on which they have demonstrated a higher competence.

Conclusion

It was not until the course was in the final weeks that students were just beginning to feel comfortable enough with their computer skills to pay attention to the purpose of the course, which was intended for students interested in educational applications of the microcomputer and not to basic computer skills. Two of the preservice teachers are participating in their student teaching experience in the fall of 2002. Future research could include follow-up interviews with them when the experiences are completed to determine if any of their expectations regarding technology were met. In many cases, teachers recognize their own teaching practice falls short of their personal ideal. Teachers struggle with what they would like to do and what they can realistically accomplish given the resources. In addition, classroom teachers often perceive the practice in their school as even more 'traditional' than their own, providing little motivation to try new approaches in the classroom (Kuehn, 1993). If the cooperating teacher is not motivated to innovate in the classroom, the preservice teacher may model similar behavior long after her student teacher experience.

I would recommend that students supplement this course with workshops offered by the university computer center in order build computer skills and self-assurance. This new found confidence may help preservice teachers focus on the application of the skills and not the acquisition of the skills. The students are excited to learn these new skills but a short semester is not enough time for students to develop them beyond the basics. Ellen indicated her concern about using an unfamiliar computer in her classroom "There are probably programs on there, you just have to find them or you have to know how to use the computer to find that and then it can be helpful in the classroom. Otherwise it would probably sit there until someone could help me use it."

It was unrealistic to assume that this IT course would have an effect on future teaching practice. The students in this study did not have a well-developed philosophy of education thus making it improbable that any one course could have a sustained impact on their beliefs. The students indicated that there isn't enough time to affect their practice, however the course did provide a number of good ideas for implementation in the classroom. Janet stated: "it [the course] has shown me a lot of new things and how you can incorporate different things beside Word into the classroom – I don't think a lot of teachers know this stuff."

Technology is a growing part of our culture. Students are exposed to computers in the grocery store, the fast food restaurants, and in their own homes. Computers provide another tool for teachers to use to present multiple representations of concepts in order to stimulate greater learning in their students. It is the job of the colleges and universities to give our preservice teachers the tools they need to meet the challenge of engaging students in their own classrooms. In this instance offering a 2.00 or 3.00 credit instructional technology course as the way of improving the eventual use of these tools in future teaching practice was not the most efficient method for these participants. The results of this short case study also indicate that the course had no effect on the students' ideas about future teaching practice, nor did they fully understand the impact that the course had on their beliefs.

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Cultural Conceptions about Computer Technologies of Hispanic Women in an Adult Literacy Program

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Abstract

Computer technologies are overwhelming the job market and education, influencing public opinion about their wants and needs. Many people see how common place computer have become and feel that their use is necessary to accomplish work and improve learning. However, the reality is that they have been subconsciously influenced by the media, school, and the society-at-large.

The goal of this qualitative study was to understand the cultural conceptions about computer technologies of 12 economically challenged Hispanic women in an adult literacy program. Findings indicated that students (a) perceived computers as important and necessary; (b) wanted to gain computer skills to be competitive in the job market and to help their children; and (c) recognized negative and positive aspects of computer technologies.

Introduction

Many Hispanic adults in poverty face the difficulty of being considered illiterate while raising their children with limited educational resources to achieve higher levels of education. Hispanics, many of them recent immigrants, hope that through education, their families can move up in society and improve their quality of life. Programs that focus on low-income families target this population, offering them educational programs that support their performance in a society where education is considered essential.

A better understanding of students' learning experiences and perceptions is needed to expand the knowledge of academically and economically challenged Hispanics. It is especially important to conduct investigations about personal experiences of adults in programs intended to break the cycle of poverty and illiteracy.

Theoretical Background

The theoretical background for this paper is based on computer penetration at home, motivation to learn to use computers, and the influence of the media.

The presence of computer technologies has been impacting the job market and education while influencing people's opinions in unexpected ways. The media promote advances in technologies, assuming that they bring progress to people's lives. For example, television and the press provide evidence for the conveniences of accessing the Internet from home. Barton (1994) argued that published advertisements "try to convince readers to make these new products part of their lives" (p. 58); furthermore, such advertising makes some people subconsciously accept the "cultural myth of technology-as-all-powerful-and-good" (Duffelmeyer, 2000, p. 291).

With the spread of computer technologies in the last decades, people receive positive media messages about the need to adopt new technologies, assuring them that computers will facilitate their work and their children's learning. When parents see these positive messages, they become convinced that computers will help their children "to remain competitive in school and in their future careers" (Takayoshi, 1996, p. 199). On the contrary, the media also promote negative aspects of computer technologies such as the possibility of the Internet making children more vulnerable to pornography and the promise of romantic dates that could threaten their personal well being (Takayoshi). As a result, people also become aware of the negative aspects of computer technologies. However, the positive impact of the messages about computers usually outweigh those risks because the pressure of the media promoting the overwhelming success of computers in education and business is magnified in its influence on people's opinions.

Technologically advanced cultures present different messages through the media, and society-at-large in positive and occasionally in negative ways. Those messages are subliminally internalized in people's minds. McLaren (2003, p. 203) argued that the dominant culture "is able to manufacture dreams and desires" where without realizing it, people develop a common way of thinking through the use of "signs, symbols, and representations." With this, the impact of dominant culture "power and privileges" (p. 203) is hidden while influencing people's opinions in expected ways. These dreams and desires are created subconsciously in the minds of people who are exposed to positive images of computer technologies that have been promoted by different entities as being necessary to their wants and needs.

As a result of the influence of the organs of media and society-at-large, people's conceptions about computer technologies are socially constructed and impacted by the dominant culture in which they live. These adulterated conceptions become part of individuals' thoughts and "appear in a culture as 'natural' and 'normal' because that which is not articulated cannot be argued against nor resisted" (Takayoshi, 1996, p. 198). People perceive computers as important artifacts, necessary for work and educational environments.

It was our interest to examine selected Hispanic women's cultural conceptions about computer technologies and to determine what aspects of the media, school or society-at-large influenced those conceptions.

Methodology

The goal of this qualitative study was to understand the cultural conceptions about computer technologies of 12 economically challenged Hispanic women in an adult literacy program. This study is part of a broader investigation that examines students' sociocultural context and cultural conceptions about learning and computers. The research question addressed in this paper was "What are the participants' cultural conceptions about computer technologies?"

Context

The study was performed in an adult literacy program housed in an adult learning center in a small city in the Southwest of the United States. The goal of the program is to improve three areas in the students' lives: early childhood development, parenting skills and adult education. The program focuses on low-income parents with children younger than eight years of age and that has an education need. The program provides childcare; students mentioned this service as an important reason that the program works so well for them. They explained that they could not study without this assistance because most of the participants have several children under eight years of age.

As part of their education, the students were enrolled in a 45-minute computer literacy class that met once a week. The primary researcher observed the students in their computer class during a period of 11 weeks. It was the first time that this class had been offered at the center. At the beginning of the semester, the class was taught in the reception area. Later, four desktop computers were acquired and the class was moved to the GED classroom.

Participants

By February 2002, the program had a total of 25 students, 24 of them from Mexican origin. From those 24, 23 students spoke Spanish as their first language. For this study, 12 students were selected to be interviewed. The age range of the participants was from 22 to 36, with an average age of 29. During the first seven weeks of the study, the primary researcher conducted interviews with four teachers of the adult literacy program. The teachers were asked to recommend students who could offer significant insights to the study.

Student composition varied during the time of the investigation due to continuous turnover. This turnover presented a challenge for the researchers when following some of the students' stories from the beginning to the end of the study.

Data Source and Analysis

The primary data source for this study was a series of semi-structured interviews with the 12 selected students. The initial interview consisted of seven open-ended questions. One of those questions "What do you think influenced your opinion about computers?" provided the fundamentals of this paper.

After a preliminary analysis of the interviews, six students were selected for a second interview, and from those six students, three were selected for a third interview. The follow-up interviews were more in depth, broadening and clarifying topics from previous interviews and observations while asking students about issues related to the computer class. This interview process resulted in rich descriptions of students' conceptions about computers. In addition, as a result of the prolonged time spent on the location, thick descriptions of students' sociocultural context were recorded. Observations from formal and informal student activities were also discussed during the follow-up interviews. This research method helped the primary researcher understand the problem under study from the participants' viewpoints.

The interviews were audio taped to ensure "that everything said is preserved for analysis" (Merriam, 1998, p. 87) and immediately transcribed. The data were reviewed and categorized according to the emerging themes following the constant comparative method (Strauss & Corbin, 1990). Open coding took place from the raw data during the initial examination of the interview transcripts. Extensive readings were done to the first interview, the primary researcher wrote comments and notes in the sides of the transcripts. The same procedure was performed for the other two interviews.

From this initial reading of the interviews, the researchers divided the data into categories of information according to the preliminary themes found in the literature review. Examples of these themes included computer penetration at home, motivation to learn computers, and the influence of the media on students' cultural conceptions. Emerging themes from subsequent readings were added to the preliminary themes. The text was pasted on cards to allow them to be sorted according to the categories. To answer the research question, the cards were reexamined searching for keywords derived from the categories using word processing features.

After this process, the researchers identified a central category, students' conceptions about computers and the Internet. An examination of the cards was performed to find the factors influencing those conceptions. The factors were narrowed until obtaining the main influences in students' opinions.

Results

The results of the research question addressed the cultural conceptions about computer technologies of twelve Hispanic women in a family literacy program. These results were based on a qualitative analysis of interviews with the participants. Three major findings were that the participants—(a) perceived computers as important and necessary; (b) wanted to gain computer skills to be competitive in the job market and to help their children; and (c) recognized negative and positive aspects of computer technologies.

Perception of Computers as Important and Necessary

The first finding is related to the participants' perception that computers are important and necessary. The participants perceived the computer as an integral part of all learning environments. They established a link between learning and computers, considering the computer indispensable to learning or accessing information that would lead them to learning. They cited as the main reason for needing computers skills the belief that these skills were essential for progress in their present U.S. culture. Even though many of the participants did not own or use a computer, they assumed that computer skills would help them and their children to acquire learning and to excel in school, and for that reason these skills were perceived as very important.

Most students mentioned that they would like to own a computer and access the Internet. Some students owned or had used a computer, but they used it only for basic applications such as paint, word processing, and games. Students perceived a need to possess computer skills; for example, Irma said, "now almost everything needs to be on computers or by the Internet, everything. I think that, yes, we need to learn computers. It is a good thing for us." Earlier, Irma had bought a $600 computer for her daughters. Irma said that she never used it because she was afraid to break it, but she ensured that her daughters knew how to use it. Participants like Irma were convinced that computer skills are important. They accessed or observed computers in the learning center where they were studying and at their children's schools.

Of all of the students interviewed, Carmen demonstrated the greatest interest in teaching herself. Curiously, with only a sixth grade education, Carmen learned to access the Internet by herself after her husband bought an old computer. One of the activities that she enjoyed was searching for recipes. Carmen would first enter "Univision," the Spanish television network, and from there she accessed other websites. Carmen explained that she also "logged into the Internet to learn English… When I need information, I access a website where I can post my questions." She posted a question about finding a program where she could learn English, and she received a program to learn English, written in English and Spanish, in the mail.

Computers are one of the resources needed in the participants' current learning environment here in the United States. Because participants noticed the presence of computers in places that they usually visited (e.g., medical and social services, school, and utility offices), they assumed that computers are necessary in any work environment. Participants stated this as an important reason why they and their children need to learn computers skills. Students cited the computer as important and necessary for their future and for a better life. Some, however, recognized that they had other financial priorities and could not afford to buy a new computer. As Elba explained, "There are many Hispanics who struggle to have something good in their lives. They are probably interested in computers, but sometimes we have…., at least I have, other priorities. There are other things first. I would like to have a computer, but it is a luxury for me, something that I really do not need."

Participants' opinions about computers were influenced by other factors in their daily lives: the visual media. Television impacted participants' conceptions about computers. When participants watched TV commercials and news reports about computer technologies, they stated that they would like to own a computer and that they were motivated to learn computer skills. As suggested by McLaren (2003), people perceive a need for a computer, and they want to have the artifact that they see on television. The participants' "needs and wants" were driven by the influence of television.

Interest in Gaining Computer Skills

The second finding is that the participants wanted to gain computer skills to be competitive in the job market and to help their children.

Competing in the job market

As mentioned earlier, students thought that computer skills are essential for the working environment because they observe computers in the offices that they visit. Students generalized by saying that computers are everywhere and assumed that being computer literate would open the doors for the job market. Cynthia explained, "you find computers in every place and find a better job if you know computers, because stores and all types of jobs have computers." Cynthia thought that Hispanics would be more competitive in the job market if they knew about computers. Irma explained how she did not accept a position of office assistant in her church because she did not know computers. She emphasized that she always told her daughters of the importance of learning to use computers, and that is the reason she bought one for them. Irma lived with her three daughters and husband in an old two-bedroom mobile home; their family struggled because only her husband worked, and like most of the husbands of the interviewees, in a low-income job.

Helping their children

Like most parents, participants were worried about the well being of their children and being able to prepare them for the future. The participants perceived computer skills as necessary to the progress of their children. Parents stated that computer literacy is an essential part of progress in life, school, and job environment. They believed that if their children possessed computer skills, they would have better chances in school and later in the job market.

In addition, participants emphasized their preoccupation with being able to answer their children's questions when they asked about computers. As Elba explained, "when they [children] come and say something about computers you do not react with 'what are you talking about?' ….if we know about computers, we can tell our children and help them to progress in life." Other students also stated this as an important reason for being computer literate. For example, Elsa said, "When they leam in school how to use a computer, I will be familiar with what they are doing. In that way, I understand more when my children use the computer."

Students not only wanted to learn computers, but also wanted to improve their English skills because of their children. They believed that with computer skills, along with improved English skills, they would be able to help their children with homework. Most of the students stated that learning English was their primary motivation for enrolling in the literacy program. When they discovered that they could also take computer classes, they became very enthusiastic and even more motivated, an "unexpected surprise" according to Elba.

Most of the mothers were aware that their children were learning computers skills in school. They assumed that if their children learned computer skills they would have better job opportunities and would excel in school. Cynthia, Gina, Irma and Miriam shared that if their children learned computer skills they would be better equipped for the future workforce. In addition, participants spoke of their motivation to learn computers to help their children with their homework. Carmen mentioned several times her interest in helping her toddler son in the future. She explained, "I could help my child with his homework, because there will be many assignments on the computer. I am very interested in being able to help my son if he asks, 'Mother help me."

Recognition of negative and positive aspects of computer technologies

The third finding is that the participants recognized negative and positive aspects of computer technologies. Participants paid special attention to the developments of computer technologies, but more specifically to the reports of the benefits and dangers of the Internet. These reports were presented on television documentaries, which detail cases of child pornography and risks of online relationships. The researchers had not considered this finding during the development of the investigation. It is an issue brought up by most of the participants during the interviews. They had the basic knowledge of the Internet and how it can be used. When they heard the television news, they feared that their children might become involved in such "negative" experiences. In addition, they reported a great distrust of relationships generated online. Students cited television news that alerts people about the risks of online relationships that can lead to crime. Lisa was aware of these issues, even though she did not own or had not used computers before. She was aware of the potential for the Internet to be a corrupting influence on minors, as she explained, "girls meet boyfriends through the computer and it can really be a trap for them." Nilsa had another concern about the negative impact of the Internet on children: "many people say that on the computer you can learn how to make a bomb." Similarly, Gina was afraid of the negative influence of the Internet and information that children can access. She said, "the only thing that I do not like about computers is that children can see dirty things on the Internet." The negative comments were very similar but the main concern of students was the access to pornography on the Internet. Because of the events they heard on the news, many of the parents were over-protective with their children; two of them reported not allowing their children to visit their friends' houses by themselves.

On the positive side, participants recognized the advantages of the computer and the Internet. Carmen searched for recipes, information about Mexico, and resources to learn English. Elba visited the library with her daughters to access the Public Broadcasting Station website. She liked her daughters' experience with online games and coloring books. Irma explained to their daughters the magnificent special effects on television and movies using computers and specialized software. She encouraged her girls to learn computers and pursue a career where they could have a good income "just with a click of a mouse." She explained to her daughters the importance of studying to avoid falling into dead end jobs where they would need to work in the sun like their father.

The students were aware of the uses of computer technologies. For example, Mirna was amazed at how easily information can be sent "from one place to another instead of using the telephone." She also believed that computers would help her to improve her reading and writing skills, areas in which she was working very hard. She was trying to pass the General Educational Development Examination (GED), having only finished eighth grade. Other uses mentioned by students such as Miriam were that computers can be use to store information and that information can be retrieved when needed. For example, Miriam hoped to open her own business in the future, and she planned to use a computer to manage her business.

Participants were aware of positive and negative aspects of computer technologies, but the positive prevailed over the negative. Those students who did not own a computer shared their interest in having one, but they explained that buying a computer did not fit in their immediate financial priorities. As Lisa explained to her older son, "with the money that I need to buy a new computer, I can save it for the down payment on a house." Lisa and her family rented a one-bedroom house; one of her wishes for the future was to buy a home of their own, but she also wanted to buy a computer for her son.

In summary, the results of this qualitative study showed that Hispanic female students enrolled in this computer literacy class: (a) perceived computers as important and necessary; (b) wanted to gain computer skills to be competitive in the job market and to help their children; and (c) recognized the negative and positive aspects of computer technologies.

Discussion/Conclusions

Hispanic Women's Cultural Conceptions about Computer Technologies

The participants in this qualitative study (a) perceived the computers as important and necessary; (b) wanted to gain computer skills to be competitive in the job market and to help their children; and (c) recognized the positive and negative aspects of computer technologies. The results support the findings of other scholars that suggest that people's conceptions are socially constructed and impacted by the dominant culture through the different entities of the society. What entities and experiences helped to shape participants' conceptions? From the data gathered for this study, we identified these factors that shaped or influenced participants' opinions: (a) cultural background; (b) life experiences and struggles; (c) visits and observations to other people's work; (d) the adult literacy program; (e) children's experiences at school; (f) teachers and friends; and (f) print and visual media.

We distinguished three categories derived from the data analysis. The participants' cultural conceptions of computer technologies were influenced by the sociocultural context, school, and media; these three aspects of students' lives impacted their conceptions.

The Sociocultural Context

The participants in this study shared their own historical background, language, and experiences. Most of them also faced the challenges of immigration to a foreign country where they were labeled as minorities and had a limited knowledge of English. Therefore, the participants shared a unique sociocultural context that influenced their conceptions about computers. Even though most of the participants had a low level of education and came from low-income homes, they recognized the impact of computers and the Internet in their current society. For example, participants were aware of the information that they could access on the Internet to obtain cooking recipes, health information, learn English, and activities for their children.

When some minorities in poverty face this overwhelming promotion of technologies in the society, they are likely to become aware of being computer illiterate. Many minorities decide to buy a computer or enroll in classes hoping to learn and become computer literate. Selfe (1999) points out that citizens of color "continue to have less access to high-tech educational opportunities" (p. 423), making them less computer literate and decreasing their share in diverse computer-related jobs. The present study focused on 12 Hispanic females enrolled in a computer class in an adult learning center. Of the 12 students, 11 were born and raised in Mexico; the twelfth student had a Mexican heritage, as her family immigrated to the United States two generations earlier. Therefore, the position of the students in their current context put them at a disadvantage when compared with other ethnic groups.

The School

Students enrolled in the adult literacy program with the main goal of learning English or obtaining their GED. Hispanic students who recently immigrated to this country felt that they would be better able to integrate into this culture if they could communicate effectively in English. By enrolling in the program, participants demonstrated a great level of commitment to the needs of their children. This was their main motivator to enter into the program. They also felt honored and recognized when were accepted into the literacy program, because it has a high rate of applications and a long waiting period.

The computer class opened a new window for students' future and they felt those skills will help them when their children ask questions about computers. As Miriam explained, "these classes that we are having in the center can be the only opportunity for most of us to learn how to use computers." Participants were hopeful about the future of the computer class in which they were enrolled in the adult learning center.

The Media

In United States, Hispanics are the fastest growing group of citizens of color; many of them come to this country in a search of a dream, but when they arrive here they face the reality of being considered illiterate and fall into menial low-paying jobs. As noted earlier, all 12 Hispanic women interviewed lived on a limited budget. For many families in poverty, television is their main source of information and entertainment (ref). Thus, these factors could influence their participants' perceptions and cause them to develop adulterated cultural conceptions about the need and desire for computer technologies.

As cited by most of the Hispanic women participants, the visual media is the source of their knowledge about issues related with computer technologies. The participants perceived computer technologies from a hegemonic point of view. That is, they watched television reports about computers and mentally translated the messages based on their current context (Hall, 1974). In the United States the use of computers is highly promoted, and computer skills are perceived as essential. Not surprisingly, participants assumed that computers were necessary and they wanted to buy one. The participants' cultural conceptions about computers and the Internet were consistent with the messages received from the media. From television reports, viewers perceived computer advances as omnipotent elements in education and the job market, and they assumed that those advances would improve their learning. McLaren (2003) explains this phenomenon as the dominant culture trying "to 'fix' the meaning of signs, symbols, and representations to provide a 'common' worldview, disguising relations of power and privilege through the organs of mass media and state apparatus such as school, government institutions, and state bureaucracies" (p. 203). Television mainly promotes the use of computer technologies as a symbol of progress in society.

Even though most of the students had no experience using computers, they showed a positive attitude toward them and perceived computers as important and necessary for the academic and future careers of their families.

Final Thoughts

Students demonstrated a great commitment attending the computer class. They conveyed their interest in having the class last more than 45 minutes or be offered more days a week. They also shared their concerns about the future of the class, improvement of the facilities, and having a computer teacher. Finally, students felt honored to participate in the study and recognized the importance of these skills. During the computer class, most of the students saw the primary researcher, who is bilingual in English and Spanish, as another teacher, and they felt comfortable asking questions of her in their native language. This practice represented a dilemma to the primary researcher in deciding the level of involvement she should have in the class and with the students. Outside the classroom, the participants saw the researcher as a friend and shared with her many dreams, advice, and their experiences in this country. This phenomenon, reported in the literature as an ethical consideration in data collection, is typical during interviews that may improve the condition of participants (Merriam, 1998). We appreciate all the participants who kindly participated in this investigation, and we recognize their motivation to improve as human beings, their roles as responsible parents, and their commitment to learning.

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Technology Integration and Innovative Teaching Through Collaboration, Reflection and Modeling: Research Results from Implementation of a Staff Development Model

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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. Self-efficacy remained positive for key research participants through study completion in Spring 2002.

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), including moving from a traditional to a constructivist (or integrated) approach to teaching (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 technology-using teachers in a staff development setting may facilitate changes in 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 beliefs about meaningful technology use.

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).

Embedding learning about technology use within authentic contexts, including active learning approaches such as problem-based learning may contribute toward using technology as a meaningful tool (Duffy & Jonassen, 1992, Torp & Sage, 1998). Learning in authentic contexts may contribute toward changed teacher practice and increased confidence with regard to technology use [Dwyer, 1996). 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 facilitated changes in (1) teachers' beliefs about technology integration; (2) teachers' technology integration practices; and (3) teachers' self-efficacy beliefs for incorporating technology. This study explores how teacher beliefs, practices, and self-efficacy changed, given this professional development experience.

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 for 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 grade levels and content taught. School demographics of the course participants are provided in Table 1. Teacher information, participant demographics and their classes as of Spring 2001 are provided in Table 2. Updated information for Fall 2001 is provided in Table 3, as some of the key research participants changed grades that term.

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%	4-6
Elm Creek	375	Approx. 3%	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	5 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
Teacher Name	Research Participation Level	School	Yrs Tchg	Teacher Degrees Obtained	Grade Level	Content Taught	Class Size	Classroom and Lab Computer Resources
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
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	Principal (18 yrs)	--	NA	I-Macs; access to computer lab

Sarah	Limited	Middleton	--	Supervision B.S., Elementary Ed., B.S. in Special Ed.	5th	All subjects	--	2 I-Macs in classroom; access to computer lab.

Table 3. Demographics for Key Research Participants – Fall 2001 through Spring 2002 (Names are pseudonyms)

Teacher Name	Research Participation Level	School	Grade Level	Content Taught
Caroline	Extensive	Hilltop	3rd	All subjects
Clara	Extensive	Hilltop	2nd	All subjects
Greta	Extensive	Hilltop	Kindergarten	All subjects
Kathy	Extensive	Fairview	3rd	All subjects
Eleanor	Extensive	Fairview	4th	All subjects
Jennifer	Extensive	Elm Creek	7th and 8th	Math and Geometry
Julia	Extensive	Elm Creek	7th and 8th	Family Living; Clothing Construction

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 teachers' 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 collection continued during the Fall 2001 and Spring 2002 semesters 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 designed 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. 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. Initial and post-course interviews were conducted to learn about changing teacher visions, beliefs (e.g., teachers' 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 course outset; the second interview was conducted in June 2001, the week following the end of the course. A third interview was conducted mid-term Fall 2001 and two interviews were conducted in Spring 2002 (early in the term and the week following term end) to continue to explore evolving teacher beliefs and visions, classroom practices, and changes in self-efficacy.

Course observations were conducted to observe class activities and teacher discussions. In addition, classroom observations of key participants were conducted on a weekly basis to observe teacher classroom practices and technology use through Fall 2001. Because five out of the seven key participants opted to implement their technology unit in Spring 2002, biweekly observations were also conducted during that time.

Teachers completed a pre- and post-course online survey relative to teacher confidence (self-efficacy); this survey was also administered mid-term Fall 2001 and late Spring term 2002. This survey instrument, specific to teacher confidence about their technology integration practices (self-efficacy), was an adaptation of an instrument developed and tested in Fall 2000 (Ertmer, Conklin, Lewandowski, Osika, Selo, & Wignall, in press). The constructed instrument had three categories (planning for classroom technology use, implementing classroom technology, and assessing classroom technology use and impact), with 10 items each, for a total of 30 items. The instrument, based on a five-point scale, required 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.

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, teachers engaged in group discussions specific to teacher ideas about what they were seeing and how that tied in with their views and goals.

Quantitative Data Analysis

Data were analyzed for the 12 course participants, based on pre- and post-course (June 2001) self-efficacy survey results. A repeated measures analysis of variance was also conducted post-course for study participants at different times through Spring 2002 for said instrument. Reliability was also measured, using Cronbach’s alpha.

Qualitative Data Analysis

Interview data (pre- and post-course) for the seven key participants and pre- and post-course descriptions of technology visions (all 12 course participants) were analyzed and coded inductively specific to teacher beliefs, practices, and self-efficacy, using cross-case and within-case analyses. Examples of 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 course outset (January 2001), teacher self-efficacy scores averaged from 1.1 to 3.0, with an overall mean of 2.2 (using a five-point scale, ranging from “Very confident” to “Not at all confident”), with a standard deviation of 0.67. At course end (June 2001), individual teacher scores on this instrument averaged from 1.2 to 4.9, with an overall mean score of 3.4 and standard deviation of 1.0. Using a repeated measures analysis of variance on pre- and post-course data (n=12), an F-value of 44.31 was obtained, significant at 0.0001.

Teacher self efficacy scores remained constant mid-Fall term 2001 (n=11), with a score range averaging 1.2 to 4.9, an overall mean score of 3.4, with a standard deviation of 1.2. A repeated measures analysis of variance between June 2001 and mid-Fall term 2001 showed an F-value of 0.07, which was not significant at 0.0001. Data collected from key research participants at the end of Spring term, June 2002 (n=7) showed a mean score range of 3.0 to 5.0, with a mean of 4.2 and a standard deviation of 0.87. Repeated measures analysis of variance, comparing mid-Fall term 2001 and June 2002 showed an F-value of 9.96, which was not significant at 0.0001. Instrument reliability, determined using Cronbach’s alpha, was 0.99 for the self-efficacy instrument, averaging across all data collection points.

These results indicate that teacher confidence steadily increased from the initial course through June 2002 for key research participants. While the changes were not significant at 0.0001, the self-efficacy scores remained positive, with mean scores increasing in a positive direction, perhaps indicating the effect of successful implementation of teacher technology units developed in the Spring 2001 course.

Qualitative Data Results

Preliminary data analysis, based on all interviews and descriptions of teacher technology visions, suggests the following 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. Teacher implementation of the technology unit was also perceived as a contributor to learning.
- 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. Implementation of the technology unit also contributed to teacher confidence, as did student motivation and enthusiasm.

- There are indications of some teachers' revising their beliefs with regard to technology. Teachers indicated a new awareness of and appreciation for the role of the student, the role of technology, and the role of the teacher in facilitating learning through technology use. Contributors to revised beliefs included a new appreciation for what the student could accomplish.
  - 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. By Spring 2002, teachers were indicating that their technology practices were becoming aligned with their vision for technology use.

Contributors to Learning: Consideration of the Staff Development Model

Course components valued as learning contributors varied with individual teachers. 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, hands-on experiences, and class discussions. Course reflections also led to new insights about teaching.

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--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 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]

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….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]

Through course reflections, Julia (a 7^{th} and 8^{th} grade teacher) expressed a new insight the importance of using active learning approaches in her classroom: "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]

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 models (which were used in the course a couple of times) might have been a stronger contributor with more use.

The technology unit developed in the course was implemented by six of the seven key participants. Julia at Elm Creek implemented her unit in Fall 2001; Jennifer opted not to do so. The remaining key participants at Fairview and Hilltop spent Fall 2001 preparing their students for the upcoming unit and other class projects through skill-building activities, such as teaching their students PowerPoint and KidPix. Students also developed keyboarding skills.. These teacher technology units were implemented, to varying degrees, during Spring 2002. The implementation of these technology units appeared to act as a catalyst for learning for some of the teachers--they learned by "just doing it." [Clara, Post-Course Interview, June 12, 27, 2002]

Many teachers learned by watching their students in action. When asked about learning contributors, Eleanor responded:

> The kids…and then just doing it. You have the idea, and you learn so much just by doing it. And the kids help…the checklists, I thought, was very helpful. They knew exactly what to do, and--and they even filled out the eval--evaluation of each other, without me even having to remind them again, and so I learned that that worked really well. [Post-Course Interview, June 11, 2002]

Kathy learned more about planning and classroom management with technology:

> I--I don't know that I learned it, but I had to remember that you need to be flexible…And we learned that with our project; we tried the four in a group and it did not work. There is not enough work for four people in a group. So I learned that…maybe it would be better to do a test run with our project with--before you actually start it with the kids, maybe would have been a good idea." [Post-Course Interview, June 11, 2002]

Increased Confidence, Confidence Contributors and Indicators

Post-course interviews and post-course teacher visions collected in June 2001 indicated increases in confidence for six out of seven key 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]

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: "Doing it with Caroline…just getting that whole page together…turned out marvelously because of Caroline, I think…cause having her in the group, that made me be able to say, 'Yeah, I can do that,' or 'How did you do it, Caroline?'…Trying to get so that I would learn from her." [Post-Course Interview, June 4, 6, 2001]

Kathy believed that 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. The chance to implement the technology unit also contributed to increased confidence, as Eleanor explains:

> Oh, it's--it's--it's definitely increased, because once you see something that you planned and you're implementing it--and it could be--it may be a struggle--a struggle planning it and a struggle implementing it, but when you finally get it done, that does--that increases your confidence big time, I think. And, well now, you can see, I've got so much more ideas on technology, and with the Power Point, I thought…it's taking it step by step, but now, who knows? [Post-Course Interview, June 11, 2002]

Contributors to teacher confidence included the students' overall excitement and motivation in using the technology, as well as relying upon the existing support structure. When asked about her confidence in implementing her goals and plans, Kathy responded: "Well, I guess I've learned that you don't have to know everything in order to do it. That you can draw on other people's knowledge and things as you go sometimes." [Post-Course Interview, June 11, 2002] Further, specific to confidence contributors, Kathy said: "Just the success that we've had…and the--the motivation for the students, and their enjoyment of it." [Post-Course Interview, February 11, 2002]

Confidence was indicated at the end of Spring term 2002 through increased technology use, an increase in planned technology use, new ideas and strategies, and the expressed desire by all five teachers to use the technology unit again in the future.

Both Clara and Greta, who initially felt a lack of confidence, saw a difference by Spring term 2002, in terms of their confidence in implementing goals and plans.

> Well, I know when I started the class I had--when I started the class, Greta [pseudonym] and I were just…when we walked out of the room the first time, and to see the growth from there to here…like my confidence in doing it, and the ideas that come from it. So…I just see a lot of growth in it. [Clara, Post-Course Interview, June 12, 27, 2002]

> Oh, see that--I wouldn't have probably been willing to take them [the students] up to the Lab by myself. And--and have them all on the computer and think, "Oh my gosh," but we--I did that and found out that it worked and so we went more. [Greta, Post-Course Interview, June 21, 2002]

Changing Teacher Beliefs

For some teachers, existing 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--I teach across curriculums…I was looking at technology as another subject area, rather than seeing it as 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 5, 2001]

Although her beliefs about the value of technology had not changed, at course end 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:

> 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]

As of the end of Spring term 2002, teacher beliefs included a awareness of and appreciation for the role of the student, the teacher, and technology in facilitating technology use. As Kathy stated, "I'm the guide…I don't like to be the one--especially in computers, where so often sometimes the kids know more than you do. I don't like to try to get up there and pretend like "Oh, I'm--I'm the one who knows everything… let me do this for you…And I guess the role of the child is just to be a learner--and a leader sometimes…" [Post-Course Interview June 11, 2002]

Kathy's new appreciation of what her students could do contributed to her changed beliefs. "The kids finding so many things on the KidPix, I think--have helped to change my ideas about what they're capable of and what's--what's available out there, and what they can do with it, I guess...To let them just take it on their own and go with it. They just really surprised me with how much they were able to do." [Post-Course Interview, June 11, 2002]

Eleanor indicated a renewed appreciation for what the students could accomplish: "It was a problem-solving process for the kids, also, but I was amazed at how much they took over, which is--is great, because that's what I like about teaching is that…you don't plan to go in and tell 'em, 'See, this is--this what I know, and this is what I want you to do.'" [Post-Course Interview, June 11, 2002]

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.

Teacher Technology Practices

Perhaps due in part to their overall increased confidence with using technology in the classroom, many teachers tried out new ideas with regard to technology. In doing so, they addressed challenges such as classroom organization, management and assessment, 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 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 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 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:

> Planning our unit, we were planning on using KidPix and I had never done that before…so I did go ahead and look at it and then use it at the end of this year, so that I'll be more able to jump into the unit next year….That was a lot of fun. And here, a couple of my student experts helped me cause…they had it at home and helped me how to use it and, so I had no idea what I was going to do with the kids, but we ended up doing 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]

While concerns about assessment and classroom management remained as issues at the end of Spring 2002, many teachers found that their ideas about technology use and their practice were coming closer together--teachers were moving closer to their technology vision, aligning more with their beliefs about teaching and technology.

Eleanor spoke early Fall term 2001 about her ideas for technology and how that tied in with practice:

> We got the whole…National Weather Service up there, and we were actually watching a front come in and, sure enough, we watched it right out the window. We saw it come in, so, I mean, that—that's daily, everyday stuff, that you're bringing right into the classroom…it's more of a…it's something that is there now…which it—it's at reach, and before it wasn't. [Post-Course Interview, September 20, 2001]

When asked in Spring 2002 how her vision for technology compared to practice, Eleanor responded, "I think it's right with it…Actually, it's…It--it--it's intermingled…because I think maybe my vision isn't very lofty, but it's-- it's attainable and in sight." [Post-Course Interview, June 11, 2002]

Clara responded, "Well, I think they're probably lining up [vision to practice]…and running parallel to each other. Where--before, my vision was probably right on track, but what I was doing was kind of faltering… moving ahead slowly where my vision was." [Post-Course Interview, June 12, 27, 2002]

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, were 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. Implementing the technology unit contributed positively to teacher confidence, beliefs and practice.

Overall, the impact of the staff development model appeared helpful in terms of changing teacher confidence, 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 varied 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

Analysis of interview data with seven teachers appears 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 of additional data sources is needed to confirm these impressions. Further analysis remains to be done on course data 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 somewhat 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 and 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. In this case, the teacher self-efficacy, specific to the key participants remained steady. This may be due, in part, to consistent researcher follow-up in Fall 2001, fading gradually through Spring 2002, until data collection ended after Spring term. It is possible that such follow-up aids teacher self-efficacy. Further research is needed to confirm this conclusion.

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English language learning via desktop videoconferencing: A pilot study

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Abstract

The researcher investigated a telecommunications project among Taiwanese English as a Foreign Language (EFL) learners and Japanese EFL learners in which they practiced English language and discussed cultural information through web-board and desktop videoconference. The purpose of this study was to understand the Taiwanese EFL learners' perceptions of language learning through distance technologies and to explore the turn-taking and intercultural communication issues during the connections. Areas for improvement in future connections are noted.

Introduction

This study investigated a telecommunications project among Taiwanese English as a Foreign Language (EFL) learners and Japanese EFL learners at the university level. The goal was for both the Taiwanese students and Japanese students to practice English language skills and exchange cultural information. The purpose of this pilot study was to understand the Taiwanese EFL learners' perceptions of practice English language skills through distance technologies and to identify difficulties or facilitators in turn-taking and online intercultural communication during desktop videoconference (DVC). This paper reports primary findings in the pilot study carried out during the school year of 2001-2002 and discusses possible improvement for future connections.

Rationale

Distance technologies have commonly been used for delivery of instruction in the West (e.g., the United States, Great Britain, and other English-speaking countries) in recent decades. Historically, distance-learning technologies have included ordinary mail, broadcast TV, and radio (Bates, 1995). The use of telecommunications by the general public started in 1991 when the Internet evolved from a tool used primarily by the military and scientists to a tool used by educators (Ryder & Hughes, 1997). In highly developed countries such as the United States, Australia, and Great Britain, courses in open universities and higher education institutions are now designed to be delivered fully or partially through distance technologies (Simich-Dudgeon, 1998).

Taiwanese educators regard the West as a provider of models for development and therefore, they follow Western scientific progress. When telecommunications started to be used in education in the western part of the world, Taiwan was not far behind. Since the mid-1990s, the Internet has become a widely adopted communication tool in Taiwan. Over time, the Internet infrastructure in Taiwan is also being improved; therefore, the government encourages researchers and scholars to study and explore in the field of telecommunications for teaching and learning.

In foreign language learning, researchers such as Cononelos and Oliva (1993), Davis and Chang (1994/95), and Leh (1997) suggested using telecommunications technologies to create authentic language-learning situations for learners to communicate with foreign speakers directly and to develop intercultural competence. In Taiwan, when such a method was implemented for English language learning and communication, it remedied Taiwan's geographical isolation as an island and provided opportunities for EFL learners to learn and converse in an English communication environment.

The potential for conducting second or foreign-language instruction via telecommunications has not been ignored by educators worldwide. Since late 1980s and early 1990s, telecommunications projects with language learning have been conducted to teach languages, such as EFL (Cifuentes & Shih, 1999; Davis & Chang, 1994/95; Kamhi-Stein, 1997; Soh & Soon, 1991; Sullivan, 1993); French (Oliver & Nelson, 1997); Spanish (Leh, 1997); Portuguese (Kelm, 1992); and Russian (Samsonov, 1998).

The conclusions of these projects mostly stated the benefits and limitations of these online connections. Benefits included accessibility to people, language improvement, acquisition of cultural knowledge, and the development of communicative and critical thinking skills. On the other hand, limitations included technical difficulties and the lack of response from students.

With the synchronous connections via videoconferencing in the second or foreign language teaching, not many teachers adopted this method in their classrooms due to the high cost of the equipment and poor quality of the results (O'Dowd, 2000a). Among the ones that tried large-group videoconferencing or desktop videoconferencing in language teaching or learning situations are University of Leon in Spain (O'Dowd, 2000b), University of Exeter and University College London (Buckett & Stringer, 1997; Bucket, Stringer, & Datta, 1999; Stringer & Buckett, 1999), three primary schools in North Yorkshire (Bell & Maynard, 1996), and London School of English and Foreign Languages (Goodfellow, Jefferys, Miles, and Shirra, 1996). These papers delineated the experiences, achievements, and limitations of language teaching and learning via videoconferencing.

In Taiwan, there have been studies on EFL teaching and learning through telecommunications such as electronic mail by Hsien-Chin Liou (1996) and Meei-Ling Liaw (1997). In her study, Liou studied syntactic errors, topics discussed, and communicative functions in the e-mail writings by Chinese EFL college students who corresponded with foreign pen pals. She further developed a Computer-Mediated Communications model to facilitate EFL learning (Liou, 1998). Liaw found multiple advantages through effective integration of e-mail writing between two classes of EFL students in Taiwan.

Hardly any English courses in Taiwan are taught through the synchronous format (Liu, 2001), let alone having students communicate with teachers or EFL learners of other countries via videoconferencing systems. Nevertheless, a few researchers in other areas have started to use large-group and desktop videoconferencing in their courses. Shih-Chang Hsin (1997) had graduate students in the Institute of Teaching Chinese as a Foreign Language at National Taiwan Normal University tutoring students in University of Hawaii via desktop videoconferencing. In his second study (Hsin, 1999), he compared the use of large-group videoconference against desktop videoconference. Chen, Chen, Guo, Lin, Chen, Lee, and Chen (1998) studied the effectiveness of teaching a general medical education course "health promotion" via videoconference system in the National Taiwan University College of Medicine. The results showed that students' overall satisfactory rate on the distance delivery mode of the course was 60%.

Methodology

Procedures

Forty-four Taiwanese EFL students taking the course *English Language Learning through Multimedia I and II* and 30 Japanese EFL students participated in this project in the fall semester of 2001 and spring semester of 2002. First, as the semester started, participants' digital pictures and self-introductions were uploaded on to the project website (these were situated under the course website: http://night.ntcc.fju.edu.tw/doris/media/media.htm). Second, participants also received instructions on the basics of telecommunication technologies and the use of DVC software *iVisit v2.6 b7*. In addition, they watched a section of the videotape entitled *Learn & Live* produced by The George Lucas Educational Foundation. This prepared them for situations of DVC as most of them were unfamiliar with DVC.

During the semester, students of both ends carried out web-board discussions and multiple DVC connections. Five web-board discussion areas were set up using *Beseen*, a Looksmart service. With DVC, the Taiwanese students were divided into groups of three or four people for separate connections. Each student took turns to speak to the Japanese students. An assistant was present to help with the technical setup, which allowed the researcher to take observation notes. Topics discussed extended beyond the students' learning of EFL. The coordinators at both ends provided discussion starters on topics such as digital divide, eWorld, wired schools, and job and technology. The students were asked to reflect on their learning and experiences after the connections.

Method

This study employs a qualitative research design. This design enables the researcher to inquire, comprehend, and describe the experiencing world of the participants and the meaning of these experiences (Bodgan & Biklen, 1998; Lincoln & Guba, 1985).

The data sources included desktop videoconferencing records (i.e., chat files), observation notes, reflective papers, and interview transcripts of participants. Each time data are gathered, information has been analyzed using content analysis procedures. In the paper, Taiwanese students are identified as T1-T44 and Japanese students as J1-J30.

Results and Discussion

A Web-board was set up for participants to communicate with each other before and after the DVC sessions. They each sent a self-introduction on to the board. Four students posed technical questions regarding the use of the web-board. Teachers in Taiwan and Japan took turns to pose discussion starters each week but not many students responded to the questions. Only three Taiwanese students and two Japanese students wrote long responses. There are two reasons for this phenomenon. One reason is that the participants were not forced to use the discussion board. Another reason is that Asian students dislike expressing opinions in the public (Hofstede, 1986; Shih, 2000). T7 expressed that she felt very shy to interact with the instructor in the class, not even to mention having interactions with unfamiliar Japanese students in the discussion board.

With the DVC connections, each group of students was given a worksheet for the ice-break session. The questions on the worksheet were related to personal background and individual uses of the Internet. All groups completed the worksheet successfully. In the next two sessions, the participants talked about the cultures of Taiwan and Japan and their EFL learning experiences.

Data showed the most positive outcome of the connection was the pleasure that the participants exhibited regarding learning about the cultures of Taiwan and Japan. Forty-four out of 44 Taiwanese students expressed in their written reflections that they enjoyed or liked this activity very much. Other benefits included opportunity to experience the use of this "fun hi-tech" (T22), authentic language practice, and making foreign friends. Many noted that they learned what distance learning is and became un-afraid of the machines. Several said they realized the importance of social presence. "If I want to see the other's face, I need the web-cams. It's a useful tool to communicate to others" (T36). Thus they wanted to buy web-cams after the class and would definitely use DVC in their own time by connecting to friends or chat with foreigners on the Internet.

Difficulties encountered were interrupted audio transfer in DVC, confused turn-takings when there were more than two communicators, and misinterpreted underlying messages. The Internet speed was slow during several DVC sessions. Once the audio transfer became problematic, the participants immediately switched to use the chat function in the software. Every student in Japan had access to a computer; therefore, at times there were more than one Japanese student connected to talk to one Taiwanese student. Data showed that the one-on-one connection allowed for a more smooth communication (see chat transcript 1; the names are pseudonyms).

Chat transcript 1:

Multimedia65, Fu-Jen: yes, do you like music?
RR: you can call me Ricky
Multimedi a65, Fu-Jen: you can call me Austin.
RR: yeah... I like music
RR: austin powers
Multimedia65, Fu-Jen: what type of music do you like?
RR: I like Brit-Pop.. and hip hop and soul music

When there were multiple communicators in DVC, multiple conversations went on at the same time and caused confusion for some participants. One person decided to disconnect herself halfway during the connection (see chat transcript 2).

Chat transcript 2

Multimedia64, Fu-Jen: what's the name of your uni
JJ: uni?
Multimedia64, Fu-Jen: University
JJ: ferris
English, Fu-Jen: because she want to tell you something
MM: Or, if that doesn't works
English, Fu-Jen: she will go to Japan
MM: please send to mm83@hotmail.com
MM: OH!!! please send me email
MM: then I can tell you many thing !!
English, Fu-Jen: Her : p@yahoo.com.tw
Multimedia66, Fu-Jen: WW is working in a hotel
Multimedia66, Fu-Jen: you are thinking too much...
Multimedia66, Fu-Jen: it too difficult to us
PP: Question F
Multimedia64, Fu-Jen: Where is JJ?
Multimedia64, Fu-Jen: Is JJ here?
PP: Nope!!!

A system must be developed to help the participants, especially EFL learners, to communicate functionally on turn-takings in the DVC and chat situations. Murphy & Collins (1998) identified the need to train students to use communication conventions and protocols for clear communication.

Educational Significance

This project is significant in the following points. First, it provides students who study in the humanity areas (such as the English majors) experiences of using online technologies for learning and authentic communication with foreigners in English. Many students of English-language majors do not have much access to technological courses or are fearful of technologies. Through such experiences, they will understand multiple ways of using technologies to learn English as a foreign language and start to apply the skills into their foreign language learning situations. Second, the study provides insights for distance educators, both for those in Taiwan and for those in other countries who have Taiwanese students enrolled in courses that are delivered via telecommunications. The results of the study will help these instructors to design curriculum by selecting and incorporating appropriate asynchronous and synchronous technologies. Third, the online intercultural communications issues experienced in this project assist telecommunications users with more effective communication. It helps users become aware of and anticipate problems when coming into contact with people of other cultures via distance technologies.

The Future

During the school year of 2002-2003, this project will be funded by National Science Council of the Republic of China. The researcher proposes to make the following adjustment. First, participants will be reduced to 30 students in Taiwan to make the number equal to that in Japan. This allows the researcher to carry out many more in-depth interviews with the Taiwanese participants. Second, the processes of connection and the interviews will be recorded through a video camera, as DuFon (2002) noted that good video footages provide valuable and usable data, and give more linguistic information than field note taking. Third, in addition to showing clips from the videotape *Learn and Live*, another video entitled *New Business of Paradigms* can be shown to prepare participants for change of a new paradigm. Fourth, participants will be given articles related to intercultural communication, such as "Cultural differences in Teaching and Learning" by Geert Hofstede (1986) and "Intercultural Communication via E-mail Debate" by G. M. Chen (1998). The readings will prepare participants to self analyze intercultural problems evolved in the telecommunications setting.

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The Influence of Inquiry-Based Multimedia Learning Environment on Scientific Problem-Solving Skills Among Ninth-Grade Students Across Gender Differences

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Abstract

This study investigated the use of inquiry-based multimedia learning environment as a way to increase students' problem-solving skills, especially female students in a ninth-grade astronomy course. Using a pre- and posttest design, the study used multiple choice and written essay questions to measure students' content understanding and problem-solving skills. The results of ANOVA conclude that inquiry-based multimedia learning is viable and effective for improving content understanding and problem-solving skills with all students, especially females.

Introduction

The investigation of gender differences has been a significant area of study for many researchers in science (American Association of University Women [AAUW], 1992; Craig, 1999; Mael, 1998; Scanlon, 2000). After years of research outlining inequities, there still remains a discrepancy between the performance of females and males in science courses (Shymansky, Hedges, & Woodworth, 1990; Third International Mathematics and Science Study, 1998). More efforts are needed to remove the obstacles to gender equity (Kirkpatrick & Cuban, 1998; Littleton, Light, Joiner, Messer, & Barnes, 1992; Whitelock et al., 1995). Researchers indicate that females often become uncomfortable and uninterested in science early in the educational process (Jewett, 1996; Valentine, 1998). AAUW (1992) and National Assessments of Educational Progress (1979) report that females have lower achievement scores in science knowledge, hold a less positive attitude toward science, and participate in far fewer science-related activities than do males (Schibeci & Riley, 1986). Hill, Pettus, and Hedin (1990) cite that females in science-related fields exhibit a high level of science anxiety.

A variety of factors contribute to the poor performance of female students in science. These factors include social expectations related to gender-role in career choice, teacher bias, and discrepancy in the amount of hands-on experiences (Jewett, 1996). Researchers believe that a primary reason for gender differences is that females are not given the same opportunities to learn as male students (Valentine, 1998). Females receive an inferior education to males in the use of science equipment and materials. In a science laboratory, for example, male students more often work with the equipment while female students write down the observations (Rosser, 1990). As a result, females do not gain experience or confidence in the manipulation of science equipment (Hill, Pettus, & Hedin, 1990; Kahle, 1996; Rosser, 1990; Sjoberg, 1993).

This lack of experiences lowers females' self confidence in their science abilities and fosters negative attitudes toward science (Kahle, 1996). It might account for a large portion of the differences between males and females in science achievement (Jewett, 1996; Kahle, 1996). Researchers suggest that females' performance in science will improve by using instructional methods such as inquiry-based approaches (Greenberg-Lake, 1991; Hill et al., 1990; Lock, 1992; McLaren & Gaskell, 1995; Shakeshaft, 1995). These methods provide a wider variety of science experience for all students, particularly females. These opportunities include practice observing, measuring, and testing hypotheses (Eccles, 1989; Freedman, 2001; Matyas, 1985; Shakeshaft, 1995). Inquiry-based approaches are a key to keeping females interested in science and participating in hands-on experience (Freedman, 2001; Jenkins & MacMonald, 1989; Matyas, 1985).

Inquiry Learning

Inquiry-based approaches have been described as a "pedagogical method combining intellectual questioning with student-centered discussion and discovery of pivotal concepts through laboratory activities" (National Research Council, 1996). Inquiry emphasizes observing, classifying, formulating hypotheses, identifying and controlling variables, experimenting, and making valid conclusions (Gagne, 1970). Inquiry has been shown to be a successful intervention technique in science (Anderson, 1993; Doran, Boorman, Chan, & Hejaily, 1993; Lock, 1992; Sjoberg, 1993; Thomas, 1986). Inquiry-based activities facilitate scientific problem solving because they let students question their own observations, generate and refine hypotheses, deal with experimental data, test those hypotheses by experimentation, and evaluate evidence (Bybee, 1993; Collins, 1998; Kuhn, Amsel, & O'Loughlin, 1988; Moore, 1993; National Research Council, 1996; Uno, 1990; Windschitl, 2000).

Many studies have shown that inquiry-based approaches produce significantly greater science process skills than conventional approaches (Chiappetta & Russell, 1982; Glasson, 1989; Krajcik et al., 1998). Moreover, some groups report that students' cognitive ability, science achievement, and scientific problem solving improve if students experience inquiry-based approaches (Bredderman, 1983; Greenberg-Lake, 1991; Haury, 1993; Hill et al., 1990; Lindberg, 1990; Lock, 1992; McLaren & Gaskell, 1995).

In addition, research has shown that inquiry-based, hands-on strategies increase the science success of female students (Bredderman, 1982; Shymansky et al., 1990). The inquiry activities enable females to participate in hand-on experiences, to see relevance in the application of science, and to make science important for them to learn (Anderson, 1993; Greenberg-Lake, 1991; Hill et al., 1990; Lock, 1992; McLaren & Gaskell, 1995; Thomas, 1986). Researchers have demonstrated that increasing these experiences for female students boosts their attitudes toward science and their achievement (Shakeshaft, 1995; Simpson & Oliver, 1985). For instance, Eccles (1989) reports that females who have more inquiry-based experiences and opportunities can develop greater confidence in their abilities, more interest in subjects, and more interest in pursuing careers in mathematics and science-related fields.

Inquiry-based approaches have been applied in many innovative ways to assist science instruction. Most notably computer technology lets students experience authentic problem-solving activities that are difficult or impossible to create in real classroom situations (Geban, Askar, & Ozkan, 1992; Windschitl, 2000; Yager, 1995; Zietsman, 1986). Inquiry-based approaches that incorporate new technologies allow students to experience authentic science, and they result in improved science achievement (Bybee, 1993; Collins, 1998; Kuhn et al., 1988; Kuhn.D., Amsel, & O'Loughlin, 1988; Mayer, Moreno, Boire, & Vagge, 1999; Moore, 1993; National Research Council, 1996; Pea, 1993; Uno, 1990; Windschitl, 2000).

Purpose of the Study

Based on prior research findings, inquiry learning incorporating technology improves students' achievement, especially females (Greenberg-Lake, 1991; Hill et al., 1990; Jenkins & MacMonald, 1989; Lock, 1992; McLaren & Gaskell, 1995; Shakeshaft, 1995; Simpson & Oliver, 1985). This study investigates two specific research questions:

- Does a multimedia program designed around inquiry-based approaches improve students' conceptual understanding and problem-solving skills?
- Does a multimedia program designed around inquiry-based approaches have a differential effect on the conceptual understanding and problem-solving skills of male and female students?

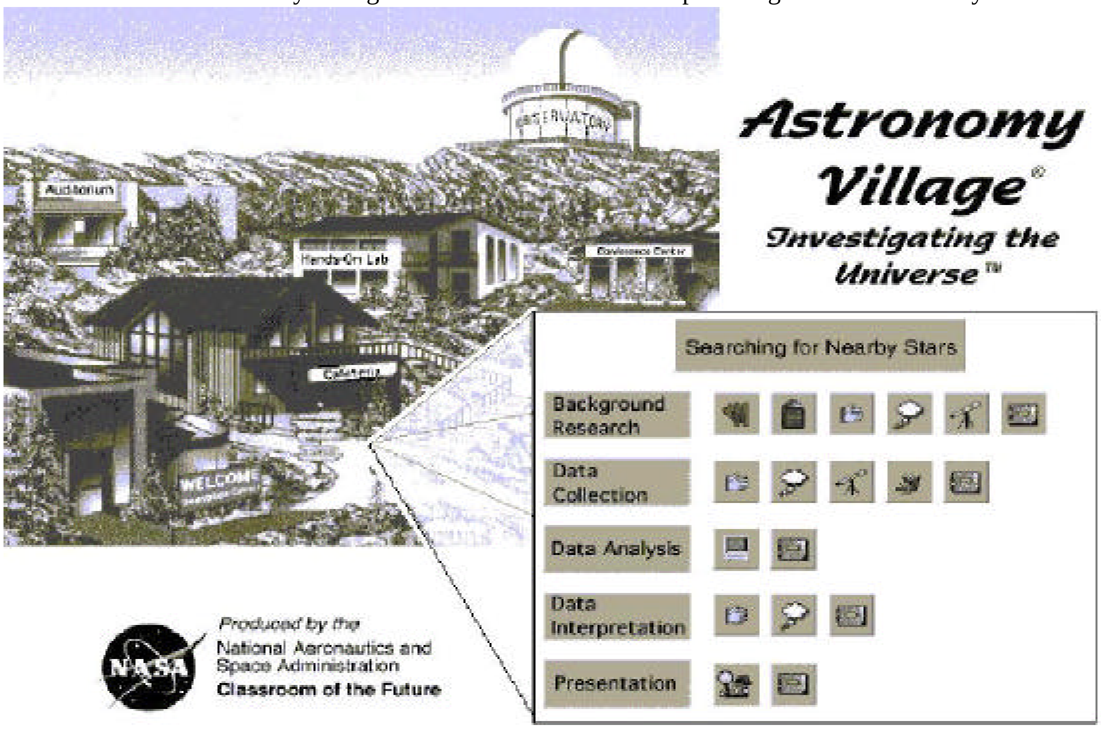
Instructional Context

This study was conducted within the context of *Astronomy Village®: Investigating the Universe*™ (see http://www.cotf.edu/AV/av1.html). *Astronomy Village* uses the metaphor of living and working at a mountaintop observatory (the village) as the primary interface from which students investigate contemporary problems in astronomy (Pompea & Blurton, 1995 Jan/Feb). The environment includes 10 investigations covering a broad cross-section of current research in astronomy. In *Astronomy Village* a student research team is aided by a virtual mentor who immerses team members in science concepts and science inquiry skills. The research path diagram provides an overall guideline for the use of the program (see figure 1). Student teams proceed along a path of activities represented by various icons in the research path diagram. Each icon guides them to the village's virtual research facilities. At each facility the students gain information relative to their investigation.

The design principles of *Astronomy Village* come from inquiry processes emphasizing observing, classifying, experimenting, and making valid conclusions (Gagne, 1970). For example, *Astronomy Village* used four phases to support the inquiry process: (1) identifying questions to investigate in the background research phase, (2) designing investigations, (3) conducting investigations in the data collection, data analysis, and data interpretation phases, and (4) formulating and communicating conclusions in the presentation phase (Howard, McGee, Shin, & Regina, 2001; Robitaille et al., 1993). Within each phase students may complete up to six activities, such as simulations, hands-on experiments, thought questions, LogBook entries, and library research.

In the phase of identifying questions to investigate, students are presented with contemporary issues in astronomy. The questions are currently important to the scientific community and not fully answered by scientists. In the Nearby Stars investigation, for example, students are asked to measure the distance to nearby stars, using a technique based on the parallax angle.

FIGURE 1. The Astronomy Village interface and the research path diagram for the Nearby Stars investigation.



The background research phase encourages students to examine articles and other sources of information to see what is already known in light of experimental evidence. The activities in this phase include reading articles in the virtual library and listening to lectures in the virtual theater. The library contains a large number of resources directly or indirectly relevant to the investigation.

As part of the designing investigations phase, investigations were developed to allow students to use multiple methods to address the problem. The virtual environment provides an authentic research context based on Kit Peak Observatory in Arizona.

In the conducting investigations phase the environment provides scaffolding to help students successfully complete the investigation. The students' virtual mentors send e-mail messages providing scaffolding on how to analyze the image data using an image-processing software program. This gives students an expert's suggestions and encouragement for pursuing their investigation. The software contains all the resources students need to conduct the investigation, including articles, data analysis tools, and organizational help. Moreover, students are given choices in selecting activities most beneficial for solving the problem.

In Nearby Stars, for instance, students collect from the virtual observatory images showing stellar movements. In the computer lab they use image-processing techniques to analyze these images taken at different time periods. Stars that move during a six-month period are nearby stars. Using the movement, students calculate the parallax angle of the nearby star. That angle then lets them calculate the star's distance from Earth. Students see how they can measure the distance to nearby stars. They then propose answers, explanations, and predictions.

In the phase of formulating and communicating conclusions, students have opportunities to develop formative conclusions and receive feedback from their peers and the teacher. The LogBook provides a place for students to jot down their observations, formulate written conclusions, and draw diagrams about their investigation. Students are encouraged to develop verbal conclusions as well as draw diagrams within their LogBook. At the end of the investigation, students host a virtual press conference in which they click on virtual reporters who ask them questions about the investigation. Students respond in written form to the questions and store the responses in their LogBook. Finally, students present their findings to their classmates in an oral presentation. It lets them articulate their understanding by discussing their results with their team members as well as the entire class. It also supports a social environment that allows students to get feedback by comparing their works to others.

Many aspects of *Astronomy Village* can be identified as potentially appealing to females' interests, therefore their achievement. For example, the program deals with investigation questions based on contemporary issues. The real-life contexts enable all students, especially females, to support social interaction and to see relevance in the application of science (Anderson, 1993; Freedman, 2001). Additionally, the main techniques of *Astronomy Village* emphasize observing, measuring, and hypothesis testing, which female students lack exposure to and experiences in the current science classrooms (Jenkins & McDonald, 1989). Increasing these experiences has been demonstrated as a successful intervention technique for all students, especially females (Simpson & Oliver, 1990; Shakeshaft, 1995). Finally, students in *Astronomy Village* conduct their own experiments and activities using provided information and virtual mentor's messages. The environment provides students pupil-centered experiments, which is a preferred teaching style by females (Freedman, 2001).

Method

Subjects

The participants in this study were 122 ninth-grade students attending a high school in a small working-class community near a large, Midwestern city. All ninth-grade students enrolled in the Earth and space science course were invited to participate. Ninth-graders were chosen because *Astronomy Village* was designed to support ninth-grade science classes. The school used *Astronomy Village* in regular science classes consisting of mixed high- and low-ability students.

Of the 122 students who completed surveys, 103 (84 percent) students were Caucasian (white). One male student (1 percent) was black. One male student (1 percent) was Asian-American. Two male students (2 percent) were Hispanic. Five females and two males (6 percent) were other races. Eight students (7 percent) did not indicate their race. The gender breakdowns of the sample were 62 females (51 percent) and 57 males (47 percent). Three students (2 percent) did not indicate their gender.

Instruments

In this study instruments were developed to measure the students' problem-solving skills and content understanding, using multiple choice and written essay questions. The test items were subjected to an extensive construct validation process (Hong, 1998; Shin, Jonassen, & McGee, in press). Subject matter experts, curriculum developers, educational researchers, and teachers iteratively reviewed the test items with regard to content accuracy, readability, vocabulary level, and appropriateness for ninth-grade students. In addition, the test items were pilot tested with students using think-aloud protocols.

As a measure of content understanding, students were asked to classify important concepts relating to a research study by selecting relevant concepts from a list (Clark, 1990; Hong, 1998). Students were required to analyze the problem statement to determine which concepts are relevant to the solution. Additionally, to gauge how the concepts are organized in a meaningful way, students were asked to describe the relationships between the chosen concepts (Jonassen, Beissner, & Yacci, 1993).

Two problems are developed to measure students' problem-solving skills in astronomy. On the assessment students are required to present and explain their approach for solving given open-ended questions (Hong, 1998). One of the problems focuses on extensions to the Nearby Stars investigation; the other focuses on extensions to the Variable Stars investigation. These represent 2 of 10 research investigations in *Astronomy Village*. In the Nearby Stars investigation students use the concept of parallax to measure the distance to nearby stars. In the Variable Stars investigation they use the inverse square law to determine the distance to a nearby galaxy.

The scoring rubric was developed similar to other rubric systems (Baxter, Glaser, & Raghavan, 1993). It was reviewed by content experts, educational researchers, curriculum developers, and teachers to make sure it was developed appropriately and includes all important aspects for measuring students' problem-solving skills in astronomy. The scoring rubric was tested for construct validity using the method of instructional sensitivity, which compares differences in the response of experts and novices (Gall, Borg, & Gall, 1996). The result of construct validation indicated that the scoring rubric can discriminate differences between students who demonstrate a well-organized problem-solving process and those who demonstrate a disorganized process in given problem situations ($p < .000$) (Hong, 1998; Shin et al., in press). In addition, the instrument has been shown to correlate with measures of metacognition, science-related attitudes, and motivation (Hong, 1998). Three raters scored the students' responses individually. The average overall interrater reliability was .82.

Procedure

The study was conducted during a two-month period. The teacher and students were asked to provide demographic information and complete a release form before any data was collected. Before students used *Astronomy Village,* the teacher and an investigator spent two classroom periods administering the pretest.

During science classes the research team worked closely with school district members and teachers to support the effective implementation of *Astronomy Village*. The research team provided all the technical support through the entire program. One team member assisted teachers in designing classroom activities, including lesson plans. Another team member monitored the classroom activities to determine if the program was being implemented properly. This team member also helped to resolve any technical issues students experienced in the implementation.

All students used a PC computer and *Astronomy Village.* They worked in 55-minute class periods, five times per a week, for a total of 15 class periods. The teacher taught five classes. Each class had 23-26 students. The teacher had previous experience teaching *Astronomy Village.*

The teacher randomly assigned students to conduct one of two *Astronomy Village* investigations, Nearby Stars or Variable Stars. Each investigation took students through five phases of research: background research, data collection, data analysis, data interpretation, and presentation of results. During the investigation students used an electronic LogBook to record their scientific notes and observations. At the end of the program, each student team presented its results to the class.

After students finished *Astronomy Village,* a posttest was administered during two classroom periods. In both the pre- and posttests, each student took all the tests. These included conceptual understanding, the Nearby Stars problem, and the Variable Stars problem. In the tests the problems were printed individually for each student. After the tests were distributed, the students read the introduction before being told to solve the problems. Students were not allowed to use computers or any resources while completing the tests. There was no time limitation to finish all the instruments.

Data Analysis

The research sought to explore how the inquiry-based multimedia program would affect students', especially females', problem-solving skills in science. Dependent variables included content understanding and problem solving. The data was analyzed separately using analysis of variance (ANOVA). In the study students conducted only one investigation (either Nearby Stars or Variable Stars), and they took tests in conceptual understanding as well as Nearby Stars and Variable Stars problem solving. Thus, the scores on the test that is based on the path that students did not conduct serves as a control group. The analysis for conceptual understanding and problem solving was a 2 (treatment: experimental vs. control) x 2 (test occasion: pretest vs. posttest) analysis of variance in which the treatment was between subjects variables and the test occasion was a within-subjects variable. Within the treatment group, 2 (test occasion: pretest vs. posttest) x 2 (gender: females vs. males) analysis of variance was conducted as well.

Results

Conceptual Understanding

Table 1 shows the means and mean proportions of problems answered correctly on the pretest and posttest and the standard deviations for these means. It also provides descriptive statistics of two dependent variables based on gender. Using scores of experimental and control groups as the between-group factor and the pretest and posttest as the within-subject factor, a two-way ANOVA was employed to analyze the differences between students' improvement on conceptual understanding. Examination of the results for the significant interaction revealed that disordinal interaction existed between the two independent variables, test occasion and treatment, $F(1, 474) = 53.28$, $MSE = 1.616$, $p < .000$. On the pretest the control group ($x = 1.28$) had higher scores than did the experimental group ($x = 1.13$). However, the experimental group ($x = 2.73$) did achieve significantly higher scores as compared to the control group ($x = 1.54$) on the posttest.

Using the scores of the experimental group, females and males were analyzed separately to obtain more precise data on the gender difference of the improvement from instruction. The results of ANOVA indicated that there were significant differences for gender $F(1, 231) = 4.40$, $p = .037$, and test occasion $F(1, 231) = 79.6$, $p < .000$. For test occasion, subjects' scores were significantly higher for the posttest ($x = 2.35$ for males and $x = 3.12$ for females) than those of the pretest ($x = 1.16$ for males and $x = 1.13$ for females). The scores of the posttest revealed that the females statistically outperformed the males. Additionally, ANOVA yielded a significant two-way interaction for gender factor by test occasion, $F(1, 231) = 5.05$, $p = .03$. This interaction reflects the fact that the female group received more benefits for understanding basic concepts from the multimedia program than the male group. What these two results indicate is that students working with the multimedia program improved their conceptual understanding regardless of the gender difference and that females received slightly higher benefits.

Table 1. Descriptive Statistics of Conceptual Understanding and Problem-Solving Tests by Gender

	Conceptual Understanding			Problem Solving		
	n	M	SD	n	M	SD
Control						
Pretest	119	1.28 (26 %)	1.02	119	.55 (3%)	.82
Posttest	119	1.54 (31%)	1.24	119	.80 (4%)	.14
Treatment						
Pretest	119	1.13 (23%)	.98	119	.42 (2%)	.82
Posttest	118	2.73 (54%)*	1.72	118	2.92 (15%)*	2.84
Treatment						
Pretest						
Male	57	1.16 (23 %)	.88	57	.47 (2 %)	.97
Female	61	1.13 (23 %)	1.06	61	.37 (1 %)	.66
Posttest						
Male	56	2.35 (47 %)	1.39	56	2.57 (13 %)	2.57
Female	61	3.12 (62 %)*	1.89	61	3.28 (16 %)	3.05

Note. * P < .05. ns vary because of missing data. M: mean. SD: Standard Deviation. Mean proportion of correct responses is shown in parentheses.

Problem Solving

With regard to conceptual understanding, the 2 (treatment: experimental vs. control) x 2 (test occasion: pretest vs. posttest) ANOVA yielded significant interaction, $F (1, 474) = 149.44$, $MSE = 2.82$, $p < .000$, in problem solving as well. While the experimental group ($x = .42$) performed lower than did the control group ($x = .55$) in the pretest, the experimental group ($x = 2.92$) had significantly higher scores than did the control group ($x = .80$) in the posttest. In the analysis of the gender differences, females scored higher than males on well-structured problem solving ($x = 2.57$ for males, and $x = 3.28$ for females). However, ANOVA indicates this gender difference is not statistically significant. Both the female and male students in the experimental group significantly outperformed those of the control group on well-structured problem solving in the posttest. In both groups the scores of the posttest were significantly different from those of the pretest, $F (1, 231) = 84.6$, $p < .000$, indicating that participants in the multimedia program improved their problem-solving skills after instruction.

Discussion and Implications

As noted by comparing overall results, students working with the multimedia program improved their conceptual understanding and problem-solving skills after instruction regardless of their gender. The findings show that the multimedia learning environment, *Astronomy Village,* designed around inquiry is an effective tool for helping students learn astronomy content and problem-solving skills. It was speculated that having students engage in inquiry-based activities similar to what real-life scientists undertake would help students better understand underlying concepts and improve their problem solving. The results demonstrate this and support previous research about the positive effect of inquiry-based approaches incorporating multimedia technology (Bybee, 1993; Collins, 1998; Kuhn et al., 1988; Kuhn.D. et al., 1988; Mayer et al., 1999; Moore, 1993; National Research Council, 1996; Pea, 1993; Uno, 1990; Windschitl, 2000).

Moreover, the results showed that female students outperformed male students on the conceptual understanding posttest. This finding speculates that the female group received more benefits from the inquiry-based multimedia program than the male group. It also provides empirical support that female students received more benefits from the inquiry activities than male students (Anderson, 1993; Greenberg-Lake, 1991; Hill et al., 1990; Lock, 1992; McLaren & Gaskell, 1995; Thomas, 1986). Overall, this study supports inquiry-based multimedia technology as a learning and teaching tool with a high potential for facilitating students' learning, especially for females.

The results point to what science educators can do to improve students' problem-solving skills, particularly for females in science. The findings presented in this study also indicate that the inquiry-based approaches offer promising methods for improving problem-solving skills among all science students, especially female students. It will be a prescriptive method to counter the obstacles in science education that impinge on gender equity in science instruction. Future empirical studies should examine whether results are consistent with those of this study.

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Technology Competencies of Rural School District Administrators and Instructional Technology Decision Making

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Abstract

This research study examines the relationship between the technology competencies of rural school administrators and instructional technology decision making. Superintendents, assistant superintendents, and technology coordinators from rural Alabama school districts were surveyed regarding their perceptions of the types of instructional technology decisions made, the influence of government programs on instructional technology decisions, and the instructional technology decision-making process.

Introduction

This study examines relationships between the technology competency levels of rural school district administrators and the administrators' perceptions regarding instructional technology decisions made in their district. The study is particularly concerned with the rural administrators' perceptions related to the influence of government policies and programs on instructional technology decisions and perceptions related to the personnel involved in making instructional technology decisions.

From the mid-1990s through 2000 federal government policies encouraged and supported the use of instructional technology in public schools in the United States (Blaschke, 1998). Many federal instructional technology programs focused on alleviating the problems resulting from the digital divide, including recognition of the digital divide's impact on rural schools (Clinton, 2000; Rosenthal, 2000). Part of the Clinton administration's policy regarding the digital divide was to encourage partnerships between schools and businesses or other members of the community. This study examines Alabama rural district administrator's perceptions of the influence of these federal instructional technology policies and programs begun during the Clinton administration on decisions made in the decisions made in their districts.

Characteristics of rural schools influence district level instructional technology decisions. Providing Internet access and networks for instructional use has been a challenge for rural school districts. These districts must contend with older rural facilities that often have problems with their electrical systems and climate control, along with a lack of telephone or cable access to classrooms (Phelps, Peach, & Reddick, 1998). Rural school administrators have difficulty finding knowledgeable technology coordinators, or community members, who can install and maintain complicated networks or train teachers to use the network. The small size and location of rural schools often hamper their ability to find corporate partners to assist with networking projects. Many rural school administrators and teachers are at a disadvantage in obtaining technology grants because of lack of time due to multiple responsibilities and limited grant writing experience. A large number of administrators in rural schools, like those in urban and suburban schools, received their undergraduate and graduate education before computer technology courses were a standard part of the college curriculum. This becomes a greater problem for rural school administrators; because in small schools, administrators have only a limited number of fellow administrators or staff members to call on to keep them up-to-date on instructional technology (Jensen, 1998).

William Crumley (1993) has conducted one of the few studies that describes the instructional technology decision-making process in a rural setting. He describes decision making that occurred during the development of a comprehensive technology plan. Crumley was selected to chair a committee with the goal to develop a long-range comprehensive technology plan to serve as a guide for budget and curriculum development. He chose the following committee members: an elementary teacher, a middle school teacher, two high school teachers, one teacher from adult education, one school board member, one administrator, and two representatives from the community. The study demonstrates how instructional technology decisions can be made in a shared decision-making manner showing the involvement of a variety of stakeholders in the group (Crumley, 1993).

Methodology

This study examines the following research question: Is there a relationship between the technology competencies of the rural district administrators and perceptions of decisions made concerning instructional technology? Survey research was conducted to examine this question. The population surveyed consisted of Alabama rural school district superintendents, assistant superintendents, and technology coordinators. Rural school districts were selected because they are one of the groups specifically targeted by recent government instructional technology programs. The districts chosen for the survey were identified as rural based on National Center for Education Statistics (NCES) information (National Center for Education Statistics, 2000). NCES identifies 33 Alabama school districts as rural. These districts are located in three types of communities: high growth communities, moderate growth communities, and high child poverty rates and/or lack of economic growth communities. The rural districts have 98 administrators in the positions of superintendent, assistant superintendent, or technology coordinator. Surveys were sent to the entire population since it is small. Of the 98 surveys mailed to administrators in Alabama rural school districts, 65 responded for a return rate of 66%. Demographic data is displayed in Table 1.

Table 1 Frequency and Percentage of Respondent Demographic Data

Demographic data	Frequency	Percent
Positions		
Superintendents	22	34%
Assistant Superintendents	19	29%
Technology Coordinators	24	37%
Years as administrator or technology coordinator in district		
New-3	23	35%
4-10	27	42%
More than 10	15	23%
Internet and e-mail competency		
None	1	2%
Low	6	9%
Moderate	27	42%
High	31	48%
Use of technology for instruction competency		
None	1	2%
Low	11	17%
Moderate	31	48%
High	22	34%
Knowledge of distance education competency		
None	3	5%
Low	25	39%
Moderate	24	37%
High	13	20%
Knowledge of networking equipment and services competency		
None	5	8%
Low	20	31%
Moderate	23	36%
High	17	26%
Setting		
High growth	18	28%
Moderate growth	26	40%
High child poverty rates and/or lack of economic growth	21	32%

As Table 1 shows the 65 respondents to the survey held positions as superintendents, assistant superintendents or technology coordinators in rural Alabama school districts. All three positions were well represented in the responses. The greatest number of responses, 24, came from technology coordinators. Slightly fewer responses, 22, came from superintendents. The least number of responses, 19, came from assistant superintendents.Table 1 also shows that most of the participants had worked less than ten years as an administrator in their district. The greatest number (42%) had between four and ten years of experience as an administrator in the district. Slightly more than one-third (35%) had less than one year and up to three years as an administrator in the district. Only 15 of the participants had spent more than ten years in a district level administrative position in the school district where they were employed.

Demographic data were collected concerning the technology competency of rural district level administrators. Respondents were asked to provide a self-assessment of their level of technology competency in four areas. They chose from "none," "low," "moderate," and "high" to indicate their competency level in the use of Internet and e-mail, the use of technology for instruction, their knowledge of distance education, and their knowledge of networking equipment and services. Nearly half (48%) of the respondents indicated a high level of competency in the use of the Internet and e-mail. An equal number indicated a moderate level of competency in the use of technology for instruction. Slightly less (42%) indicated that they had a moderate level of competency in the use of Internet and e-mail. Approximately one-third of the administrators indicated a high level of competency in the use of technology for instruction. Slightly more than one-third indicated that they had a moderate knowledge of distance education technology and a moderate level of knowledge of networking equipment and services. A low competency level regarding knowledge of distance education technology was chosen by 39% of the respondents and a low competency level regarding knowledge of networking equipment and services was chosen by 31% of the respondents. Less than 10% of the administrators indicated that they had no competency concerning knowledge of networking equipment and services. The technology competency levels of administrators from Alabama rural school districts are found in Table 1. Data concerning technology competency levels were collapsed for purposes of analysis. Few respondents indicated “none” for their competency level in the four competency areas. For this reason the "none" and "low" competency levels were combined.

Spearman rank-order correlation analysis was conducted on the data collected. This procedure was used to determine whether there are relationships among position, technology competencies, and setting. Spearman rank-order correlation analysis revealed a significant relationship between technology competency levels and positions held. Significant relationships were found for position and competencies in (a) the use of the Internet and e-mail (r_s (63) =.313, p<.05), (b) the use of technology for instruction (r_s(63) =.263, p<.05), and (c) knowledge of distance education (r_s(63) =.251, p<.05), and (d) knowledge of networking (r_s(63) =.511, p<.05).

Table 2 Frequency and Percentage of Competency Level Responses for Uses and Knowledge of Technology by Positions Held

Competency	Superintendents		Assistant Superintendents		Technology Coordinators	
	Number	Percent	Number	Percent	Number	Percent
Use of Internet and e-mail*						
None/low	3	14%	4	21%	0	0%
Moderate	11	50%	9	47%	7	29%
High	8	36%	6	32%	17	71%
Use of technology for instruction*						
None/low	4	18%	6	32%	2	8%
Moderate	13	59%	9	47%	9	38%
High	5	23%	4	21%	13	54%
Knowledge of distance education**						
None/low						
Moderate	12	55%	9	47%	7	29%
High	7	31%	8	42%	9	38%
	3	14%	2	11%	8	33%
Knowledge of networking equipment and services**						
None/low	11	50%	13	68%	1	4%
Moderate	10	45%	3	16%	10	42%
High	1	5%	3	16%	13	54%

Note. * p<.05, **p<.01

An examination of the data in Table 2 indicates that approximately twice as many technology coordinators indicate a high level of competency in the use of Internet and e-mail and in the use of technology for instruction compared to superintendents or assistant superintendents for this level of competency. A higher percentage of assistant superintendents than either superintendents or technology coordinators chose “none” or “low” levels of competency in all of the competency areas except knowledge of distance education. This was especially true in the knowledge of networking equipment and services. Few technology coordinators chose “none” or “low” for their level of competency in any of the competency areas. Knowledge of distance education was the only competency area in which more than 25% of the technology coordinators indicate a “low” level of competency. This was still better than the competency levels indicated by other administrators. The percent of technology coordinators who indicate a high level of competency in knowledge of networking equipment and services is more than ten times higher than for superintendents and nearly four times higher than for assistant superintendents.

Spearman rank-order correlation analysis revealed a relationship between technology competency levels of administrators and the setting of the rural school district. Spearman rank-order correlation analysis revealed a significant relationship between the rural school district setting and competency in the use of e-mail and the Internet ($r_s(63) = .394$, $p < .05$), use of instructional technology ($r_s(63) = .265$, $p < .05$), knowledge of distance education ($r_s(63) = .397$, $p < .05$), and knowledge of networking ($r_s(63) = .360$, $p < .05$).

Table 3 Frequency and Percentage of Competency Levels by Setting of the Rural School District

Competency	High growth		Moderate growth		Child poverty and/or lack of growth	
	Number	Percent	Number	Percent	Number	Percent
Use of E-mail and the Internet**						
None/low	3	16%	4	15%	0	0%
Moderate	10	56%	12	46%	5	24%
High	5	28%	10	39%	16	76%
Use of Instructional Technology*						
None/low	5	28%	7	30%	0	0%
Moderate	7	39%	14	52%	10	48%
High	6	33%	5	18%	11	52%
Knowledge of Distance Education**						
None/low	10	56%	16	62%	2	10%
Moderate	5	28%	9	35%	10	48%
High	3	16%	1	3%	9	42%
Knowledge of networking**						
None/low	12	67%	8	31%	5	24%
Moderate	4	22%	12	46%	7	33%
High	2	11%	6	23%	9	43%

Note. * $p < .05$, ** $p < .01$

Table 3 shows that administrators from school districts located in areas with high child poverty rates and/or lack of economic growth were more likely to indicate a high level of competency in the use of e-mail and the Internet, the use of instructional technology, and knowledge of networking than leaders from moderate growth or high growth settings. Table 3 also shows that administrators from districts in high growth areas are more likely to indicate a moderate level of competency in the use of e-mail and the Internet than those from the other types of settings. Leaders from high growth and moderate growth settings are more likely to indicate “none” or “low” competency in knowledge of distance education than those from high child poverty or lack of growth settings. Participants from high growth settings are more likely to indicate “none” or “low” competencies in knowledge of networking than those from either moderate growth settings or those from settings with high child poverty or lack of growth settings. The data analysis shows that there is a relationship between administrator’s technology competency levels and the demographic factors of position and setting of the district.

The Spearman rank-order correlation analysis revealed a significant relationship between years as a district level administrator in the district and competency in the knowledge of distance education ($r_s(63) = .306$, $p < .05$). The significant results are shown in Table 4.

Table 4 Frequency and Percentage of Competency Level Reponses for Knowledge of Distance Education by Years as an Administrator in the District

Competency	New to 3 years		4 to 10 years		More than 10 years	
	Number	Percent	Number	Percent	Number	Percent
Knowledge of Distance Education*						
None/low	14	61%	11	41%	3	20%
Moderate	6	26%	11	41%	7	47%
High	3	13%	5	18%	5	33%

Note. * $p < .05$

Administrators who had three or fewer years of district level experience in the district are much more likely to indicate a "low" level of knowledge concerning distance education than those with more years of leadership experience in the district. As can be seen in the table above, administrators with ten or more years of experience in the district are likely to indicate a "moderate" or "high" level (80%) of competency for knowledge of distance education. The data analysis shows that there is a relationship between administrator's technology competency levels and demographic factors such as position, setting of the district, and years as an administrator. The next section of the study examines whether the relationships regarding technology competency also extend to perceptions regarding aspects of the instructional technology decision-making process.

Next, the study examines whether the relationships regarding technology competency also extend to perceptions regarding aspects of the instructional technology decision-making process. The first perceptions to be examined are those concerning the influence government instructional technology programs on district instructional technology decisions and on the acquisition of technology resources and services. Six items on the survey refer to the influence of government programs and policies. For these items respondents were asked to indicate their agreement or disagreement concerning the influence of government overall and on the acquisition of various types of resources or services regarding decisions made during the last four years (1997-2001). The results of the items related to this question were totaled. Higher totals indicated stronger agreement concerning government influence on district instructional technology decisions. Responses to the totaled items are described. One-way analysis of variance procedures were conducted. The significant ANOVA results are also described, including results of follow-up tests that indicate which groups showed significance. Descriptive results from the Items Related to the related to this area of the study appear in Table 5.

Table 5 Descriptive Data for the Items Related to the Influence of Government Programs on Decisions Regarding the Acquisition of Resources and Services

	Totals for items											
	12	13	15	16	17	18	19	20	21	22	23	24
Frequency	1	1	2	1	7	8	5	2	11	7	7	13
Percentage	2%	2%	3%	2%	10%	12%	7%	3%	17%	10%	10%	20%

Note. Highest possible total for six items in group =24.

As Table 5 shows the totals for the items related to the influence of government programs regarding the acquisition of resources and services range from 12 to 24. The percentages for each of the totals range from 2% to 20%. The percentages related to totals 20 through 24 account for 60% of the responses for this totaled group of items.

One-way ANOVAs were conducted for this data. Significant differences were found among competency levels for knowledge of distance education ($F(2,62) = 3.558$, $p < .05$) after one-way ANOVAs were run. Tukey's HSD was used to determine the nature of the differences between levels. Tukey's HSD reveals that respondents with a high level of distance education knowledge competency ($M = 22.00$, $SD = 1.58$) have a significantly higher level of agreement concerning the influence of government programs on decisions regarding the acquisition of resources and services than respondents with none to low levels of distance education knowledge competency (M = 19.46, SD = 3.25).

This study also examined how rural administrators perceive the influence of government programs on the development of instructional technology partnerships. Two items on the survey addressed this area of the study. For these items respondents were asked to indicate their agreement or disagreement concerning government encouragement on the formation of technology partnerships community groups or technology vendors. The results of the two items related to this question were totaled. A higher total indicates stronger agreement that government programs influenced the formation of partnerships. One-way ANOVAs were conducted. Descriptive data for these totaled items are found in Table 6. The table shows that totals for the items range from two through eight. Eight is the highest possible response for this compound group. Percentages range from 2% to 35%.

Table 6 Descriptive Data for Items Related to the Influence of Government Programs on the Formation of Partnerships

	Totals for items					
	2	4	5	6	7	8
Frequency	1	14	15	23	8	4
Percentage	2%	22%	23%	35%	12%	6%

Note. The highest possible total for group=8

One-way ANOVAs were run for the total of items for the influence of government programs on the formation of partnerships. Significant differences were found among competency levels for knowledge of distance education ($F(2,62) = 3.558$, $p < .05$). Tukey's HSD was used to determine the groups showing differences. This analysis revealed that respondents with a high level of distance education knowledge competency (M = 6.38, SD = 1.26) have a significantly higher level of agreement concerning the influence of government on the formation of technology partnerships than respondents with none to low levels of distance education knowledge competency (M = 5.32, SD = 1.25) as well as for those with a moderate level of distance education knowledge (M = 5.29, SD = 1.00).

The next area of interest in this study is whether there is a relationship between rural district administrators' technology competency level and perceptions concerning the participants in the instructional technology decision-making process. Results relating to this part of the study can be found in four items on the survey. Descriptive data for the items related to this area of interest are displayed in Table 7.

Table 7 Descriptive Data for Participants in the Decision-making Process

Item	Number				Percent				Mean	Standard Deviation
	N	AN	S	F	N	AN	S	F		
Groups or teams	1	4	24	35	1.5	6.2	36.9	53.8	3.4531	.6884
Teachers	1	2	30	31	1.5	3.1	46.2	47.7	3.4219	.6376
Students	6	35	20	3	9.2	53.8	30.8	4.6	2.3125	.7099
Community members	1	23	28	12	1.5	35.4	43.1	18.5	2.7969	.7597

Note. N=never AN=almost never S=sometimes F=frequently. The scale was 1-4. A higher mean indicates more frequent participation.

Table 7 shows that 53.8% of the rural administrators perceived that groups or teams frequently made instructional technology decisions. Groups or teams were perceived to make these decisions sometimes by 36.9%. Only 7.9 % indicated that groups or teams were never or almost never involved in instructional technology decisions. (M=3.4531, SD = .6884).

As the table above shows, according to 46.2% of the participants, teachers were sometimes involved in the instructional technology decision-making process. Nearly the same number of participants (47.7%) indicates that teachers were frequently involved in the decision-making process. Less than one-third (30.8%) indicates that students were sometimes involved in the instructional technology decision-making process. Slightly more than twice as many (63%) indicate that students were never or almost never involved in this process. The respondents believe that community members were more frequently involved in the instructional technology decision-making process than students. Data analysis shows that 18.5% believe that community members were frequently involved in the process, 43.1% believe that community members were sometimes involved in the process, and 35.4% believe that community members were never or almost never involved in the process. (The findings are: teacher involvement: $\underline{M}$ =3.4219, $\underline{SD}$ = .6376; student involvement: $\underline{M}$ = 2.3125, $\underline{SD}$ =.7099; community involvement: $\underline{M}$ = 2.7969, $\underline{SD}$ = .7597.)

Chi-square tests of independence were conducted for competency levels of rural administrators and the items concerning who was involved in the decision-making process. A significant interaction was found (χ^2 (9) = 21.970, $\underline{p}$<.05) for competency levels regarding knowledge of distance education and how frequently teachers participated in the instructional technology decision-making process. Participants with moderate or high levels of competency regarding knowledge of distance education are more likely to indicate that teachers were frequently involved in the decision-making process than those with low levels of competency in the knowledge of distance education.

Chi-Square and ANOVA analyses conducted for this study show that one group of respondents, administrators with a high competency level concerning knowledge of distance education, have significantly different perceptions about the instructional technology decision-making process compared to other administrators. The respondents in the group with a high level of distance education competency reveal a stronger agreement than other administrators with items related to the influence of government programs on instructional technology decisions and on the formation of partnerships. One-way ANOVAs found significant differences for items related to items asking about the influence of government programs on the formation of partnerships. Table 8 displays descriptive data concerning this group of administrators.

Table 8 Descriptive Data for Administrators with a High Competency Level for Knowledge of Distance Education

Demographic Area	Number	Percent
Positions		
Superintendent	3	23%
Assistant Superintendent	2	15%
Technology Coordinator	8	62%
Years of Experience		
New-3	3	23%
4-10	5	39%
More than 10	5	39%
Settings		
High growth	3	23%
Moderate growth	1	8%
High child poverty rates and/or lack of economic growth	9	69%

Note. $\underline{N}$=13

The group of administrators with a high competency level in the area of distance education consists of 13 respondents or 20% of the survey participants. The group is composed of eight technology coordinators, three superintendents, and two assistant superintendents. When compared with the entire group of participants this group has more administrative experience in their district. Ten of the 13 group members have four or more years of experience as an administrator in their district, and five participants from this group have more than ten years of administrative experience in their district. Interestingly, 69% of this group is composed of administrators from districts in areas with high child poverty rates and/or lack of economic growth.

Following are the significant findings from the data analyses:

1. Administrators from settings with high child poverty rates and/or lack of economic growth have significantly higher technology competency levels than those from moderate or high growth settings.
2. Technology coordinators have significantly higher technology competency levels than superintendents and assistant superintendents.
3. Administrators with more years of administrative experience in their district have significantly higher levels of competency for the knowledge of distance education.

4. Administrators with a high level of competency for knowledge of distance education are more likely than administrators with lower competency levels for knowledge of distance education to agree that government programs influenced instructional technology decisions regarding the acquisition of resources and services.
5. Administrators with a high level of competency for knowledge of distance education are more likely than administrators with lower competency levels for knowledge of distance education to agree that government programs encouraged the formation of technology partnerships.
6. Administrators with moderate and high competency levels for knowledge of distance education indicate that teachers more frequently participate in the instructional technology decision-making process than administrators with lower levels of competency for knowledge of distance education.
7. Perceptions differed for administrators with different levels of competency levels for knowledge of distance learning regarding the influence of government programs on instructional technology decisions related to the acquisition of resources and services and the formation of technology partnerships.

Conclusions and Recommendations

Most Alabama rural districts have district level administrators who are competent in the skills and knowledge of technology needed to make instructional technology decisions. This is particularly true of technology coordinators in Alabama rural school districts. The only exception to high levels of instructional technology competency is the knowledge of distance education. This is an area where many Alabama rural administrators need additional technology staff development. This study found that among the administrators who participated in this study, there is a small core group of district level administrators (20%) who have a high level of knowledge in the area of distance education.

The study also shows that the rural administrators with a high level of competency concerning the knowledge of distance education perceive a greater influence of government influence in some areas of instructional technology decision making. Since many distance education programs are government sponsored or require government funding, the leaders who have high levels of competence in this area have greater experience over an extended time period with government instructional technology programs. This is likely to be why they perceive a greater influence from government programs on instructional technology decisions than leaders without as high a competency level in this area. In addition, the study shows that a high percentage of the leaders with a high level of competency in knowledge of distance education work in districts with high child poverty rates and/or a lack of economic growth. This is a positive conclusion because this group of leaders is capable of helping their districts located in poorer settings obtain instructional resources for their students through distance education that are not available otherwise in their communities.

Most administrators in rural Alabama school districts are competent in areas of technology related to instructional technology decision-making, with the exception of knowledge of distance education. In addition, the leaders with a high competency level concerning the knowledge of distance education perceive a greater influence of government programs on instructional technology decisions possibly related to greater experience over an extended time period with government sponsored distance education activities. Rural districts located in poorer settings benefit from the finding that administrators from settings with higher child poverty rates and/or lack of economic growth have higher competency levels regarding the use and knowledge of technology than leaders from other settings.

It is recommended that qualitative studies be conducted to learn about why there are differences in technology competency levels for rural administrators in poorer settings. Qualitative researchers should conduct interviews and make observations that delve more deeply into the formal and informal technology training and experiences of a sample of district level administrators from the various settings to determine why these differences exist.

Further study is recommended to compare the technology competency levels of administrators in various settings and geographic areas. Future study is needed to look for changes in findings as more district level administrators participate in technology professional development programs that provide for the acquisition of additional technology competencies and improvement in the competency levels examined in this study.

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Understanding Why Faculty Use (or Don't Use) IT: Implementation of Instructional Technology from an Organizational Culture Perspective

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Abstract

Using the lens of Mary Douglas' Grid and Group Typology, an organizational culture model, the purpose of this case study was to: (1) describe the organizational context of two colleges; (2) explain the influences on individual faculty members' preferences toward IT use; and (3) explain the interrelationship of culture and the decision process to implement IT use in curricula. Through this study, the College of Human Ecology was best described as a Corporate (high grid/high group) culture, while the College of Veterinary Studies best fit in the Collectivist (low grid/high group) category. The findings also suggested patterns of barriers and incentives related to IT use in each college, reinforcing the reviewed literature. Also indicated was that the cultural bias of many of the faculty members in CHE is individualistic in perceptions of incentives to use IT. This individualistic cultural bias is juxtaposed against the overall cultural identity, which is Corporate, or Hierarchical. This can be one explanation for apparent discrepancies, conflict, and dissatisfaction among the cultural members of the college. In contrast, the cultural bias of the faculty and the cultural identity of the college in CVS are more in harmony. For example, incentives are also intrinsic and self-defined, but this low-grid characteristic is in sync with the Collective environment of the college. Because of this alignment, there are less discrepancies, conflict, and dissatisfaction in relation to IT use. The findings suggested conflict between cultural biases of individual faculty members and actual cultural identity of the college as a key mitigating factor to IT implementation.

Introduction

While the availability of, familiarity with, and pressures to use instructional technology (IT) have greatly increased, higher education faculty members are using IT tools at levels and in ways that can hardly be considered revolutionary (Baldwin, 1998; McArthur and Lewis, 1998; McMillan and Hyde, 2000; Green & Gilbert, 1995; Gilbert, 1995). Understanding why some faculty members embrace IT, while others in the same organization do not, is a crucial aspect of implementation and the focus of this study.

Noted barriers to IT implementation include techno-phobia, fear of and resistance to change, pedagogical or philosophical incongruity, deficient monetary incentives, disempowerment, and frustration with new, difficult, and unreliable technologies (Rutherford & Grana, 1995; Derco, 1999; Gilbert & Green, 1994; Bollentin, 1998; DeSieno, 1995; Ganzert & Watkins, 1997; Kussmaul, 1996; Lee, 1996; McCollum, 1998; Nantz & Lundgren, 1998). Each of these explanations has some degree of merit, but an all-encompassing, holistic perspective to the dilemma can be found in Cultural Theory. This study posits that a university's organizational culture has influence on the preferences and practices of IT use among faculty members. This notion implies that IT is a sociocultural construct rather than merely a technical construct, and cultural context exerts tremendous influence over individual choice and preferences (Goodman, Griffith, & Fenner, 1990; Sproull & Goodman, 1990; Susman, 1990; Shields, 1995).

A common tendency is to limit the focus of IT use to the tangible aspect of technology tools and expect their availability and apparent benefits to lead faculty members to appropriate application and practice. This viewpoint leaves out the two very important aspects of social and cultural measures (Pacey, 1983). If we merely consider the functional application of IT without considering cultural and organizational aspects, we will continue to experience an inability to fully explain the dichotomy between faculty members who use IT and faculty members who do not.

The purpose of this study is to explain, in terms of grid and group, the organizational context of two colleges within a large, four-year, research institution and the interrelationship of context and faculty IT preferences and practices.

Conceptual Framework

A framework that describes the reasons for individual choices and preferences in a particular sociocultural context is Douglas' Typology of Grid and Group. Douglas (1982) posits that the identification of grid (the roles and rules that define members of an organization) and group (the social experience of the members) shape the perceptions of those within the organizational group.

Mary Douglas' grid and group analysis (1982) provides a framework for understanding underlying processes of social change and addressing two "central and eternal questions of human existence: 'who am I?' and 'how should I behave?'" (Schwarz & Thompson, 1990, p. 6). Douglas espoused the use of grid and group "for anyone desirous of checking out the pressures of constraint and opportunity which are presumed to shape individual response to the social environment" (Gross and Rayner, 1985, p. xxii). They are the two factors which contribute to social constraints in complex interactions between individuals within organizations and the organization's environment. Grid is the dimension of individuation of members of the organization, and group is the dimension of social incorporation of members in the organization. These two dimensions serve as a screen through which the culture of an organization allows options to be perceived. (Douglas, 1982). Assessing the relative strength of these dimensions is a valuable tool in understanding the values and belief dimensions that are characteristic of a specific context.

Grid represents the degree to which an individual's choices are constrained within a social system by imposed formal prescriptions such as role differentiation, rules, and expectations (Douglas, 1982). A high/low continuum can show grid strength. High grid refers to a social context in which an explicit set of institutional classifications regulate individual interactions and restrain their autonomy, or, in other words, role and rule dominate social interactions (Douglas, 1982). Moving down the continuum, roles become more achieved than ascribed, and individuals are increasingly expected to negotiate their own relationships and life choices. At the low end of the grid continuum, there are few distinctions among members; individuals are esteemed more for their behavior or character than their role status. Four criteria are used by Douglas (1982) to determine grid: insulation, autonomy, control, and competition.

Gross and Rayner (1985) suggested that group represents the degree to which people value collective relationships and are committed to a social unit larger than the individual. Evaluation of group involves recognition of the holistic aspect of social incorporation and the extent to which people's lives are absorbed and sustained by corporate membership (Harris, 1995). A low/high continuum shows group level. On the high end of the continuum, there are specific membership criteria and explicit pressures to consider group relationships. The survival of the group is more important than the survival of individual members within it, perpetuating the life of the social collective rather than its individual members. In a low group social context, people are not constrained by or reliant upon a group of others, and they experience more of a competitive, entrepreneurial way of life (Gross and Rayner, 1985). Douglas' four criteria to evaluate group included survival/perpetuation, membership criteria, life support, and group allegiance.

When simultaneously considering high or low strength in both the grid and group dimensions, Douglas' four distinct possibilities of social environments emerge as presented in Figure 1.

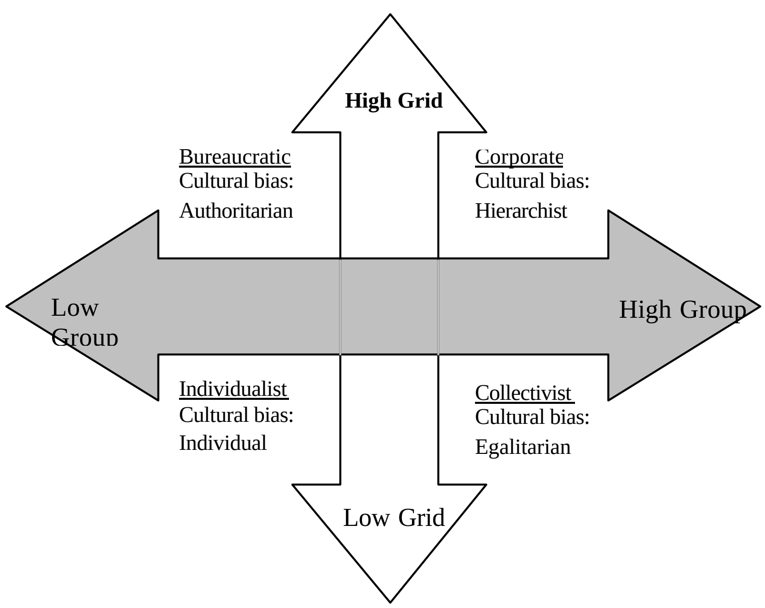

FIGURE 1. Mary Douglas' Typology of Social Environment Prototypes

Since its introduction, grid/group analysis has undergone considerable theoretical elaboration (Douglas, 1982, 1989, 1992; Douglas & Wildavsky, 1982; Thompson, Ellis, & Wildavsky, 1990). Researchers inspired by Douglas' insights have used the framework primarily for describing particular social units and constructs such as technology policy (Schwarz & Thompson, 1990), high-tech firms (Caulkins, 1997), work cultures (Mars & Nicod, 1984), career expectations (Hendry, 1999), higher education (Lingenfelter, 1992), and school culture (Harris, 1995).

Methodology

The participants in this explanatory case study (Yin, 1993) included higher education faculty members within the College of Veterinary Studies (CVS) and the College of Human Ecology (CHE) at a four-year, land grant research institution, which will be referred to as Midwestern University.

Purposive sampling strategies were applied to the selection of colleges and respondents. The two colleges selected consisted of faculty members who have exhibited use of IT to varying degrees in their teaching activities. A minimum of one academic administrator, one IT staff member, three faculty members who use IT, and three faculty members who do not use IT were initially interviewed, and further interviews were conducted as a result of member referral.

Data were collected through questionnaires, interviews, document and artifact analysis, and participant observation, with the aim of corroborating emergent facts or phenomena. As participants answered the questionnaire, their results were forwarded to the investigator via email and stored electronically in a spreadsheet. For analysis of items, a frequency count was conducted. Analysis of the interview responses was done from verbatim transcriptions. The field notes taken during and immediately following observations were transcribed and analyzed along with the interviews. Analysis of documents and artifacts took place as they were gathered. All analysis activities occurred simultaneously with data collection and were ongoing throughout the study. As data were collected, physical organization and filing was conducted using the qualitative software N*VIVO. The Douglas typology was used in classifying the data.

Presentation of Cases

Midwestern University is a modern, comprehensive land grant university, which strives to serve the state, national, and international communities by providing its students with exceptional academic experiences and by conducting scholarly research and other creative activities that advance fundamental knowledge. Approximately 26,000 students are enrolled on four campuses. Undergraduate, Masters' and Doctoral degrees are offered in a large number of fields. The university claims to be emerging as a leader in network computing resources and is accredited by a regional association of colleges and schools.

Case One: The College of Human Ecology

The College of Human Ecology (CHE) is housed in two redbrick buildings conjoined by a second-floor atrium/walkway. One building contains offices for the college administration, general classrooms, faculty offices for three of the four academic departments in the college, and offices for college service units. The three academic departments located in this building are Fashion and Interior Design, Nutrition and Dietetics, and Child/Family Relations. Offices range in size and appearance from large, recently remodeled administrative suites for the Dean, Associate Dean, and Assistant Dean and their respective administrative assistants, to faculty offices that are approximately one-fourth the size of the smallest administrative office with unadorned walls, a bare floor, and old furniture. Office space is grouped according to discipline and department, with classrooms interspersed throughout. The classrooms are primarily traditional in construct and hold an average of 30 wooden chairs with attached desks, a whiteboard at the front of the room, an instructor's podium, a pull-down projection screen, and an overhead projector on a rolling cart.

Two classrooms in the college have permanently installed multimedia presentation stations with a touch-pad control panel, a computer, a VCR, and laserdisc player. These classrooms are larger than the others, seating approximately 60 students in rows of chair/desk combination seating. Faculty can, and do, request to teach in these two classrooms. One respondent said that the college had been "chastised for using Student Tech Fee money for purchasing equipment for faculty to teach with in classrooms." The Student Technology Fee is a per-credit-hour fee charged each Midwestern University student. A portion of the money goes to each college to facilitate the purchase of technology expenditures benefiting students directly.

Grid Considerations from Douglas' Typology

CHE is categorized as a high grid environment for many reasons. Property is viewed as a status symbol, which is typical of a high grid culture. Work related tools in a high-grid environment are allotted to faculty by the college or unit administration. The Associate Dean and the Dean in CHE both held responsibility for decisions regarding IT. The college-level technical support personnel were under the direct supervision of the Associate Dean. IT tools for faculty members were initially purchased through a college-level fund with the Dean's approval.

All spaces were maintained at the college level, indicating a typical high grid environment in which higher positions have more control over property. The three college administrators – the Dean, Associate Dean, and Assistant Dean – officed in separate, much nicer spaces than faculty members. The phrases, "first-floor mentality" and "first-floor agenda," indicating the tangible separation, were voiced many times during the interviews. Of the 20 general instructional spaces in the college, only two were equipped with multimedia presentation equipment. During renovation of classrooms, one faculty member had recommended to administration that they consider "what classrooms [would] really be like if we actually start using technology not just as a delivery means, like PowerPoint or something, if it's actually interactive." The administration did not take his suggestion, as evidenced by classrooms arranged in rows with traditional desk/chair combinations and minimal options for teaching presentation beyond stand-up lecture delivery.

A typical high-grid, centralized, dominant authority structure was prevalent in CHE. Repeatedly, the Dean of the college was described as "strong" and "very much in control." A "top-down control" was emphasized throughout the college. A high grid environment also typically features an administration consciously involved in maintaining setting and maintaining rules through the hierarchical roles that exist. The vision for the CHE was clearly "the Dean's" vision, and the expectation that faculty members would conform to this vision was just as clear. One faculty member explained that while the Dean "makes a sincere effort" to get input from faculty members when developing vision for the college, it doesn't actually happen. There was no indication of faculty members' perceptions and ideas being valued by administration. Rather, the division between administration and faculty members was pervasive.

This gap was particularly noticeable regarding IT use. While the administration-directed goal of the college being recognized as "state-of-the-art" in IT use was widely expressed, the Dean's reputation for ineptness with IT and unwillingness to use IT personally was just as widely expressed. The administration encouraged faculty members to attend training and made that investment in the faculty members who were willing to attend training, which was typically conducted by experts outside of the college.

Each faculty member begins as an Assistant Professor and has the opportunity for achieving promotion and tenure through the guidelines set forth in the department level and college-level Retention, Promotion, and Tenure (RPT) documents. While the fact that individuals can achieve roles is a low grid characteristic, the rules associated with the roles, which are created at the department and college levels, indicate a high-grid culture. The pursuit of RPT comes with certain risks. Committees at the department and college level determine the success of individual faculty members' adherence to the guidelines. If the faculty member is not successful, he or she risks not being reappointed, tenured, or promoted. This process is indicative of a high-grid environment, in which authorities and experts make the decision to set risks at a certain level and set standards to mitigate risks (Gross & Rayner, 1985).

Since IT use was not specifically outlined in RPT documents, many faculty members perceived that it was a risk to spend time developing and using IT. The motivation to use IT was overwhelmingly self-defined for CHE faculty members. "Enhancing instruction," "enriching students' experiences," and "keeping up with the rest of the world" were the primary motivations reported by faculty members. Without RPT as a motivation to use IT, the CHE administration encouraged IT use by providing opportunities for faculty members to obtain special training in this area, but they were expected to complete all development and delivery tasks themselves. When they needed assistance, faculty members sought support from individuals outside the college rather than using internal resources. When faculty members took advantage of offered training opportunities, they were expected to produce a return on the college's investment. One faculty member in particular described an incident in which she accepted one month's salary as an incentive for initial development of an online course. After teaching it once, she had decided not to do it again. The department head, however, reminded her they had made an investment – the initial one-month's salary – and expected her to teach the online course once per year with no further reward.

Group Considerations from Douglas' Typology

In a high group culture, ownership and management of property and resources are organized for the benefit of the whole group (Lingenfelter, 1996). Initial purchasing of IT tools in CHE was done at the college level, and technical support for these tools was organized as one college-level group. Equitability of desktop resources for faculty members was expressed as a goal, and the Associate Dean described the centralization of IT purchasing and service as a means to this end.

Both physical spaces and cyber spaces were maintained at a college level. The website for the college was built and maintained by a centralized person, and was “updated at the discretion of the administration.” One faculty member in particular expressed frustration that “the determination was made at the college level what elements would be on the faculty web pages and what format would be used.” This is a strong indicator of a high group environment in which communication flows primarily through corporately regulated or maintained processes (Lingenfelter, 1996).

Within a high-group environment, work can be described as corporately organized cooperation (Lingenfelter, 1996). While individuals in this type of environment have separate work activities, the group may call on members to participate in corporately organized activities. This description fits CHE well. Individual faculty members perform separate work activities in accordance with his or her personal interests and professional discipline. Department-level and program-level groups plan schedules and details of courses to be offered within their disciplines. Assignments are made to faculty members within the groups to teach certain courses.

Another high-group example is CHE’s involvement as a partner in a consortium of eight other colleges in the midwestern section of the United States. The mission of the consortium is to create a collaborative environment where students can take graduate level courses at a distance from any of the participating universities, and CHE’s contribution is to eventually offer two degree programs completely online. Individual faculty members are expected to contribute to this effort by teaching an online course when they are asked to.

In a high-group environment, the institution decides which risks are socially acceptable and which are not (Gross & Rayner, 1985). Reappointment and tenure expectations in CHE were outlined by department-level RPT documents and directed by department heads. In addition, faculty members faced college-level RPT documents and college-level administrative approval.

An indication of a low-group environment emerged in CHE along with the perception of risk in relation to IT use and RPT. The risk of spending time developing and using IT was perceived as higher for faculty members who were not yet tenured, since IT use was not recognized in the RPT process and non-tenured faculty members’ activities were more tightly bound by RPT guidelines.

IT use within CHE was initiated and planned by individual faculty rather than the whole group, indicating a low-group situation. Individuals were not assigned tasks and responsibilities related to IT use unless an investment of training had been made in them. IT use was not standardized across the college, but one software package for electronic presentation (PowerPoint) and another for Internet course delivery (LearningSpace) were used by an overwhelming majority of people who participated in those activities. The college had offered extensive training on these two software packages. Two different departments spoke of specialized software they use in their respective programs that the other departments in the college have no use for.

In a larger sense of the concept of time, this college seemed to reflect a strong desire to keep a firm grip on the future. On the college website, the term “future-oriented” is used repeatedly in describing CHE. In interviews, faculty members, administrators, and staff cited the desire to “keep up with the future” as a reason why they use IT. Juxtaposed with this apparent grasp for the future and its innovations, is the strong history and practice of deeply rooted higher education traditions such as RPT policies and an organizational structure built upon the position of a “strong Dean.”

Case Two: The College of Veterinary Studies

The College of Veterinary Studies (CVS) is housed in a three-building complex on the outskirts of the main Midwestern University campus. The oldest building, McDonald Hall, serves as the main instructional area for first-year, second-year, and third-year students, with three theater-style classrooms for each of the respective classes, smaller teaching laboratories, and a computer lab. The college’s library, Student Resource Center, the Office of Multimedia Curriculum Development, and most of the administrative offices are housed in this building. Two of the college’s three academic departments, the Department of Veterinary Pathobiology and the Department of Physiological Sciences, have faculty and department head offices in McDonald Hall

The Veterinary Medical Teaching Hospital is the largest of the three buildings in the CVS complex, and offers full veterinary services to the public. In addition to the for-profit services, the teaching hospital is also home to administrative and faculty offices and instructional spaces for the third academic department in the college, the Department of Veterinary Clinical Sciences.

Grid Considerations from Douglas' Typology

From a low-grid perspective, property is typically viewed as a means to an end (Lingenfelter, 1996). CVS has focused on creating a pervasive environment for the ultimate goal of "molding a good veterinarian." The goal of providing a pervasive environment to meet this end extends to IT use as well. Individual faculty members who elect to teach in one of the four traditional, lecture-style classrooms have multimedia presentation equipment in each. Smaller classrooms and labs had been set up for faculty member who chose to teach in a small-group, more learner-centered manner. For faculty members who opted for delivering web-assisted courses, an Office of Multimedia Curriculum Development, a centralized development service for college-wide website resources, provided templates designed for the case-based curriculum approach adopted by the college. In addition, instructional technology staff personnel were available to input the faculty members' content to the website templates. Since the faculty members individually chose which services and opportunities to take advantage of, this environment is considered low-grid.

In contrast to the low-grid factors considered above, two aspects of CVS were more naturally placed high on the grid continuum: 1) desktop computing resources were allotted to faculty members by the College or unit administration, and 2) the Office of Multimedia Curriculum Development was described as providing "grunt work" for faculty members.

Since administrators and faculty members were dedicated to the common mission of "molding a veterinarian," role distinction seemed to fit best on the lower end of the grid continuum. The college authority structures were centralized – a high-grid notion – yet administrators were often described as "serving in the trenches with fellow faculty members." Their desire and efforts to participate in the same activities as the faculty members in the college indicates a low-grid environment.

The Dean of the college noted in a local newspaper article his feeling of being "blessed with a group of talented people." This belief in talented people is evident in faculty members' assignments, which are adjusted on a percentage basis in accordance with individual talents. Faculty members lend their talents to team teaching endeavors in CVS, where teaching teams were comprised of both faculty members who held D.V.M. degrees and those who held Ph.D.s. Some distinction between these two groups was evident in interviews, but it was clear the differences in individual skills were valued. This situation is indicative of a low-grid, task/goal system in which individual assignments change in accordance with the goal or need at a specific time (Lingenfelter, 1996).

Students were also presented with the choice to take advantage of resources and services. The curriculum was designed to offer a variety of opportunities for students, an indication of a low-group environment. Due to a high student-to-faculty member ratio and keeping each class intact throughout the four-year program, CVS students seemed to play a very different role than students do in other colleges. Faculty members and students have a great deal of close contact, particularly in the fourth year, when students and faculty members are working side-by-side in the teaching hospital. Many faculty members mentioned that student expectations for the use of IT were very significant. In addition, student evaluations of courses carried a great deal of weight in this college. The Associate Dean for Academic Affairs described an incident in which a faculty member's teaching assignment was lessened due to poor student evaluations. The strong voice that students have in this college is indicative of a low-grid environment.

Indicative of a low-grid environment, faculty members within CVS achieve rank and role based on personal productivity within their individual, percentage-based assignment. Documents for reappointment, promotion, and tenure (RPT) provide guidelines for this process. Committees at the department and college level determine the success of individual faculty members' adherence to the guidelines. If the faculty member is not successful, he or she risks not being reappointed, tenured, or promoted. This process is indicative of a high-grid environment, in which authorities and experts make the decision to set risks at a certain level and set standards to mitigate risks (Gross & Rayner, 1985). Yet, CVS faculty members are rewarded through the RPT process based on their individual percentage assignment, a low-grid characteristic.

Since IT use was not specifically outlined in RPT documents, many faculty members perceived that it was a risk to spend time developing and using IT. In particular, the faculty members who had a higher percentage assignment in research reported the necessity of avoiding IT use in order to successfully meet RPT guidelines.

While curricular decisions were reportedly prescribed by the institution in CVS – a high-grid concept – faculty members were motivated more by self-defined interests, a low-grid concept. Faculty members reported using IT primarily to "enhance learning," because "it's fun" and "easy and effective." In addition, they cited pressure from other veterinary schools, animal producers, other faculty members, and society as motivators. The typical IT user in CVS was described as someone who "thinks outside the traditional box" and is "not a performer, they're a player, they're a participant." These motivations represented intrinsic factors that outweighed the absence of extrinsic rewards for IT use from the college.

In addition to intrinsic motivations, personal barriers to IT use also emerged in discussions with CVS faculty members. Most significantly, faculty members expressed that lack of time was the biggest barrier to IT use. With a strong recognition of the amount of time needed to invest in using IT successfully, faculty members noted that spending that time had to be balanced with the expected benefit and other scholarly pursuits. Personal issues such as intimidation, apprehension regarding assistance, and being uninformed were also cited as barriers.

Group Considerations from Douglas' Typology

In CVS, work-related tools were purchased, regulated, and maintained by the college, indicating a high-group environment, which features corporate ownership of property. Desktop computers and printers for faculty offices, multimedia presentation tools in classrooms, and IT tools in the Office of Multimedia Curriculum Development were purchased with college-level finances and supported by the college-wide technology support personnel.

When faculty members do have questions or need assistance regarding IT use, they have the Office of Multimedia Curriculum Development staff and tools available. Students were able to take advantage of this service as well. The office also handled the development and maintenance of an online database of digital images. Faculty members voluntarily contributed images they had personally gathered to add to this college-wide database. This service and facility is a high-group example of a society that organizes itself to manage its resources for the benefit of the whole.

Another indicator of a Corporate, high-group environment is that the organization has a lifespan that exceeds the life of individuals in it (Lingenfelter, 1996). CVS's group mission of "molding veterinarians" transcends any individual effort or interest. Professional clinic services through the teaching hospital serve the common mission throughout the college of "molding veterinarians." In a continued effort to provide a pervasive IT environment, the teaching hospital was designed so students could "experience different technologies that they may be using as a practitioner."

The relationship between individuals in different roles was described as creating "a family environment" by one faculty member and as "a unique, close-knit environment" by another. These descriptions indicate a high-group environment, in which the entire group shares a focus and corporate labor involves extensive social interaction among the participants (Lingenfelter, 1996). Authority within the college is organized corporately, with clear accountability for individual responsibilities. The administration clearly saw its role as one of providing a environment for faculty members to take advantage of opportunities. Faculty members collaborated on teaching teams to create opportunities for students within the curriculum. Students and staff voices were heard and expertise is valued as well. Lingenfelter (1996) described work in a high-group environment as "corporately organized cooperation." This description is fitting of CVS.

In a high-group environment, the institution decides which risks are socially acceptable and which are not (Gross & Rayner, 1985). RPT expectations in CVS were outlined by department-level RPT documents and directed by department heads. In addition, faculty members faced college-level RPT documents and college-level administrative approval. The risk of spending time developing and using IT was perceived as higher for faculty members who had a lower percentage assignment for teaching than research.

Indications of a low-group environment also emerged in CVS. Different departments in the college had different RPT documents. In addition, individual faculty members did initiate and plan their work and labor activities.

Findings

The colleges studied offer two different cultural representations of the Douglas (1982) typology. CHE presented a high-grid, high-group, or "Corporate" playing field, in which administrative roles were at the top of the hierarchical structure. The high degree of administrative control over and highly regulated processes of procurement, allotment, and use of property created an environment in which individual choice was restricted only to what was made available by decision makers. Negotiation for resources and opportunities related to IT was not a common practice. In terms of IT use, very few tools were readily available, and technical and instructional assistance outside of the college was sought and relied upon. Faculty members perceived the use of IT as high risk for someone who had not yet been promoted or tenured. With four diverse departments, this disparate social context contributed to individual roles being highly insulated from others.

In CVS's Collectivist context (low-grid, high-group), the effort to create a "pervasive environment" for IT use was paramount and evidenced by IT tools in all classrooms and a well-funded and well-trained technical and IT staff. In addition, all members of the college were united by one mission and one purpose – to "mold a good veterinarian." Faculty members as well as students were expected to make individual choices regarding use of available resources. Administration was perceived as serving "in the trenches with fellow faculty members" and as models for instructional practices. Any risk associated with IT use was low for faculty members whose percentage-based assignment was heavily weighted toward teaching, but high for those with a high percentage research assignment. Decisions regarding procurement, allotment, and use of property were more closely tied to the shared mission than to administrative control. Faculty members' choices to use IT were less restricted and less regulated, evidenced by open and welcomed negotiation for opportunities and resources related to IT.

Conclusions

The findings of these two cases indicate that barriers and incentives to IT use are more closely aligned with the cultural context in CVS than they are in CHE. In the low-grid, high-group environment of CVS, IT use appeared to be further developed. The Office of Multimedia Curriculum Development, the case-based approach to curriculum, modeling of IT use by administrators and curriculum leaders, and the availability of internal IT experts appeared to facilitate a higher level of IT use in CVS. Students were also involved in developing and presenting IT-based products and were offered assistance and tools for doing so. While the relationship between Grid and Group Typology and faculty members IT use appears to be useful, a predictive element to the relationship could not be established within the parameters of this research study, since barriers to and incentives for IT use did not fit neatly within the grid/group typology.

It is significant to note that the cultural bias of many of the faculty in CHE is individualistic in perceptions of incentives to use IT. This individualistic cultural bias is juxtaposed against the overall cultural identity, which is Corporate, or Hierarchical. This can be one explanation for apparent discrepancies, conflict, and dissatisfaction among the members of the college. In contrast, the cultural bias of the faculty and the cultural identity of the college in CVS are more in harmony. For example, incentives are also intrinsic and self-defined, but this low-grid characteristic is in sync with the Collective environment of the College. Because of this alignment, there are less discrepancies, conflict, and dissatisfaction.

The findings from this case study impacted theory, research, and practice. The significance of using Douglas' (1982) Grid and Group Typology as the theoretical framework in this study lends credence to research calling for a cultural perspective of IT use. Goodman, Griffith, and Fenner's (1990) research supported the notion that a question such as "Why do people decide to use or not to use the enabling technology?" (p. 75) must be explored with an examination of the complicated relationships among technology, the individual, and the organization. Hagner (2000) found, "If institutional culture is an important consideration affecting the success or failure of teaching transformation, innovators must consider the systemic characteristics rather than the "practice" characteristics prior to transformation" (p. 32). Sproull and Goodman (1990) found that changes in technology or use of technology lead to changes in the social structure of an organization. In turn, changes in the organization's social structure enacted further change on the technology. The implication of this reciprocal causation bears on a research design capable of capturing "the dynamic relationship between technology and the social construction of that technology" (p. 259).

Douglas' (1982) Grid and Group Typology made two primary assumptions: 1) that an individual will fail to make any sense of his surroundings unless he can find some principles to guide him to behave in the sanctioned ways and be used for judging others and justifying himself to others, and 2) that the social context of an organization serves to permit and constrain effects upon individuals' choices (Douglas, 1982, p. 190). In accordance with these assumptions, Douglas' framework was useful as a descriptive tool focusing on higher education faculty members' IT use preferences. Its effectiveness in identifying the cultural context of two colleges assisted in examining the relationship between cultural context and barriers and incentives related to IT use.

In this study, the typology was useful in focusing on cultural context issues while allowing the issues related to why faculty members choose to use IT to emerge. Throughout the study, the concepts of leadership, risk, labor issues, and resources emerged as key constructs related to IT use. One recommendation for further research would be to focus on these constructs and their relationship to IT use preferences in a higher education setting without the lens of a theoretical framework.

This study provided insights into how and why faculty members choose and are motivated to use IT. The reviewed literature outlined common barriers and incentives to IT use in general, but the theoretical framework helped put into perspective how and why certain barriers and incentives operate in a given cultural context.

This study also provided implications for practice related to the nature of IT use in higher education settings. The findings of this study indicate benefits to leadership decisions related to IT use in higher education settings. The ability to identify the cultural context of an organization and its relationship to IT barriers and incentives will allow the leader(s) of the organization to bring the pieces of this puzzle together into a complete picture. For example, the College of Human Ecology's hierarchical environment appeared to facilitate the reported barriers to IT use. Without incentives to balance the barriers, or an adjustment in cultural practices, IT use will likely remain in a static state (Haulmark, 2001). In addition, data collected revealed faculty members' strong allegiance to department-level initiatives and issues juxtaposed with a strong, controlling, centralized administration at the college level. Since the practice of IT use is stilted by barriers related to the current culture, it would seem restructuring decisions and services related to IT use to rest at the departmental level would move the culture down grid and down group, balancing more effectively with incentives for IT use.

As a leader in an educational institution, a critical role is to acclimate faculty members into the institution's culture. While this may appear to be a simple task, actually defining the culture and providing for the social integration into this culture is often an elusive process. This study will assist leaders in realizing the necessity of understanding the organization's cultural context and providing a method for studying that context.

This study also provides vital information to those individuals who provide instructional or technical support to higher education faculty members. Understanding the cultural context within which support is offered is a key to effective service.

Too often we, as IT-using educators, can be found espousing the "importance" of technology tools without even considering whether a particular tool has any relationship at all to the overall mission or purpose, which undoubtedly should be optimizing the learning experiences of all students. Just as often, non-IT-using educators can be found posturing against any use of IT in order to keep hidden the barriers they perceive. And, of course, all educators can be found using IT inappropriately on any given day in any given classroom. In order to understand what is appropriate, however, we must first seek to understand our own cultural context, and then we can ask ourselves why IT should be included in our mission and purpose and how we can optimize its use.

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Dale’s Cone Revisited: Critically Examining the Misapplication of a Nebulous Theory to Guide Practice

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Abstract

Practitioners have enthusiastically, creatively, and sometimes misinformedly applied Edgar Dale’s (1946) Cone of Experience model – and its various adaptations – to guide their work for decades now. Meanwhile, precious little has been accomplished by way of examining and refining the model (and its associated theories) to give it the concreteness necessary for effectively guiding practice. This paper suggests several philosophical perspectives by which the gaps in the prevalent versions of Dale’s Cone could be exposed. It is hoped that this discussion will help start the process of bringing about a revised theoretical model that is a more effective guide for practitioners.

Introduction

Edgar Dale, in his seminal (1946) work (which he revised subsequently in 1954 and 1969), introduced the Cone of Experience, a “visual aid to explain the inter-relationships of the various types of audio-visual materials, as well as their individual positions in the learning process” (p. 37). Dale described the Cone as an attractive “visual metaphor of learning experiences, in which the various kinds of audio-visual materials appear in the order of increasing abstraction as one proceeds from direct experience” (p. 38).

In the final (1969) edition of his book Audiovisual Methods in Teaching, Dale introduced the Cone of Experience as a “pictorial device” showing “the progression of learning experiences from direct, firsthand participation to pictorial representation and on to purely abstract, symbolic expression” (p. 108). Dale stated the following specific attributes of the Cone device (1969, p. 109): It indicates the broad base that direct experience provides for learning and communication; it classifies instructional materials according to the degree of experiential concreteness that each provides; its various levels may suggest the most appropriate method for teaching an abstract concept given the child’s needs and abilities at the time; and it suggests the interrelated and interdependent nature of learning experiences and instructional materials.

In an interesting take on the Cone model, Stewart (1969) situated the concept of simulation within the concrete-abstract continuum of the Cone, while also simultaneously explicating the related constructs of negative, positive, physical, and psychological simulation. From this standpoint, Stewart proposed an S-shaped relationship between degree of physical simulation – “the copying of that part of the real-life situation which is physically involved in the desired responses or behaviors of the learner” – and transfer of learned behavior, stating that “up to a point, increased increments of transfer of learned behaviors result from increased degrees of physical simulation” (p. 160). Stewart also proposed that “if some behaviors are not being performed adequately (by learners at a given level of simulation), it is an indication of a need for a greater degree of simulation;” and that “increased simulation built into the course materials increase(s) (learner) retention.”

Since its inception, Dale’s Cone has been a key feature in educational media courses at universities throughout the United States and abroad. Numerous training sessions and workshops have been held at professional conferences and conventions in diverse fields to train practitioners in using Dale’s Cone to guide their work. Several books and journal articles have been written that elaborate on Dale’s Cone, sometimes making confused interpretations and creative adaptations of it, and occasionally advancing explicit propositions regarding its application to teaching and other instructional activities. All this while, precious little has been accomplished by way of examining the Cone model (and its associated theories) to see if it is really meaningful as a practitioner’s guide, and of refining it to give it the explicit constraints and concreteness necessary for it to be an effective guide of practice.

Subsequent Usage of Dale’s Cone

Meanwhile, very little research seems to have been accomplished in terms of elaborating upon (and empirically testing) the postulates implied by Dale’s Cone. It is a telling state of affairs that, when this researcher sent out an e-mail message to graduate students, scholars, and faculty at one of the leading educational technology programs in the country asking whether any of the recipients had heard of a significant study that had empirically tested the postulates of Dale’s Cone, not a single convincing response was received! On the other hand, many practitioners (and those that inform them) have tended to unhesitatingly use Dale’s Cone as a guide of practice, without evidencing much thought regarding whether it was really meant to be used that way.

In an interesting case, this researcher, while attempting to find examples of the empirical application of Dale's postulates in different contexts, contacted a scholar who had presented a paper about the application of Dale's Cone to “counseling in a university environment” (at the 2000 National Conference of the American Counseling Association in Washington, D.C.) and requested a copy of the paper in question. However, the scholar (who shall remain unnamed) responded as follows: “I did not publish the presentation that I did at the conference, so I do not have a paper to send you. What I did was train the university counselors on the use of Dale's Cone of Experience so that they could utilize it from a learning and retaining perspective. We focused on how to integrate tactile and doing activities into counseling to make things happen and to encourage retention of new interpersonal skills. My presentation was on utilization and training and was very interactive.”

Further searches of the literature revealed journal articles such as Church (1999) and Kvam (2000) that made uncritical reference to Dale’s Cone as a practitioner’s guide. Church (1999) advised, “…(W)hen teaching topics that involve human interaction with (a “system” to perform some task), instructional design should … include consideration of work by Dale (1954) and Bruner (1966).” He went on to describe Dale’s and Bruner’s theories and states that they are “related,” but said nothing about whether either theory is sufficiently precise or concrete to be of tangible use to practitioners that need to make hard instructional design decisions. Kvam (2000) referred to Dale and Bruner while advocating the use of cooperative learning. According to him, Dale (1969) “suggested that learned concepts can be more efficiently retained in one’s memory if more levels of experience can be included in the learning process,” but Kvam’s paper did not evidence much concern regarding the need for empirical backing behind such propositions. Interestingly, Kvam’s article actually detailed the results of an experimental study that he had conducted to “investigate the long-term effects of active learning methods on student retention.” However, since the study used small, non-random samples, the data obtained was insufficient, preventing Kvam “from making any strong statistical claim” that active learning methods were more effective than traditional lecture methods.

Meanwhile, Tipton (1998) introduced the Cone as part of a chapter discussing the application of technology to learning, saying that Dale’s and Bruner’s theories “help us understand the role of media in the classroom in relationship to learning” (p. 3). First of all, it appears that Tipton got the chronological order of these theories incorrect when she said that Dale “took (Bruner’s) work a step further with his Cone … and related (Bruner’s) sequence of learning to mediated events” (p. 3), because Dale’s original (1946) conception of the Cone predates Bruner’s theory by 20 years. Perhaps Dale’s (1969) use of Bruner’s analysis to back up his conception of the Cone was a confounding factor? Anyhow, Tipton went on to discuss the application of Dale’s Cone to teaching in some detail (p. 5), proposing that a child needs the concrete experiences at the bottom of the Cone to understand the abstract ones at the top, and that if all we present is visual and verbal symbols, the student has no concrete referent to understand the meaning. Once again, conspicuously absent were any attempts to empirically corroborate any of the Cone’s propositions.

An Intriguing Theoretical Quagmire

Above and beyond, what is even more interesting (and even bizarre) is that, for many practitioners and their informants, Dale’s Cone seems inseparably joined to this rather bold theory that suggests an explicit relationship between the levels of Dale’s Cone and learners’ levels of recall, by saying that learners generally remember 10 per cent of what they read, 20 per cent of what they hear, 30 per cent of what they see, 50 per cent of what they hear and see, 70 per cent of what they say and write, and 90 per cent of what they say as they perform an authentic activity. It is not clear who exactly came up with these ideas (they have been variously attributed) or how much these precise figures are based on hard empirical evidence, but the ensuing confusion of these ideas with Dale’s work has certainly led to a blurring of the boundaries between the two theories in the minds of many practitioners and of those who inform them.

For example, Buehler (2000) describes these six levels under the title of Dale’s Cone, as do Sjöström & Forsberg (2001). Hall (2002, para. 2) commits the same error, saying that according to the “Edgar Dale Cone of Experience,” a person remembers 10% of what they read, 20% of what they hear, 30% of what they see, and 50% of what they see and hear. Hall goes on to explain that “the percentage increases for those fortunate enough to read, hear, see and do things in actual or practical experiences.” Leggett (2002, para. 2) offers another example of such a confusion: “Dale's Cone of Experience is a model used to describe the degree of learning that occurs with different levels of abstraction and active participation. The farther you progress down the Pyramid, the greater the learning. It has been found that we retain only 5% of what we hear but 70% of what we do.” Meanwhile, the Nottingham Trent University, Faculty of Humanities’ International Studies Resource Centre Web site (ISRC Online, 2002) states that according to Dale's Cone, people remember 20% of what they hear, 30% of what they see, and 50% of what they see and hear, and it actually cites Dale's 1969 work as the reference for this information!

Sorenson (2002, February) gets even more creative, renaming the Cone device as the "Cone of Learning" in the following blithe advice to teachers: "Passive activities, the kind of which traditional teaching is known for, guarantee only a small percentage of retention. Edgar Dale's "Cone of Learning" reveals that only 10% of what students read is likely to stay with them. 20% of what they hear, 30% of what they see is retained. While still a limited amount, mixing the senses produces more retention. Up to 50% of what is simultaneously seen and heard, stays. Active participation ensures more learning. Up to seventy percent of what is said remains with the speaker. Up to ninety percent of what is both said and done is retained with the presenter. Therefore, participating in discussions, giving speeches, doing dramatic presentations, simulating the real thing and doing the real thing ensures better retention. Anyone walking past a classroom should expect to see structured, mediated activity! Never should they expect to see the teacher talking extensively beyond the first few minutes of class" (para. 9).

There are many more such examples of the confounding of Dale's explication of the Cone with these mysterious six levels, but the above examples should suffice to make the nature of this problem apparent.

Pertinent Issues

The main point that this researcher is attempting to make via this discussion is, it does not appear that Dale ever meant for his Cone to be used by practitioners (and for that matter, by many other theoreticians) the way it has been, i.e. like some kind of concrete, unshakeable law. Yet, this fact seems to have been overlooked by numerous practitioners in the field who have, since the inception of Dale's Cone, often referred to it and used it as if it were a road map.

Dale himself provided very few constraints to his model. He clearly specified that it was "not offered as a perfect or mechanically flawless picture to be taken with absolute literalness in its simplified form" (1946, p. 37). He did not provide any concrete propositions to guide practice either. For example, "Does the cone device mean that all experience must … 'travel up' this routine from base to pinnacle? Clearly and emphatically no" (p. 48). In other words, the Cone's intention was merely "to show how sensory aids are classified in terms of more or less concreteness and abstractness" (p. 47). Meanwhile, Dale exacerbated the fuzziness of his model by saying that the Cone's bands "interlap (sic) and … blend into one another" (p. 52).

Dale (1946, p. 48) even quoted Tyler (1933) to admit that (based on experiments in the teaching of zoology) "no one series of learning activities has proved equally effective with all students." Similarly, Dale refused to make any propositions about whether one learning activity was more effective than the other, quoting Gates (1930) to say that "(t)he relative values of (different learning activities) are … determined (not by their degree of abstractness/concreteness but) by past experience and mechanical advantages" (p. 50). Furthermore, for all his claims of the "broad base that direct experience provides for learning and communication" (1969, p. 109), Dale nevertheless agreed with Dewey (1916) that direct experience had "the disadvantage of being limited in range" and was "fatally restricted" (1946, p. 51).

Dale's original presentation of the Cone was remarkably tentative, and was wide open to suggestions and criticism. "How would you revise this device? Why?" he asked (1946, p. 52). He even introduced a possible dimension of divergence into the model, asking: "As we become more mature, can we concentrate on abstract and symbolic experience, and consider the getting of direct concrete experience as something to be done in childhood?" (p. 52). Dale did not provide a satisfactory answer to the latter question in the subsequent editions of his book either, merely stating that the Cone "stands for activities that are available, in varying degrees, to learners in all age groups" (1969, p. 132). In Dale's own admission, his Cone device had no answer to questions such as "When … is a student ready for a generalization? Should we first (state) general principles or (rely) primarily on illustrative examples? When is … rote learning permissible?" (1969, p. 130).

However, these conceptual holes seem to have been largely ignored by practitioners (and their informants) in their rush to suggest the design of instruction on the basis of propositions somehow "implied" by Dale's model. In fact, Dale seems to have disregarded these facts himself, in his 1969 book, when he claimed that "the Cone can be a helpful and practical guide," (p. 110) without explicitly detailing how. For instance, Dale said that in teaching one does "not always begin with direct experience at the base of the cone," but rather "with the kind of experience that is most appropriate to the needs and abilities of a particular learner in a particular learning situation" (1969, p. 128). A logical question from the practitioner's standpoint could then be, 'If the Cone cannot tell me categorically when, where, and under what conditions I should or should not use direct experience (or any other learning activity) as an instructional strategy, then of what real use is it as a practitioner's guide?' Meanwhile, regarding whether one kind of audio-visual learning experience was instructionally more useful than another, Dale had no concrete answer, advising merely that "varied types of sense experiences should be provided in the classroom" (1969, p. 129). One could argue that this rather shallow piece of advice was a mere restatement of something that teachers had known for a long time before Dale conjured up the Cone device, and therefore is not particularly illuminating as far as the practitioner is concerned.

To give another example, it is reasonable to expect that practitioners would like to have concrete advice regarding the relative cognitive demands imposed upon the learner by each type of audio-visual learning experience. However, Dale said that "the narrowing upward shape of the Cone does not imply an increasing difficulty of learning," and that "the basis of (his) classification is not difficulty but degree of abstraction" (1969, p. 110). This immediately raises the classic 'So what, who cares?' question, because it can be argued that merely classifying learning experiences on the basis of degree of abstraction does is not saying much to a practitioner who is looking for a guide to help him/her make vital, pressing instructional decisions.

Examining Dale's Cone from Other Philosophical Standpoints

This discussion could possibly be enriched by examining the empirical usefulness of Dale's Cone from a Popperian perspective. As Karl Popper saw it, if a theory does not lend itself to falsification, it is more metaphysical than scientific. It could be argued that Dale's Cone is indeed such a theory. It does not make any "risky" predictions in the Popperian sense, being so imprecise in terms of its conditions and so fuzzy in terms of its propositions as to practically impossible to test or falsify. Further, according to Popper, "every genuine scientific theory is prohibitive, in the sense that it forbids, by implication, particular events or occurrences" (Thornton, 2001). However, Dale's Cone does not forbid anything to happen. Popper would therefore be likely to frown upon the way Dale's Cone has been used by scholars and practitioners, as if it were a real scientific theory. It has to be admitted that Dale's Cone of Experience theory certainly has excellent face validity. After all, no one can argue with the logic of a ladder of abstraction leading from direct experience to visual symbolism. Nonetheless, this high level of probability would most likely not convince Popper, who believed that "the probability and informative content of a theory vary inversely" (Thornton, 2001), with the most informative theories being the ones that are the most improbable-sounding.

Meanwhile, another argument against the prescriptive use of Dale's Cone is the fact that there is very little by way of an "empirical tradition" associated with this theory. According to Imre Lakatos, a theory would be considered "empirically progressive" if it led "to the actual discovery of some new fact" (quoted in Court, 1999, p. 212). Reading Dale's explication of the Cone of Experience model from a Lakatosian perspective will make it clear that it does not have much empirical content to offer (nor does it offer any real new "facts") and is therefore not likely to be the most effective practitioner's guide. Lakatos observed that social scientific theories are often judged by "assessing the number, faith and vocal energy of its supporters" (quoted in Court, 1999, p. 215). According to Court (1999, p. 217) especially in our field there is a risk of "assuming a theory is good because it is popular." Court describes instances of "bandwagon" theories, unsupported by sufficient research, sweeping into town and being uncritically embraced. Clearly this has been the case with the widespread misunderstanding and misapplication of Dale's Cone by practitioners.

The main reason for this state of affairs is probably the notable lack of theoretical dialogue in our field. As Schwen (2002, personal communication) says, "the discussion of theory in our literature is flaccid at best," the result being the human performance technologists' claim that we promote an outdated view of the world. Schwen has suggested the use of Dubin's (1976) conception of the elements of a theoretical model as "intellectual tools" by which scholars could "deconstruct" theories. According to Dubin (1976, p. 23), a (complete) theoretical model involves Units ("Variables … whose interactions constitute the subject-matter of attention"); Laws of Interaction ("Among the units of the model"); Boundaries ("Within which the theory is expected to hold"); System States ("In each of which the units interact differently"); Propositions ("Conclusions that represent logical and true deductions about the model in operation"); Empirical Indicators ("Each term in each proposition whose test is sought needs to be converted into an empirical indicator of the term"); and Hypotheses (Substituting "the appropriate empirical indicators in the propositional statement … generate(s) a testable hypothesis").

It may thus be a worthwhile exercise to carry out a Dubin-esque deconstruction of Dale's explication of the Cone of Experience into its constituent units, laws of interaction, boundaries, system states, propositions, empirical indicators, and hypotheses. This would help expose the gaps in the prevalent version of Dale's Cone, and provide an indication of what needs to be done in order to plug these gaps and make the model a more effective guide for practitioners.

Deconstructing Dale's Cone using Dubin's Elements

Attempting a deconstruction of Dale's Cone using Dubin's elements of an ideal theoretical model is a very illuminative exercise, because it immediately exposes the extensive holes in Dale's model and reveals its remarkable fuzziness and extraordinary lack of informative content. A careful analysis of Dale's work divulges the following units: Learning Experiences; Audio-Visual Instructional Materials; Levels of the Cone; Degree of Experiential Concreteness; and Methods for Teaching Abstract Concepts. However, the only discernible law of Interaction among any of the above units of the model seems to be that 'there is an inverse relationship between the Level of the Cone and the Degree of Experiential Concreteness.'

Dale provided some very broad boundaries within which he expected the Cone model to hold. In "a specific case," the Cone could describe the range of experiences involved in "a child's eating of a kumquat to his recognition of a picture of a kumquat to his understanding of the word 'kumquat'" (1969, p. 110). Concurrently, "over a lifetime of learning," the Cone could symbolize the experiences involved in a "youngster's first playing with blocks to his understanding of a periodic chart of the chemical elements and from there to his recognition of the formula e=mc2" (p. 110-111). Meanwhile, regarding the system states in each of which the Cone's units interact differently, these were variously described across Dale's works as "the needs and abilities of a particular learner in a particular learning situation" (1969, p. 128), the learner's "age, ability, and background" (p. 130), and the learner's "past experience and mechanical advantages" (1946, p. 50).

A Dubin-esque deconstruction along these lines reveals that concrete propositions are the department in which Dale's Cone is most lacking. The only propositions that present themselves after a thorough analysis of Dale's works are that "varied types of sense experiences should be provided in the classroom" (1969, p. 129), and that the Cone "stands for activities that are available, in varying degrees, to learners in all age groups" (1969, p. 132). As is immediately apparent, these propositions are so weak, so generic, so abstract, that any attempt to find any empirical indicators for their constituent terms (and consequently to restate them as testable hypotheses is an exercise in futility. For Dale's Cone to be a meaningful guide for practitioners, it needs to be refined so that it has concrete propositions and empirically testable hypotheses to offer.

Final Remarks

This paper attempts to bring to light the fundamental issues concerning one of the most influential bodies of theory in our field during the 20th century, seeking to describe how the related ideas of Dale and other theoreticians have emerged without evidence of much dialogue having taken place between them. As a result, individual theories such as Dale's Cone display significant fuzziness and lacunae, which reduce their value as guides of practice. Meanwhile, those purporting to inform practitioners have often done the latter a disservice by blurring the boundaries of these theories and/or drawing inadvisable inferences from them … although this may well be due to the fact that these theories themselves are (in a Popperian sense) unscientific.

However, it must be emphasized at this point that the object of this paper is not to discredit Dale and devalue his Cone model, but rather to provide an example of a state of affairs that is widely prevalent in our field today … a state of affairs in which theoretical fuzziness and misconception abounds due to the lack of sufficient dialogue between scholars. Consequently, the resulting nomological network is one that is full of holes and missing links. Meanwhile, the waters are muddied further by the fact that practitioners rarely have first-hand access to original works, but have to rely on second-hand sources … indirect 'interpretations of interpretations' that are very often far from accurate reflections of what the original author had to say.

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What Types of Technology Do Middle School Teachers Really Use?

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Introduction

The importance of technology continues to grow in American society. From e-mail and cell phones to laser surgery, technology seems to touch all phases of life today. As in business and medicine, the uses of technology in education have grown dramatically in the last decade. Huge numbers of schools have been wired for telecommunication access in the last three years alone. As of fall 1998, 90% of schools had Internet access and 39% of teachers had access to the Internet in their own classrooms (Becker, 1998). The numbers of computers in U.S. schools also continues to increase with more than six million computers in the nation's elementary and secondary schools today (Fulton, 1999). Many states, too, have now established standards for the use of technology by their students. In one major national report on school technology and readiness, it was pointed out that all students must graduate with the technology skills needed in today's world and tomorrow's workplace and all educators must be equipped to use technology as a tool to achieve high academic standards (CEO Forum, 1999). Furthermore, many states have now adopted specific technology requirements for students preparing to teach and stress the use of technology in their schools based on the new standards of the International Society for Technology in Education (ISTE). Accordingly, most educators today believe that public schools must ensure the effective use of technology in the classroom in order to transform our children for 21st century learning environments.

In spite of the tremendous growth of technology in our nation's schools and the belief by a majority of educators that all students must have access to technology to be truly successful in today's world, there is evidence that many teachers still do not use technology at all in their teaching (Education Week, 1999). In addition, there are many questions regarding the values and uses of technology in schools. Are teachers adequately prepared to use technology in their teaching? Are schools providing appropriate types of technology for teachers and students? Do teachers really value technology in their teaching? What types of technology do teachers really use in their classrooms? There also are major questions dealing with the role of technology in schools. For example, what are the goals of using technology in elementary, middle and high schools? How can technology improve student learning? Middle schools, in particular, can play an important role in helping students become skilled in the use of technology. Not only can technology help middle graders learn more effectively, its use can also enable students to improve their skills.

To answer many of the questions surrounding technology in schools, a study was conducted in 1,000 middle schools in ten states (Michigan, Pennsylvania, Arizona, Oregon, Maine, Ohio, Georgia, North Carolina, New York, and Wisconsin). This study explored the types of technology used by middle school teachers, how they value the technology, and the facilities and equipment provided by their schools. One thousand questionnaires were sent to these teachers and 239 were returned.

The questionnaire consisted of two parts. In Part One the teachers marked how often they used particular types of technology (never, rarely, sometimes and often) and how valuable these types of technology were (very valuable, valuable, no opinion, little value and no value). In Part Two the subjects indicated the availability of different types of technology in their schools and the training provided for them and their students by their schools. The results were analyzed using percentages of use and of value. The majority of those responding were female and most had one to ten years of experience. Moreover, most of the respondents were mathematics and science teachers followed by those teaching social studies and English.

Results

The results of this study indicate several important findings concerning technology in middle schools. Table A shows that the most often used types of technology were: word processing for teaching (81.7%), computers in preparing lessons (70.2%), and the overhead projector (56.1%). The next most often used forms of technology were: the Internet for teaching (50.9%), using e-mail to discuss teaching with other educators (44%), computer assisted instruction (39.9%) and computer graphics for teaching (39.7). Table A also reveals that there were other types of technology used less often by the teachers: VCR's (31.7%), Microsoft Power Point and other types of computer programs (33.5%), spreadsheets for assisting teaching (29.5%), CD-ROM disks (27.4), television (26.6%), web pages (22.4%), video projector (LCD projectors) (21.5%), database to assist teaching (18.3%), digital camera (23.7%), and films (15.2%). Additional evidence found in Table A indicates that the least often used types of technology were: the tape recorder (8.5%), digital camcorder (6.8%), laser disc player (5.8%), radio (4.9%), film strips (4.1%), and slide projector (2.7%).

Table A: Technology Used by Teachers

	Often	Sometimes	Rarely	Never
Use of word processing for teaching	81.7%	13.8%	3.1%	1.3%
Use of computer to prepare lessons	70.2%	23.6%	4.9%	1.3%
Use of overhead projector in teaching	56.1%	21.1%	11.2%	11.7%
Use of Internet for teaching	50.9%	37.4%	7.7%	4.1%
Using e-mail to discuss teaching with other educators	44.0%	32.4%	14.7%	8.4%
Use of computer assisted instruction	39.9%	39.9%	14.8%	5.4%
Use of computer graphics for teaching	39.7%	38.4%	13.8%	8.0%
Use of VCR in Teaching	31.7%	41.1%	19.6%	7.6%
Use of Microsoft Power Point and other computer programs for teaching	33.5%	29.0%	13.8%	23.7%
Use of spreadsheets for assisting teaching	29.5%	34.8%	22.3%	13.4%
Use of CD-ROM in teaching	27.4%	38.1%	21.1%	13.5%
Use of television in teaching	26.6%	41.0%	21.6%	10.8%
Create web pages for teaching	22.4%	22.0%	10.8%	44.8%
Use of video projector in teaching	21.5%	26.0%	19.3%	33.2%
Use of database to assist teaching	18.3%	29.9%	23.7%	28.1%
Use of digital camera in teaching	23.7%	31.3%	15.6%	29.5%
Use of films in teaching	15.2%	30.8%	24.1%	29.9%
Use of tape recorder in teaching	8.5%	27.7%	25.4%	38.4%
Use of digital camcorder in teaching	6.8%	17.1%	21.2%	55.0%
Use of laser disc player in teaching	5.8%	9.4%	13.8%	71.0%
Use of radio in teaching	4.9%	16.1%	23.2%	55.4%
Use of film strips in teaching	4.1%	9.0%	18.9%	68.0%
Use of slide projector in teaching	2.7%	9.5%	21.2%	66.2%
Use of record player in teaching	2.2%	4.0%	13.9%	79.8%

Results reported in Table B show the different types of technology required or encouraged by teachers for their students: encourage student use of Internet for work (55.2%), require computers for learning or assignments (49.1%), require student to use word processing for assignments (38.7%), require use of Internet for work (34.4%), encourage power point use by students (29.9%) encourage students to use computer graphics (29.6%), encourage use of different types of media in work (21.4%), encourage students to use CD-ROM for work (20.6%). Further results in Table B show that other lesser used types of technology by students were: encourage e-mail use by students (13.4%), spreadsheets (9.9%), database (9.6%), VCR (7.3%) and digital camcorder (4.5%), and laser disc players (3.6%).

Table B: Technology Encouraged or Required for Students

	Often	Sometimes	Rarely	Never
Encourage student use of Internet for work	55.2%	33.6%	8.1%	3.1%
Require computers for learning or assignments	49.1%	36.2%	8.0%	6.7%
Require students to use word processing	38.7%	37.8%	13.3%	10.2%
Require use of Internet for work	34.4%	37.9%	10.3%	17.4%
Encourage power point use by students	29.9%	29.9%	13.8%	26.3%
Encourage students to use computer graphics	29.6%	42.6%	13.5%	14.3%
Encourage use of different types of media in work	21.4%	33.5%	21.9%	21.9%
Encourage student to use CD-ROM for work	20.6%	34.1%	17.9%	27.4%
E-Mail use by students	13.4%	24.1%	28.1%	34.4%
Student use of spreadsheets	9.9%	26.5%	33.2%	30.5%

Student use of database	9.6%	18.3%	29.8%	42.2%
Student use of VCR	7.3%	26.5%	32.4%	33.8%
Encourage student use of digital camcorder	4.5%	18.6%	21.4%	55.5%
Encourage student use of laser disc players	3.6%	5.8%	9.9%	80.7%

Findings in Table C indicate that schools are providing many types of technology for their teachers. VCR's are provided for a majority of teachers (92.0%) and Internet access is provided in most classrooms (90.2%). CD-ROM equipment is available in nearly eighty percent of the classrooms (82.3%) and computers are provided for students in more than half of the classrooms (72.0%), along with digital cameras (68.4%) and e-mail facilities which are available in many classrooms (80.4%). Video (LCD) projectors are available in several schools (54.5%), while training for teachers (90.2%) and students (92.9%) in the use of technology is provided by most schools.

Table C: Technology Provided for Teachers and Students

	Yes	No
VCR's provided in classroom	92.0%	7.6%
Internet access in classroom	90.2%	9.3%
CD-ROM equipment provided in classroom	82.3%	17.7%
Computers provided in classroom	72.0%	28.0%
Digital cameras provided in classroom	68.4%	31.6%
E-Mail in classroom	80.4%	19.2%
Video (LCD) projectors provided in classroom	54.5%	45.5%
Training for teachers to use computers	92.9%	7.1%
Training for students	90.2%	9.4%

Conclusions

Evidence from this study indicates several important findings concerning technology in middle schools. First, middle school teachers are using technology in their classrooms. Computers seem to be the most popular choice with over 70% of the teachers reporting that they often use them in their teaching. This finding is important because it supports the views of most contemporary educators and the public who want more technology in schools. Second, middle school teachers are using many types of technology in their classroom. Beside computers, teachers are using e-mail, VCR's, Microsoft Power Point, CD-ROM's, digital cameras, and other contemporary form of technology. The result is significant because it supports the demands for greater use of technology in education by educators, parents, and the public.

Third, middle school teachers are encouraging and requiring that their student use technology in their work. This result, too, is important because it reinforces the belief that students need technology to aid their learning and to develop technology skills needed in later life.

Fourth, middle school teachers and students are receiving technology resources and training from their schools. This finding is crucial because without these essentials teachers and students could not successfully use technology in their work.

Although the study indicates that middle school teachers are using technology in their teaching, encouraging their students to use technology, and are being provided essential resources, equipment, and training. It is also clear that these teachers need to continue and increase their uses of technology in their classrooms. Students, too, must continue to improve their skills in using technology by using it for their learning. Schools, also, must continue to provide different types of technology, resources, facilities and training for both teachers and students. As we enter the 21st century, it is hoped that all middle school teachers will make technology an essential part of their teaching and that they will strive to help their students become "technologically literate."

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Affective video and problem solving within a Web-environment

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Abstract

Currently there is a growing interest in Web-based multimedia learning environments, particularly those making use of asynchronous streaming video. This interest motivates renewed attention to properties of video for educational purposes. A typical property of video is its emotion-evoking potential. Research by Isen, Daubman, and Nowicki (1987), Kaufmann and Vosburg (1997) and by Vosburg (1998) on video-evoked positive or negative mood states inspired a research project on the didactical functionality of emotion-evoking video materials in relationship to (educational) problem solving tasks within a Web-based environment. The results show that the video materials that were used in the experiment induced the expected positive or negative mood. Differential effects of positive or negative mood for problem solving tasks, however, were not observed. This outcome is discussed in the context of the findings of the above-mentioned authors.

Introduction

Vosburg (1998) reviewed research studies by Isen, Daubman, and Nowicki (1987) and Kaufmann and Vosburg (1997, Study 2) that show that video segments that are used to evoke affective responses can influence the performance on a problem solving task that follows the video segment. These studies pertain to positive and negative mood states that may be related to the way a creative problem-solving task is carried out. In all cases, the content of the video segments was not related to the task. The results of these studies seem in a first instance to lead to contradictory conclusions. Isen, Daubman, and Nowicki found that positive mood had a facilitative effect on creative problem solving, while Kaufmann and Vosburg found that positive mood could significantly inhibit creative problem solving. Vosburg (1998) proposes a model that may help to get a better understanding of the underlying phenomena and thus provide an explanation for the earlier results. It is a satisficing/optimizing model that describes differential effects of mood states (positive versus negative) on problem solving tasks as a result of given task requirements or conditions. Kaufmann and Vosburg (1997) suggest that optimizing and satisficing strategies may be important moderators of this mood influence. The purpose of the current study is to explore whether the satisficing/optimizing model could be verified as a first step towards the development of didactical functions of emotion-evoking video materials. The two types of task requirements or conditions are described as follows (adapted from Vosburg, 1998, p166-167):

Under satisficing conditions the requirements for the solution of the problem-solving task are open. When a participant is satisfied with his or her answer according to self-selected subjective criteria the task is finished. An example of a task with a typical satisficing requirement is a divergent thinking problem. In this kind of task participants are asked to generate “as much solutions as possible for a presented problem that they can think of and not to think of the quality of their responses".

Under optimizing conditions participants are asked to present the best solution for a given problem that fits the strict solution requirements. Insight problems exemplify problem solving under optimizing conditions, because strict solution requirements exist and there is (often) only one acceptable solution. An example of such a task is Duncker’s candle task (Duncker, 1945). On this task, subjects get a candle, a box with tacks, and a book of matches. Their task is to mount the candle against a wall so that it can burn without dripping. How to do that with the help of the given items, is the problem to solve.

The satisficing/optimizing model proposes that positive mood tends to lower and negative mood to raise subjective criteria for acceptable solutions. Positive moods are expected to facilitate and negative moods to inhibit task performance under satisficing conditions (for instance a divergent thinking task). Negative moods are expected to facilitate and positive moods to inhibit task performance under optimizing conditions (for instance an insight task).

In the present study both video, as mood induction technique, and two creative problem-solving tasks (a divergent and an insight task) are embedded within a Web-based environment as opposed to more traditional settings in the comparable studies. If the model can be verified, this mood-facilitating approach to problem solving could also be relevant for realistic problem solving tasks in Web-based E-learning environments.

(The preliminary question whether the affect-evoking potential of video presented in a Web-environment is comparable with video presented in a more traditional context, has been answered earlier by Verleur and Verhagen, 2001, who conducted an experiment that demonstrated that Web-based affective video can be an effective mood-induction technique.).

The purpose of the current study is operationalised in the following research question:

<u>When both the mood-evoking video materials and the problem solving tasks are embedded in a Web-based environment, can the "satisficing-optimizing model" (Vosburg, 1998) be verified?</u>

This question is answered by testing the following hypotheses (see also Table 1) in a Web-based environment:

1) Compared to a negative video clip, a positive video clip will result in:
   A better performance on the divergent thinking task that follows the clip;
   a worse performance on the insight task that follows the clip.
2) Compared to a positive video clip, a negative video clip will result in:
   A better performance on the insight task that follows the clip;
   a worse performance on the divergent thinking task that follows the clip.

Table 1. Overview of the expected influence of affect-inducing video clips on task performance in a Web-based environment

	Insight task	**Divergent-thinking task**
Positive video clip	-	+
Negative video clip	+	-

Note:
+ = Facilitates performance
- = Inhibits performance

Method

To study the hypotheses, an experiment was carried out that is specified below.

Participants

101 first-year university students in communication studies (70 women and 31 men, mean age = 18.67 years) participated in the experiment that was part of a course that introduces the field of media communication and media research. The results of the experiment and the experience of the students as subjects for 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. In the experimental setting the positive video segment was taken from the comedy movie ‘When Harry met Sally’ (2’45”); the negative video segment was a news-item about ‘Hunger in Ethiopia’ (2’04”). To establish a comparable starting position for all subjects a 'neutral' video segment was added as a first video clip for all participants. This segment was a part of a documentary about birds (‘1’53”). All three clips were also used in the experiment reported by Verleur and Verhagen (2001).

Two types of tasks are used to test the satisficing-optimizing model: A divergent thinking task as a typical example of a task with a strict satisficing requirement and an insight task as a typical example of a task with a strict optimizing requirement. Task selection started from a replication perspective with considering the creative problem solving tasks from the studies of Isen, Daubman, and Nowicki (1987), Kaufmann and Vosburg (1997) and Vosburg (1998). Although the Duncker Candle task that was used in the study of Isen, Daubman, and Nowicki (1987) has attractive properties to be used for the insight task, it was not selected because the original task with realia cannot easily be embedded in a Web-environment. The chosen insight task is the "Two String Problem" from Maier (1970).

This task was the best performing insight task in the study of Kaufmann and Vosburg (1997). The chosen divergent thinking task is the "Real-life divergent-thinking task" that was described in the study of Vosburg (1998). This task is referred to as the "Class problem" (how to handle being distracted during a lecture class) adapted from Mraz and Runco (1994).

In the Two String problem the task is to tie together two strings hanging down from the ceiling. The two strings are too far apart to be reached by hands alone. The participants have to solve this problem by using tools that they select from a set of items. The available items are a pair of pliers, a screwdriver and a box of tacks. The correct solution is to tie one or each string to one of the tools (i.e. the pair of pliers or the screwdriver), push one or both into a pendulum movement and to grab the string(s) when they are close enough. Following Martinsen's version of the task (1993) two points were given for this solution; one point for a good try (for instance when the tacks were used to stitch one or both strings to the wall to get them closer to each other); and no points for a wrong or no solution. Hence the score for these tasks could be 2, 1, or 0. Conform the study of Kaufmann and Vosburg (1997) the task was presented in writing with an illustration of the situation and the tools available.

The Class problem is a verbal description of a realistic problem situated in a classroom and is written from the perspective of the problem solver. Following Vosburg 's version of the task (1998) the description presented was as follows: "Rolf, a friend of yours sits next to you in the classroom. Rolf likes to talk to you and often interrupts you when you are taking notes. Sometimes he distracts you so that you are missing important parts of the lecture." The accompanying instruction asked the subjects to think of different solutions to solve this problem: "What are you going to do? How are you going to solve this problem?". In a pre-test with a task comparable to the Class Problem it appeared, however, that subjects tended to generate a step-wise procedure for one solution in stead of generating different solutions. This made it necessary to reformulate the instruction into "Think of different solutions to solve this problem"; to make sure that students would generate 'different solutions'. The instruction specified what was mend by the word 'different'.

Design and procedure An experiment was designed with two conditions: A 'Positive Affect' and a 'Negative Affect' condition. In each condition the participants encountered both the insight and the divergent thinking task. To balance for order effects the task order was randomized within each condition. Table 2 presents an overview of the experimental conditions and the resulting four versions of the experimental arrangement that were embedded in the Web-environment. To improve the precision for analyzing affective state effects, the study was balanced by keeping the number of subjects in each of the two conditions equal. Furthermore the subjects were blocked by gender.

Table 2. Overview of the experimental conditions

Condition	**Task order (two versions for each condition)**
Positive Affect	Insight task - Divergent thinking task
	Divergent thinking task - Insight task
Negative Affect	Insight task - Divergent thinking task
	Divergent thinking task - Insight task

Note: Insight task = Two String Problem; Divergent thinking task = Class problem

After viewing the 'neutral' video clip a questionnaire was presented to pre-test the initial affective state of the participant. Then an example problem-solving task was presented to familiarize the participant with this type of task. (The data of the example problem are no part of the analyses.) Next the experimental part of the session started by showing the positive or negative affective video clip followed by the same questionnaire that was used after the neutral video clip to measure the video-induced affective state. This was followed by both problem tasks that were presented in random order: half of the participants first encountered the insight task followed by the divergent thinking task, for the other half this was the other way around. For each task a maximum of 5 minutes was available to work on the solution.

The experiment was conducted parallel in two computer rooms during scheduled computer lab hours with all four versions of the Web-environment in both rooms present. Each room contained 20 individual workplaces. The number of participants required three rounds to lead all participants through the experiment. Each round took place in a time slot of one hour and 15 minutes. All participants were able to complete their tasks within that period without further time pressure than the timed answers to the problems. All rounds were administered on the afternoon of the same day.

Each individual workplace consisted of a computer configuration with a 17-inch monitor and a headset. Separation screens prevented distractions by eye contact or viewing other monitors. The experimental Web-environment was available as a click able icon on the desktop. The experimental procedure, instruments and introductions to the steps in the experiment were all embedded in the Web-environment.

Randomizing in advance each order of four versions predetermined the order of the Web-version assignment. In order to spread the male participants equally over the versions, in each round the male group had to enter the room first and was then randomly distributed over all versions. After a brief introduction to the experiment the participants were asked to click on the icon on the desktop that would launch the experimental Web-environment. The experimental procedure, instruments and introductions to the steps in the experiment were all shown, explained, and practiced in an introductory part of the Web-environment before the experimental part of the study started.

Scoring

Instruments. To measure the affective responses the paper-and-pencil version of the Self-Assessment Manikin (SAM) devised by Peter Lang (Bradley & Lang, 1995) was adapted into a Web-version. The original SAM measures three emotional dimensions: Valance (ranging from pleasant to unpleasant), arousal (ranging from calm to excited) and Dominance (ranging from controlled to in-control) with a 9-points rating scale for each dimension. The Valence dimension of the SAM-scale was used in the present study as a measure for the 'Affective State'. Figure 1 shows the Web-version of this scale. In addition a small number of bipolar items on a semantic differential (also using a 9-point scale) were added to assess cognitive and mood responses to the video materials. These questions were not part of the experiment but were used to mask the purpose of the study

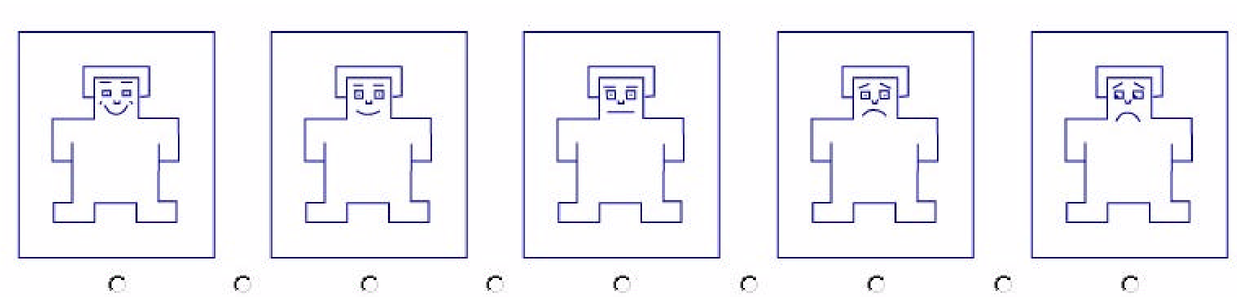

FIGURE 1. Web-version for the Valence dimension of the Self-Assessment Manikin (SAM)

Results

Homogeneity and manipulation check for affective state

Initial affective state. During the practice part of the session the initial affective state was measured just after the presentation of the 'neutral' video clip on the 9-points SAM scale (1= unpleasant, 9= pleasant). Overall the neutral clip resulted in a 'light positive' affect state (N=101, M=6.41, SD=1.23). When the two experimental conditions were compared, a t test showed no significant differences between the positive (n=50, M=6.46, SD=) and the negative (n=51, M=6.35, SD=) condition (t[99]=-0.437, p=.663, two-tailed). The two conditions can be considered homogeneous on initial affective state.

Affective state changes. The affective state after viewing the first 'neutral' clip was compared with the affective state after viewing the second 'affective' clip (being positive or negative depending on the condition). In the negative condition the affective state changed into a more negative state (ΔM=3.06, SD=1.62; $\Delta M = M_{neutral} - M_{negative}$). A paired-T-test showed that this mean change was significant (t[50]=13.51, p<0.001, two-tailed). In the positive condition the affective state changed into a more positive state (ΔM=-1.58, SD=1.39; $\Delta M = M_{neutral} - M_{positive}$). Although the mean change was less than in the negative condition a paired-T-test showed that this change was also significant (t[49]=-8.06, p<0.001, two-tailed). The 'light positive' nature of the neutral clip might have been of influence on the magnitude of these changes. The manipulation check data confirmed the expected positive and negative affective states in the two conditions as result of the affective video inductions.

Resulting mean affective state scores for the two conditions. The resulting mean affective state score was in the negative condition clearly lower (M=3.29, SD=1.43) than in the positive condition (M=8.04, SD=1.12). A t test showed that the difference between the two conditions was significant (t[99]=-4.75, p<0.001, two-tailed).

Two String Problem (Insight Task)

Only 20 (19.8%) of all subjects found the best solution for the problem. In the negative condition 12 of the 51 subjects found the optimal solution to the problem, 31 subjects had a 'good try' score and eight subjects did not solve the problem. In the positive condition 8 of the 50 subjects solved the problem, 27 subjects had a 'good try' score and 15 subjects did not solve the problem at all. A Mann-Whitney test indicated that the differences between the two conditions were not significant (Z=-1.68, p=0.92, two-tailed). Solutions that were categorized under 'good try' (f=58) were: 'extending string or arm with tools' (f=25), 'stitching strings to the wall or ceiling' (f=23), 'pushing strings into a pendulum movement without using (sufficient) weight' (f=10). Table 3 summarizes the results.

Table 3. Frequencies per solution type for the Two String Problem

Condition	**No/wrong solution**	Good try	Best solution
Negative Affect (n=51)	8	31	12
Positive Affect (n=50)	15	27	8
Total (N=101)	23	58	20

Class Problem (Divergent Thinking Task)

Based on the solutions given by the subjects a category list was developed to make a clear distinction between the different solutions/answers. The data showed that some subjects combined two solutions in one solution, where others presented them as two separate solutions. For example two solutions might have been 'telling Rolf to stop talking' and 'agree to meet Rolf during the break'. Some subjects combined these two solutions into one sentence. In both cases two solutions were counted. (Although this procedure was used because it seemed the most fair one, analysis of the uncorrected scores showed that there was no clear need for it. The overall scorings pattern remained the same but with slightly lower mean scores.) To solve the problem subjects in the Negative Affect condition generated a mean number of 4.24 (SD=1.63) solutions and subject in the Positive Affect condition a mean number of 4.32 (SD=1.97) solutions. A t test indicated no significant differences between the two conditions (t[99]=-0.24, p=0.815, two-tailed).

Discussion

The purpose of the current study was to explore whether the satisficing/optimizing model of Vosburg (1998) could be verified when both video, as mood induction technique, and two creative problem-solving tasks (a divergent thinking and an insight task) were embedded within a Web-based environment. Table 1 presented an overview of the expected effects. The results show that the two affective video clips were effective in inducing a positive and a negative affective state in the subjects. This finding replicated the results of a preliminary experiment (Verleur and Verhagen, 2001). The data, however, do not confirm the satisficing/optimizing model nor did they replicate findings from comparable studies that were conducted in more traditional settings.

A first question that occurs is whether the adaptation to the Web environment or the changes in the methodology may have prevented the replication of the earlier results. Vosburg (1998) and Kaufmann and Vosburg (1997) used paper-and-pencil tests to administer their experiments. It cannot be guaranteed that filling in Web forms gives the participants equal mental room for playing with their thoughts during the different tasks. Kaufmann and Vosburg also used more tasks. Vosburg (1998) used four divergent thinking problems and Kaufmann and Vosburg

(1997, Study 2) used two insight tasks. They based their conclusions on combined scores of all tasks in each of their experiments. Vosburg was able to find significant effects in line with the satisficing/optimizing model. Kaufmann and Vosburg, however, did not find a differential effect for mood on task performance, which is in line with our results. As Vosburg (1998) and Kaufmann and Vosburg (1997) only reported the combined scores of the tasks, no data are available to analyze whether for instance the use of the class problem in the Web environment did or did not equally well as in their case. Also it is not known how the Class problem itself performed in comparison to the other divergent thinking tasks used by Vosburg.

The choice to limit the number of tasks to one insight task and one divergent thinking task was made in order to make the experiment manageable. This was considered to be feasible because it was expected that the difference between a well-chosen insight and a well-chosen divergent thinking task should be observed if the satisficing/optimizing model is valid. This expectation was supported by the fact that the present study used the described video-based mood induction technique (which appeared to change mood significantly) while the subjects in Vosburg's study were not brought into the different affective states by a mood induction technique, but that the actual affect state 'on arrival' was measured and taken as the independent variable. Still she found significant results to support her model. A critical question is whether the tasks were indeed 'well-chosen'. As there are no data about these tasks from the other authors and there was also no control condition, this is difficult to know.

One possibility is that the tasks were not so different after all. In the Method part of this paper it was explained that the task instruction for the Class problem was reformulated to make sure that students would generate 'different solutions' instead of a step-wise procedure. This might have triggered the participants to look more at the quality of their solutions to make sure that the solutions were different from each other, which could have changed the perception of the task in the direction of an optimizing task. However, when discussing this in a debriefing session with a group of students (where about 30% of the subjects was present), the students reported that they did realize afterwards that the task evoked a satisficing strategy in them. They had felt that they could end the task after they had generated 'enough solutions'. Other reasons for stopping to work on the task were that they 'run out of solutions' or 'they run out of time'. Although the instruction was not literally saying to 'generate as much solutions as possible', almost all students did understand that this was the objective for the task. In all it seems that the task instruction was perceived in the same way as in Vosburg's study.

A further uncertainty is that although the video clips were able to evoke the different affective states in the subjects, no evidence was collected that this evoked state was continued during the task performance and thus remained sufficiently effective.

The uncertainties about the applied methods make that conclusions about the validity of the satisficing/optimizing model cannot be drawn. There are, however, a few reasons why doubts raise about this validity.

In the study of Isen et al. (1987, Study 2) subjects were presented two types of tasks, one of them being an insight task (Duncker Candle task). In that study the subjects in the positive mood performed better than the subjects in the negative mood. Vosburg (1998) gives a possible explanation for this effect: The Candle task was performed using real attributes, so it was not a paper-and-pencil task. By physically working on the task the subjects would receive feedback on the correctness of their problem solving attempts. This type of feedback might have yielded direct information on how to proceed for finding the solution. This fact may explain why task performance differed from paper-and-pencil insight tasks. In the study by Isen et al. there were four conditions: A positive affect, a negative affect, a neutral affect and a control condition. A remarkable finding of their study was that the positive affect condition did best, than the negative affect condition, followed by the neutral affect condition. The control condition did worst. Kaufmann and Vosburg (1997) put forward that this could mean that there is a more general performance-facilitating factor at work as a function of mood manipulations prior to task performance. This might suggest that there is a main effect for mood manipulation. As the present study was carried out without a control condition, no data are available to analyze whether such a general effect occurred.

Kaufmann and Vosburg (1997, Study 2) used the Two String problem in combination with another insight problem (Hatrack problem) in a paper-and-pencil version. In their study the tools that were available to solve the Two String problem were a cup, a screwdriver and a box of pins. They scored the tasks according to a strict solved/unsolved criterion, where one point was given for a true solution, and 0 for no solution or quasi-solutions, not fulfilling all solution criteria. In the present study only one of the tasks was used and for which the scoring system of Martinsen (1993) was followed. The same visual representation of the problem (with adaptation for the tools) and instruction was used as in Kaufmann's and Vosburg's study. In general more subjects (45%) were able to solve the Two String problem in the Kaufmann and Vosburg study compared to our study (19.8%). This might have been related to the other tools used. For the combined insight tasks they did not found a significant effect of affective state on problem solving which is in line with the findings in the present study, but in contradiction with the satisficing/optimizing model.

A different issue is that that Kaufmann and Vosburg did find a significant effect of affective state on the time spend to solve the problem (latency rates) or 'solution ease'. A negative affect state produced the most superior performance (faster) and the positive affect state the most inferior performance (slower). ‘Time’ was not used as a dependent variable in this study, but may be used in further work.

In all, the experiment was not able to confirm the satisficing/optimizing model. Further work has to be done to get a better understanding of the relationship between video-induced affective states and problem solving. For subsequent research it is recommended that: (a) the research methods control for the main effect of mood induction by means of a no-treatment control condition; (b) possible decay of induced mood during the experiments is monitored (at least by post testing mood state after the task performance); (c) several (in stead of one) tasks are used for each factor (insight or divergent thinking) to middle out the noise that is caused by inevitable task imperfections; and (d) the tasks as well as the related instructions are extensively pre-tested to assure their validity and reliability.

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Critical Thinking and Discourse in Distance Education and in Traditional Education: Challenges and Opportunities

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Critical thinking and discourse: defining the concept

Before we start this discussion of critical thinking it is useful to mention that the authors of this paper see critical thinking as a disciplined manner of thought (Scriven & Paul, 2000) and that a person uses to assess the validity of something (statements, stories, arguments, research, etc.). Critical thinking involves things such as asking questions(Facione, 1998), defining a problem, examining evidence(Facione, 1998), analyzing assumptions and biases, avoiding over-simplification, reflecting on other interpretations, and tolerating ambiguity (Fisher, 2001).

The role of critical thinking and discourse in education has been recognized through the centuries. In fact, it was Socrates who, through discourse, already challenged his students to become critical thinkers(Facione, 1998). As such, Socrates encouraged his students to become competent in knowing how to formulate and ask questions and how to develop a thorough and profound understanding of the issues being discussed and investigated.

Critical thinking underlies reading, writing, speaking and listening (the basic elements of communication). When discussing critical thinking and discourse we assume that these basic elements of communication play an important role in all levels of education, and particularly in graduate level education. We furthermore assume that critical thinking and discourse should create new understandings among learners, and that being able to think critically is a "must" in a continuously changing world where being able to adapt to a changing environment is of utmost importance(Facione, 1998).

It is important to note that critical thinking includes the willingness to change one's point of view as a result of examining and re-examining ideas and facts that may seem obvious. And, even more so, critical thinking not only takes time and effort, it also includes the willingness to say the three words that are not so easy to use: " I don't know".

Some findings about critical thinking in traditional university courses

There are a few questions to ask when thinking about critical thinking. The first one is a very basic one: Are we, as students and instructors (as learners) helping our students to become critical thinkers? One group of researchers asked this question in their research project in 38 public and 28 private universities in the State of California (Paul, Elder, & Bartell, 1997). They assessed current teaching practices and investigated the knowledge of critical thinking among faculty, while they also identified exemplary practices in teaching critical thinking. The findings were not very encouraging.

Although almost 90% of the instructors claimed that critical thinking was the primary objective of their instruction, only 19% of the instructors could give a clear explanation of critical thinking, while only 9% could clearly differentiate between an assumption and an inference; only 4% could differentiate between an inference and an implication. Although 67% of the participating instructors said that their concept of critical thinking is largely explicit in their thinking, only 19% could elaborate on their concept of critical thinking(Paul et al., 1997). These are interesting findings that emphasize the need for more profound reflection on critical thinking.

One thing is sure and that is that learning environments must be designed in such a way that they promote critical thinking(Facione, 1998). In addition, instructors should have at least a basic knowledge of the concept of critical thinking and model critical thinking in their own instruction.

We should, however, also mention that there are frequently discrepancies that discourage critical thinking. We often see that university students are supposed to develop their own point of view, have to avoid being spoon-fed, have to be critical thinkers, but also have to adhere to the system by producing the "right" answers.

Distance Education and Critical Thinking and Discourse

In recent years distance education has become an increasingly prominent aspect of learning and instruction. There are, however, fundamental differences in the challenges and opportunities distance education offers when compared to traditional education. Distance education has the last quarter of the twentieth century shown characteristics of an industrialized process of learning/teaching and frequently does not really allow students to use/apply knowledge in a variety of ways. Distance education organizations are still in the process of moving from Fordist organizations (uniform products, bureaucratic processes) to Post-Fordist organizations (tailored products, decentralized approaches, empowered students and staff, new ways of doing things, being dynamic, moving fast and being ready for change).

If we look at the following important areas of critical thinking a number of questions are justified on how to include these areas in distance education environments:

- Creativity (distance education has a tendency to adhere to an industrialized process)
- Impact of language (lack of attention for specific communication skills needed in distance education)
- Decision making (curriculum and courses in distance learning are often very much prescribed – no electives)
- Meta-cognition (distance education courses tend to focus on content, not on learning processes and meta-learning)
- Collaborative learning and problem solving.

The latter area – i.e. collaborative learning and problem solving - may have been more effectively developed in distance education than in traditional education and may thus be used as an important "carrier" for critical thinking processes.

There are a number of ways to use collaboration as a way of promoting critical thinking:

- Case-based reasoning (partner activities: share, check, review, tell and retell ideas)
- Critiques, rebuttals around topics posted
- Mock trials, debates, posted arguments with logic delineated
- Graphic organizers, flowcharts, decision-making trees, concept mapping. (McVay Lynch, 2002)

Collaboration in distance education is fostered by the following important factors:

- Increased equity among participants and proven high participation rates
- Interactive technologies, growth of the Internet, the potential of the WWW.
- Better possibilities for students to explore their potential as thinkers and conveyers of ideas through improved access to (re)sources, such as knowledge-based communities.

In addition, distance students have *"real-world"* experiences, while many face-to-face students have *"real-world-like"* experiences.

To foster critical thinking and discourse in education we suggest that first of all the instructional design of the course includes critical thinking strategies, such as clarity of objectives and of the expectations, and a Socratic perspective in encouraging and offering discourse(ADEC, 2001). Furthermore critical thinking should not be something that "suddenly" appears and is expected to take place at graduate level courses. It should be developed at a much earlier level, for instance through philosophy and humanities courses, and continue to be part of the learning and teaching process, whereby the instructors not only actively encourage critical thinking, but also, through dialogue and discussion demonstrate their being critical thinkers.

Cultural dynamics and discourse

Students in traditional classroom-based learning environments may come from a variety of different backgrounds in terms of their social culture and their learning culture. However, they exercise and develop their academic growth within a fairly fixed community operating within the culture and values prescribed by the institution that they are attending. This differs significantly from distance learning environments, in which learners continue to operate within their own social and cultural contexts and thus more readily integrate this familiar context within a distance learning environment. It is likely that critical discourse and thought in such distance learning contexts is fundamentally different in nature from classroom-based contexts. This notion should be explored further through collaborative efforts of learning specialists and practitioners in both traditional and distance education settings.

Final considerations

Research in educational design presently argues in strong support of the notion that essential skills for negotiating real life complexity cannot be developed in isolation from the authentic context in which such skills are to be applied. Current research supports the notion that discovery oriented learning environments are essential for the development and effective transfer of higher order skills applied in critical thinking, discourse and problem solving. Since distance learning environments differ from classroom-based environments in ways that are central to the notion of “authentic practice” the strengths and weaknesses of each of these environments for developing and applying critical thinking and discourse must be considered.

Finally, distance education is in an excellent position to explore how different media affect the learner’s cognitive processes in different ways. In considering the cognitive processes essential to higher order cognitive functioning, the effect of differing media on the development of such skills should be explored further. Such inquiry must seek to address the fundamental goals of modern educational design, in which the primary effort is to develop individuals capable of critically interacting with a complex and changing world, and capable of adapting their learning and cognitive processes as their realities change and evolve(Facione, 1998).

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Educational technology in People's Republic of China: Problems and solutions from leadership perspective

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Abstract

This paper discusses the present situation of educational technology in People's Republic of China focusing on the problems and solutions from leadership perspective. The problems perceived are synthesized from the literature review, document analysis, and the personal discussions and correspondences with those people working in the field of educational technology. There are four parts in this paper: (a) Defining educational technology and educational leadership, (b) problems identified, (c) proposed solutions, and (d) conclusion. This paper is based on a pilot result of an on-going research in Sichuan Province, P. R. China.

Introduction

Since beginning of 90s, educational technology in China has experienced a great change. It has developed very fast from the use of simple audio-visual technology to application of complex modern communication technology of satellite and internets. Its great potentials in improving education quality, education effectiveness and education efficiency have been recognized. It begins to step out of the role of assisting teaching and instruction in education to functions as a new critical force to improve education practice, to increase education quality, and to implement education reform.

To further unleash these great potentials, and to advocate sound practice of educational technology, authors of this article initiated a research project to examine the perception of educational technology of those leaders who worked in the front line of educational technology. The research site is in Sichuan Province, which is in the southwest part of P. R, China. The province has over 100 million people and is usually regarded as a very typical province in China in terms of education and economic development. Based on the pilot study results and together with observations made during past few years in our work, problems in current educational technology practice are synthesized and possible solutions are proposed from leaders' perspective. The problems synthesized are also typical in many other provinces, especially those in the southwest part of China (Wang, 2001).

There are four parts in this paper: (a) Defining educational technology and educational leadership, (b) problems identified, (c) proposed solutions, and (d) conclusion.

Defining educational technology and educational leadership

Educational technology

Educational technology, sometimes known as instructional technology, is concerned with the improvement of educational programs and educational systems through the application of technology. The representative definition of instructional technology prepared by the AECT Definitions and Terminology Committee (2000) well defines concept of educational technology.

> Instructional Technology is the theory and practice of design, development, utilization, management, and evaluation of processes and resources for learning. ... The purpose of instructional technology is to affect and effect learning (Seels & Richey, 1994, pp. 1-9) (online: http://www.aect.org/Affiliates/National/Standards.pdf)

As a relatively new field of specialization, there is no clear cut of its boundaries in the field of educational technology. It draws upon the essence mainly from the fields of psychology, system theory, communication, leadership and management, and science and technology, in order to improve human learning and human performance (Peck, 2000). Thus, its theoretical research is interdisciplinary one, encompassing learning and cognition; instructional design theories and models; instructional strategies and tactics; instructional media, educational systems design, development and evaluation, system change and leadership, etc. In short, Educational technology is about how to improve human learning and performance in diverse contexts in an efficient and cost effective fashion.

Educational leadership

People define it from different perspectives. Owens (1995) defines leadership as a group process that influences the actions of other participants. Keith and Girling define leadership as a relationship between a leader and followers involving power, vision, and influence (1991, p. 57). Wills (1994) emphasizes that the leadership must contain three elements: a competent leader, willing and able followers, and worthwhile and shared goals. Maurer and Davidson assert "leadership is ambiguous, amorphous, contextual, and idiosyncratic. Leaders must create their own definition of leadership for themselves that are consistent with their values and beliefs" (1998, p. 16).

Our definition of leadership used in this paper is the process of decision making and problem solving in achieving organizational objectives and goals, realizing organizational vision, and accomplishing organizational mission by guiding, directing, motivating or influencing people and organizations.

Problems identified

Based on the pilot study result and together with observations made during past few years in our work, following problems are identified in the field of educational technology in China. They are (1) misconception of educational technology, (2) inappropriate mission for the educational technology units in respective educational institutions, (3) poor management and utilization of limited resources, and (4) administrative problem.

Misconception of educational technology

Educational technology is still undergoing through the process of development. In spite of its merits, there are a lot of problems need to be solved. These problems in the current practice of educational technology in China are in one way or another related to people's fundamental perception and understanding of what educational technology is. Since people's perception and understanding of educational technology direct influence their decision making in practice of educational technology, many of the problems actually stem from the misconception of educational technology. The misconception of Educational technology is in two folds. First, educational technology is the "hard and solid" product of modern science and technology. The second one is that educational technology is privilege reserved for those specialized professionals. Only those well trained professionals know applications of educational technology. Both of perceptions of educational technology are very similar to the idea that regards educational technology as "hardware" only.

Inappropriate mission

With fast development of science and technology, many educational organizations and institutions have set up a educational technology unit responsible for managing the equipment and facilities of educational technology. The unit varies in the number of personnel from 45 in a large university to 1 person in a local school.

Unfortunately in our research results show that many of these educational technology units do not have an appropriate mission to accomplish. The inappropriate mission statement of educational technology office from a large university in Sichuan Province is typical among these units:

"Our mission is to serve for students, faculty, and staff of the university by

- Managing and maintaining the educational equipment and facilities;
- Providing training on using educational equipment and facilities;
- Providing in-time technical support."

With such a narrow-minded and inappropriate mission statement, the university center of educational technology is turned into a rear service department. It is not an educational frontier force any more. Although many of these educational technology units also provide training to university faculty and school teachers, the training programs are often focused on the usage of equipment and facilities. They are for the protection of the equipment and facilities rather than for the active and creative use of them.

Poor management of limited resources

The inappropriate mission of educational technology units leads to another common problem: the poor management of limited resources. The poor management of resources includes the human resource, equipment and facilities, and finance.

Because the main task of these educational technology units is to manage and maintain the equipment and facilities, the most personnel in these units are engineers and technicians. They are experts in the equipment and facilities in terms of their usage rather than their uses. The personnel who are specialized in application of educational technology are rarely found in these units. This problem in human resource management makes many educational technology units incompetent to promote the sound practice of educational technology.

For the same reason, managing and maintaining the equipment and facilities, the equipment and facilities are tend to be tightly controlled by those educational technology units. The equipment and facilities, especially those new and high-priced ones are not easily accessible. In fact, many teachers would rather not use it because of troublesome access process. Thus, the educational equipment and facilities are really in the hands of technicians rather than in the hand of students and teachers.

Another instance of poor management of limited resource is of finance. In the development of educational technology, many educational technology units look for huge project that could help them to acquire huge funds. Usually, the educational technology units are willing to spend lots of money from their limited resources on fancy labs, to spend thousands dollars to update a computer, yet very reluctant to spend anything on simple overhead projectors. Their finance is not prioritized according to the actual needs of educational technology from students and teachers. For example, there are the project of inter-communication of “Earth-Net (Internet) and Sky-Net (satellite-net)”, the project of inter-university communication stations, and broadband project within each university going on in Sichuan Province. These projects require huge investments and are usually designed, developed and managed on a project scope. There is no systemic analysis of its needs. No wonder some one comments on these projects saying that these projects are great and necessary, but the equipment of its end users are outdated and they could hardly benefit from the newly built up facilities. This problem needs to be addressed right away. This is also closely related to the administration problem that looks only at the numbers and fancy equipment in evaluation of those educational technology units.

In fact, these three problems relating to the management waste a lot of limited resource in educational technology practice.

Administrative problem

The perceived problems in the practice of educational technology do not stand in isolation. They are, as mentioned above, closely related to the problem in the whole educational system. In terms of administration, educational technology is not well integrated in their respective educational system such as universities or schools. As a matter of fact, the education administrations very often misguide the practice of educational technology. This is especially true in evaluation and financial planning. The educational leaders tend to look at numbers of equipment and facilities instead of the actual effects of their uses in evaluation of educational technology units.

Second, there are almost no incentives and rewards for promoting sound practice of educational technology at any level of the educational systems. Incentives and rewards are provided for managing and maintaining the equipment and facilities. There is no administrative effort that concretely recognizes that the educational technology is the frontier force of educational practice and educational reform.

Although many educational leaders themselves will not deny the idea that educational technology has great potentials in improving educational practice and educational reform, the actual practice of their leadership shows that they fail to see or realize the great potentials of educational technology. Under their leadership, the system fails to build in itself the mechanism to promote the sound practice of educational technology and actualize its potentials. Under such circumstances, we can hardly expect that educational technology units function properly and effectively in accomplish its appropriate mission.

Possible solutions proposed

The following solutions are based on our personal understanding of the problems, and change model offered by Roger (1995) and Engineering Worth Performance offered by Gilbert (1996). The possible solutions to the problems proposed are only initial attempts. For this reason, I name this section as possible solutions proposed. The proposed solutions include (1) system approach towards system change, (2) top-down and bottom-up strategies of change, and (3) sustained efforts.

Proposed solution 1: System approach towards system change

The system approach refers to the way that takes every aspect of the problems identified into consideration and tackles them holistically in problem-solving process. In our cases, to rectify the problems in educational technology practice is not only to fix the problems themselves but to improve the whole system of educational technology and maybe even to improve its superior organization by fixing those problems. This approach should be differentiated from systematical approach. The systematical approach is linear, step-by-step approach while the systemic is integrated, holistic approach. (Banathy, 1996).

Change, according to Fullan and Stiegelbauer (1991), Reigeluth and Garnfikel (1994), Roger (1995), and Ellsworth (2000), is a process rather than an event. The purpose of organizational change is to achieve the organizational goals more efficiently and effectively. This requires a systemic approach in dealing with change. In other words, the proposed solutions here should not be considered as isolated measures but many of integrated efforts in the problem-solving process to promote the sound practice of educational technology in education.

Specifically, the systems approach recommended should have three main characteristics: First, the effort to change in educational technology must be carried out at all different levels of the educational systems (from the provincial bureau of education to local school) in order to be effective. Second, within each educational technology unit, the consideration to implement the change should include the aspects at philosophical, culture, policy, strategic, tactics and logistics levels as suggested by Gilbert (1996). The effort should cover all the cells in the following table of change effort. Programs to facilitate this change should be offered to people involved so that they can reach a consensus on the mission of educational technology unit and their individual responsibilities in accomplishing it.

	Provincial Bureau of Ed.	Municipal Bureau of Ed./University	County Commission of Ed.	Town & District Committee of Ed.	Local School Administration
Philosophic Levels					
Cultural Levels					
Mission/Vision Levels					
Strategic Levels					
Tactic Levels					
Logistic Levels					

Because this system change affects the majority people of educational technology units including their job security and role of life, another characteristics the system approach should have is dynamic balance toward the change. In many situations, change is not one way or the other. It is a matter of degree and extent of effort to maintain well-balanced progress. At least following list of issues of balance should be considered in the system change process. They are not exhaustive but good to start with. Only the balanced approach can bring the desired changes effectively in our case.

←	Balance →
Organization goals	Individuals' goal
Organization benefits	Individuals' benefits
Autocratic leadership/ Control	Democratic leadership/ Empowerment
Provincial level of change	Local school level of change
Resources for education	Resource for change
Fast radical change	Maintain status quo
Change personnel	Educating personnel
Old mission	New mission

Proposed solution 2: Top-down and bottom-up strategies of change

Top-down strategy of change is recommended mainly because of the centralized educational system. The educational leaders at various levels can impact the system tremendously. To change them is almost equal to change the whole system. Besides, the rooted tradition to follow the leaders will spread very quickly across the system the correct concept of educational technology if the educational leader at a higher level initiated the change. However, bottom-up strategy of change is also recommended because many changes have to be implemented at very local level.

Specifically, I recommend to initiate the change by educating educational leaders about educational technology at provincial, municipal, and finally at county levels. There are two reasons behind this proposed solution. First, although the educational system is still centralized hierarchical system, it is changing and becoming more open, receptive, and dynamic than ever before. The concepts such as life-long learning are widely accepted among many educational leaders at various levels. In Sichuan and other 16 provinces in China, all directors under age 40 at provincial, municipal, and county levels are required to take either a leadership or management certificate program to be qualified for their positions. There are possibilities to educate those educational leaders. It is crucial to help those leaders, who are very often educational policy makers, understand correctly about educational technology and its potential power to improve educational practice. Second, by educating those educational leaders in the educational system, the ideas of potentials of educational technology in educational practice and reform are more effectively communicated.

To ensure that people at local level of educational technology are actively involved in the change process, more powers should be given to the local educational technology unit. These people are working in the front line of educational technology and their concerns can never be ignored. In many cases, we found that the really needs to change starts at the local levels.

Proposed solution 3: Sustained efforts

The sustained effort of change includes (1) establishing new mission for educational technology units at all levels, (2) improving the management of educational technology units, and (3) establishing support system.

(1) Establishing new mission for educational technology units

This proposed solution originates from Gilbert engineering worthy performance concept. Gilbert (1996) asserts that any human performance achievement should be measured according to the goal of the organization and the organizational goal and objectives must be in alignment with mission, vision, and the philosophical values of the organization. If the mission of an organizational unit is unclear and inappropriate, it is very like to run off the track.

The new mission statement for the educational technology unit is recommended to at least include the following:

- To promote the active and creative use of educational technology in educational practice;
- To design and develop effective and efficient instructional programs by collaboration with teachers
- To conduct research relating to educational technology to expand the knowledge of it and enhance the ability of applying those knowledge in education.
- To provide training programs on the uses of educational technology
- Manage and maintain the educational technology equipment and facilities and provide technical supports

The new mission statement is an initial attempt to turn these educational technology units into a frontier force in educational practice and educational reform. It is an effort to recognize what educational technologist can do in improving educational practice. Educational technology unit should not be regarded as the rear service department!

(2) Improving the management of educational technology units

" 'Healthy' institutions are 'fit for purposes'; in other words, they are organized to ensure that their goals and purposes are achieved in the most effective and economical manner "(Bates, 2000, p.36). The newly established mission should rectify the original purposes of the educational technology units. To accomplish the newly established mission, the management of educational technology units has to be improved. This improvement of management should be parallel to the three problems identified in the management of human resource, equipment and facilities, and finance.

For the management of human resources, the human structure of educational technology unit needs to change. The present human structure, with engineers and technicians taking up 65 ~ 85 % of its workforce, cannot be efficient in accomplishing its new mission.

The practical methods dealing with this problem are of three. The first is to recruit educational technologists to work in these units so that it has capable people to accomplish its new mission. The second is to invite experienced teachers and university faculty to work with those engineers and technicians in educational technology unit. This would reinforce its human resources in accomplishing the new mission. The third is to train some young engineers and technician to become competent educational technologist through career development and practice.

In management of equipment and technology, to make all the equipment and facilities accessible to the students and teachers should be its first priority. The complicated procedures of arranging equipment and facilities must be simplified. The purpose of managing educational technology equipment and facilities is to maximize the use of them. I believe that inviting faculty to work in the educational technology unit will also make educational technology equipment and facilities more easily accessible to students and teachers.

For the management of finance, educational technology units of different levels should conduct thorough equipment and facility need analysis before purchasing any equipment and facilities. The practical method is to organize an ad hoc committee for financial management at various levels that represent all the parties involved in the development of educational technology. They are responsible for the conducting equipment and facilities needs analysis and making recommendations for educational technology unit in terms of financial management and equipment purchase.

(3) Establishing support systems

To help the organization to go through the change process smoothly and effectively, supporting systems must be built to ensure the sustained efforts in change. The supporting systems should at least include incentive and rewards, evaluation, collaboration, and resources at all levels from provincial bureau of education to the local school administrations.

Establishing a supporting system of incentives and rewards is to encourage and motivate people for promoting the sound practice of educational technology. The incentives and rewards should be based on the scientific evaluation of educational technology. This, consequently, involves a system of evaluation. The evaluation system should support the change efforts by not only looking at the numbers but the effects of educational technology in actual practice.

Establishing a system of collaboration across all levels of educational technology units and across other departments within their respective schools and organizations is another way to sustain the change. This ensures the support hierarchically from the superior organization and support horizontally from other departments in educational technology practice.

Establishing a system of resources is another way to sustain the efforts in implementing changes. The resources include human resource, financial resource, equipment and facility resources, etc. All these supporting systems have to work together to sustain the efforts in implementing the change, if the change is meant to be effective one.

Conclusion

Educational technology is an important indicator of the modernization of Chinese education (China Education and Research Network, 2000). The government as well as educational leaders at various levels has come to realize the important roles and functions of educational technology in educational practice and reform. However, this is far from enough.

Change is concrete. The results must be observable. Change is complicated. The approach must be systemic and balanced. Change is a difficult process. We must build supporting systems to sustain the efforts to change. Change is evitable and we all have to face it! There are much more that need to be done but we must, we can and we will implement this difficult change!

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Effect of varied concept mapping strategies in facilitating achievement of different educational objectives in a web-based learning environment

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Abstract

This study examined the effects of three concept mapping strategies in facilitating achievement of different types of educational objectives. The three concept mapping strategies were concept identifying, proposition identifying and student generated concept mapping. The instructional material was a 2000-word expository text related to the physiology and functioning of the human heart. Instruction was presented in a web based environment. Achievement was measured by three individual and a total criterion tests. 105 college levels students were randomly assigned to one of four instructional treatments. Criterion tests were administered immediately after students interacted with their respective treatments. One-way analysis of variance indicated that (a.) specific concept mapping strategies can significantly improve student achievement of specific types of educational objectives and (b) all types of concept mapping strategies are not equally effective in facilitating student achievement.

Introduction

Concept maps are most commonly defined as two dimensional diagrams that consist of concepts or nodes linked by labeled lines to show relationships between and among those concepts. The concepts are usually arranged hierarchically with the most inclusive, general concepts appear at the top of the map and the less inclusive, subordinate concepts below (Jonasson & Grabowski, 1993; Jonasson, Beissner, & Yacci, 1993; Novak, 1990, 1998; Plotnick, 1997, 2001). The web-based learning environment refers to those learning situations where instructions are delivered over computer network and displayed by web-browser (Clark, 2000). In a web-based learning environment, concept maps have been used for course site navigation (Gaines & Shaw, 1995; Tan, 2000), as a learning tools to facilitate learning (Gaines & Shaw, 1995; Shortridge, 2001), and as evaluation tools to assess the learning (Tsai, Lin, & Yuan, 2001). This study examines the use of varied concept maps to facilitate student achievement of different educational objectives in a web based learning environment.

Studies of concept map as a tool to facilitate learning are extensive and diverse. One group of the studies focuses on the effects of concept maps used in different formats. Examples include the instructor-provided concept map versus student completed or generated concept map (Wang, 1995; Smith & Dwyer, 1995); individual concept mapping versus group concept mapping (Brown, 2000); and hand drawn versus computer generated concept maps (Sturm, 1996). The second group of studies compares and contrasts the effects of concept map with those of other learning strategies. Examples for this group of studies are comparing and contrasting concept mapping with note-taking, outlining (Keng, 1996), Gowin's Vee heuristic diagramming (Rumer, 1990; Passmore, 1996), post-questioning and feedback (Naidu, 1991). The third group of concept map studies focuses on effects of concept maps when they are applied in a specific area or with specific group of people. Examples in this group are the studies of concept mapping in science classroom (Green, Ritchie, & Volkl, 2000) and with low-achieving inner-city seventh graders (Guastello, Beasley, & Sinatra, 2000).

Although concept maps as a tool to facilitate learning are generally effective and robust (Winn & Snyder, 1996), it cannot be assumed that concept map works equally well under all conditions to achieve all kinds of learning objectives. Research also revealed some problems in the use of concept mapping. Wandersee (1990) and Romance & Vitale (1999) reported that students had problems formulating meaningful propositions and efficiency of student generated concept mapping was generally low. Beissner, Jonassen, and Grabowski (1994) pointed out: "When different graphic techniques are used as learning tools, different cognitive processes are elicited, resulting in different learning outcomes" (p.20). They also suggested a match between the desired learning outcomes and characteristics of the graphic techniques used to achieve those outcomes. In general, when different learning objectives are to be achieved, it seems reasonable to expect that those types of concept maps which instigate deeper levels of cognitive processing would be most effective in facilitating higher levels of learning. Concept map development consists of three important elements: the concepts, the propositions and its hierarchical structure. By controlling and manipulating these variables in concept mapping, it is hypothesized that the different levels of cognitive process will be effected and therefore instigate different levels of information processing.

Statement of the problem

In the literature, many studies indicate that concept maps as a tool to facilitate learning are effective and robust . However, there is limited research on the appropriate use of concept mapping strategies regarding their effectiveness in facilitating the achievement of specific learning objectives. This study attempts to examine the instructional effects of three concept mapping strategies used to facilitate student achievement of different educational objectives.

Procedure and treatments

One hundred fifty six college level students participated in this study. Extra credit points were awarded for participation. Students were randomly assigned to one of the four treatment groups. One week prior to the study, six workshops on concept mapping were offered to the students in the varied treatment groups. Students in control group received the same workshop about concept mapping after the study. Each workshop lasted for about one hour. Written instruction for the study was given to every subject when they came to the lab. Following the instruction, the subjects browsed the web course site, interacted with the instructional material at their own pace to understand its contents and then took the different criterion tests (identification, terminology, and comprehension) online. The instructional material used in this study was a meaningful 2000-word expository text describing the human heart including its parts, locations and functions during systolic and diastolic phases. The material was developed by Dwyer and Lamberski (1977) for the purposes of measuring the instructional effect of different independent variables on different types of educational objectives. Following is a description of each treatment in this study.

Treatment Group 1: Control Group

Students in this group were required to interact with the instructional material at their own pace and to take the online criterion tests immediately after they finished the instructional materials and felt that they understood its contents.

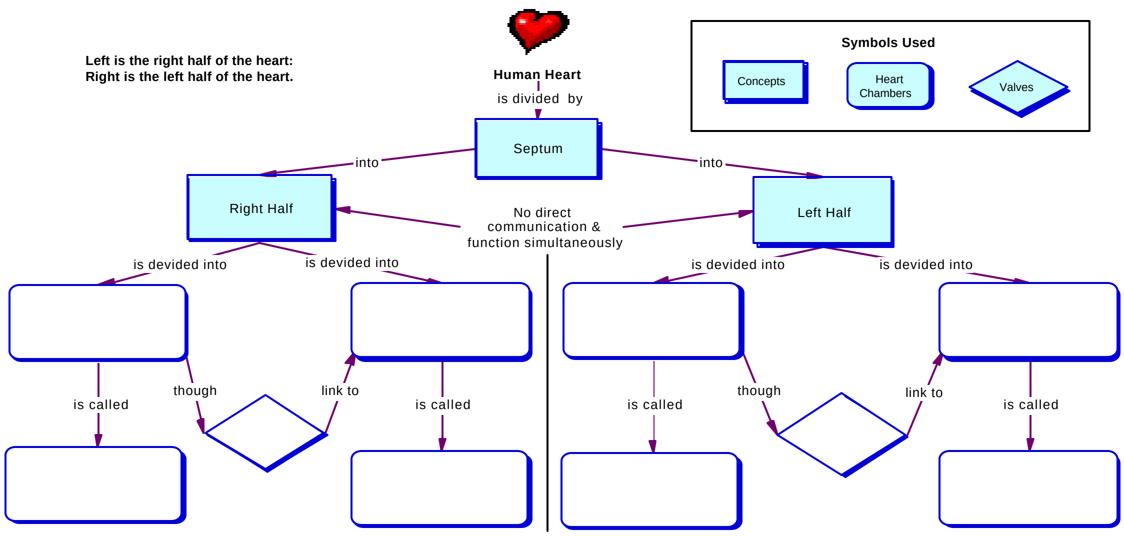
Treatment Group 2: Concept Identifying Mapping Group

Students in this group were required to interact with the instructional material at their own pace and to use concept identifying mapping strategy to summarize the instructional material. They took the online criterion tests after they finished the concept mapping activity. Figure 1 is an example of the concept identifying mapping activity in Treatment 2.

FIGURE 1. Sample activity of concept identifying mapping strategy

Direction: Please complete the concept map by filling in the concepts according to reading **Part 2 & 3**.

Concept Map of Heart Structure



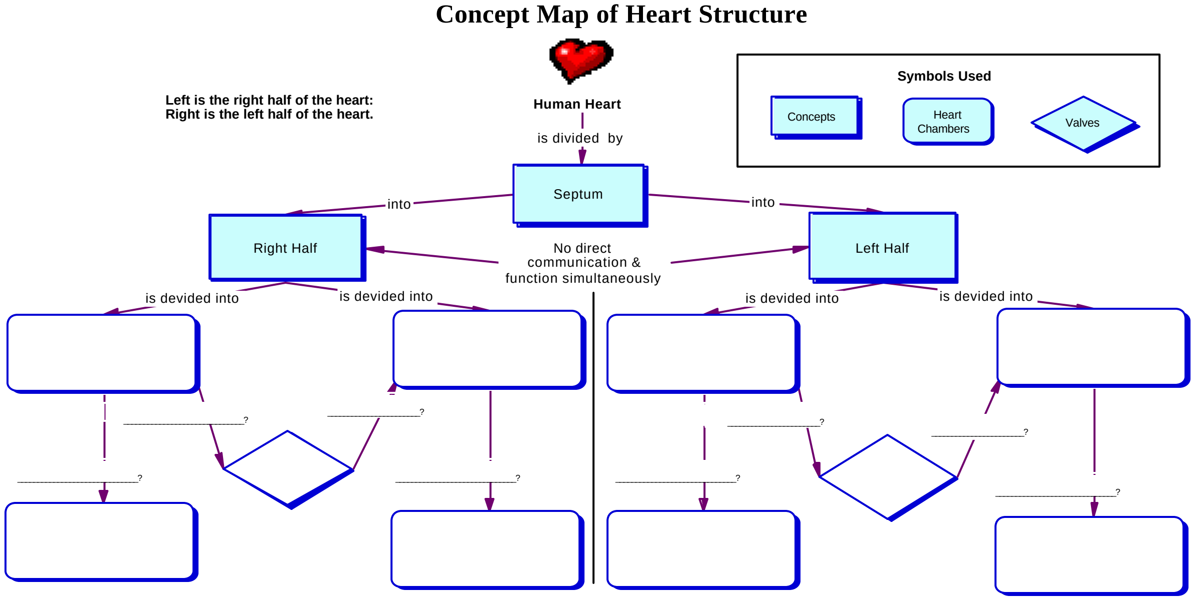
Treatment 3: Proposition Identifying Mapping Group

Students in this group were required to interact with the instructional material at their own pace and to use proposition identifying mapping strategy to summarize the instructional material. They took the online criterion tests after they finished the concept mapping activity. Figure 2 is an example of the concept identifying mapping activity in Treatment 3.

FIGURE 2. Sample activity of proposition identifying mapping strategy

Direction: Please complete the concept map by filling in concepts and link words according to reading **Part 2 & 3**.

Concept Map of Heart Structure



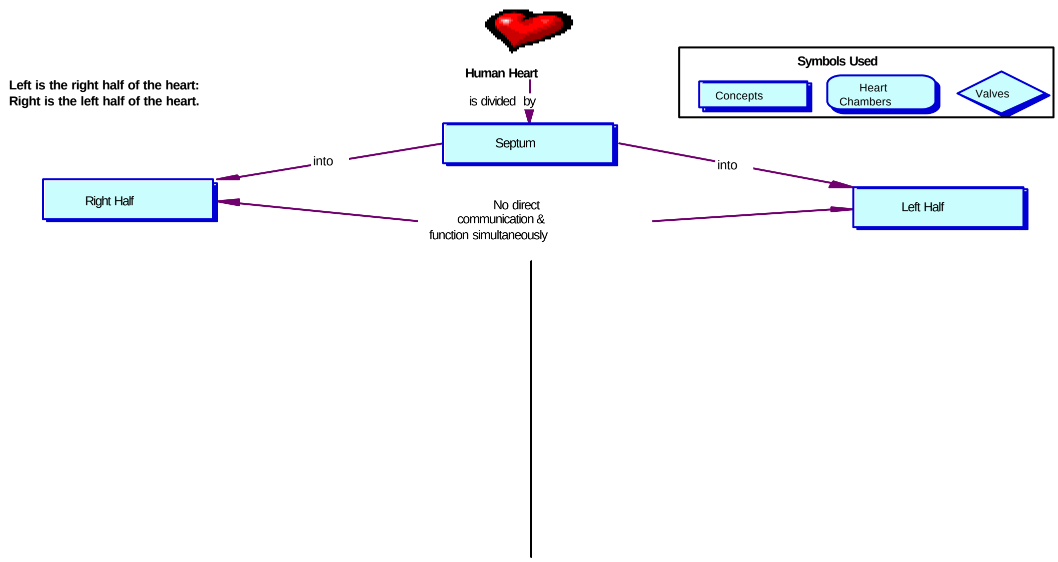
Treatment 4: Student Generated Mapping Group

Students in this group were required to interact with the instructional material at their own pace and were required to generate their concept maps summarizing the instructional material by identifying both the concepts and propositions in the instructional material. They took the online criterion tests after they finished the concept mapping activity. Figure 3 is an example of student generated concept mapping activity in Treatment 4.

FIGURE 3. Sample activi ty of student generated concept mapping strategy

Direction: Please create a concept map about heart structure according to reading **Part 2 & 3**.

Concept Map of Heart Structure



Criterion measures

The objective of each criterion test was as follows: (a) identification test – to measure transfer of learning (i.e., the ability to identify numbered parts of the heart based on the information received in the study), (b) terminology test – to evaluate students' knowledge of references for specific symbols, (c) comprehension test – to measure understanding of the heart, its parts and functions, and (d) total criterion test – to measure the students' total understanding of the concept presented (Roshan & Dwyer, 1998). The following description of the criterion tests used in this study was adapted from Roshan and Dwyer (1998) and Baker and Dwyer (2000).

Identification Test

This test of 20 item multiple-choice question was designed to measure the subjects' the ability to use visual cues to discriminate one structure of the heart from another and to associate specific parts of the heart with their proper names. It required the subjects to identify the numbered parts on a detailed drawing of a heart. Average Kuder-Richardson Formula 20 Reliability coefficients from a random sampling of prior studies for this identification test was .81.

Terminology Test

This test of 20 item multiple choice questions was designed to measure knowledge of specific facts, terms, and definitions in the instructional material. The objectives measured by this type of test could be appropriate to all content areas which an understanding of the basic elements as a prerequisite to the learning of concepts, rules, and principles. Average Kuder-Richardson Formula 20 Reliability coefficients froma random sampling of prior studies for this terminology test was .83.

Comprehension Test

This test of 20-item multiple choice questions was designed to measure the students' ability to comprehend the instructional material content. This comprehension test required the subjects to have a thorough understanding of the parts of the human heart, their functions, and the internal processes that took place during the systolic and diastolic phases. It was designed to measure a type of understanding in which the individuals could use the information to explain some other phenomenon. Average Kuder-Richardson Formula 20 Reliability coefficients from a random sampling of prior studies for this comprehension test was .77.

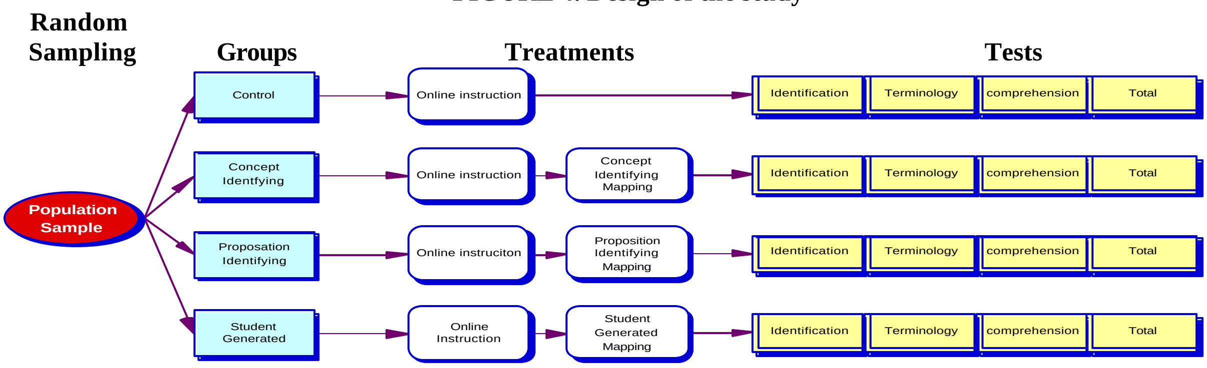
Total Criterion Test

The items in the identification, terminology and comprehension tests were combined to provide a 60 item total criterion score. The score was used to measure students' total performance on the three individual criterion measures.

Design of the study

The design of the study was 1x4 posttest only. The independent variable was concept mapping strategy that included 4 levels: one control group and three concept mapping strategy groups described as the treatments above. The dependent variable was the individual students' achievement measured by the identification, terminology, comprehension, and total criterion tests. One-way analysis of variance was run to determine the differences between groups. Alpha level was set at the .05. Figure 4 shows the basic design of this study.

FIGURE 4. Design of the study



Results and conclusions

Table 1 presents the number of subjects in each treatment, the mean scores and standard deviation achieved by the students in each treatment on each criterion test.

Table 1: The Number of Subjects, Means Scores, and Standard Deviation on Criterion Tests

		Criterion Tests							
		Identification		Terminology		Comprehension		Total	
Treatment Group	n	M	SD	M	SD	M	SD	M	SD
Treatment 1	29	7.10	3.47	8.38	3.55	6.86	2.64	22.34	7.64
Treatment 2	27	11.67	4.95	11.85	4.39	11.00	4.79	34.52	13.22
Treatment 3	24	10.00	5.49	10.25	4.67	9.42	4.45	29.67	13.56
Treatment 4	25	11.52	5.24	11.68	4.05	8.36	3.39	31.56	11.78

Note: Maximum score possible = 20.00
Total = Identification + Terminology + Comprehension

One-way analysis of variance (ANOVA) was conducted to analyze the data collected. Alpha level was set at the .05. The results revealed that there were significant differences existed among treatment groups on all criterion tests (Table 2).

Table 2: Results of ANOVA

		Sum of Squares	df	Mean Square	F	Sig
Identification	Between Groups	376.061	3	125.354	5.450	.002
	Within Groups	2322.930	101	22.999		
	Total	2698.990	104			
Terminology	Between Groups	216.054	3	72.018	4.156	.008
	Within Groups	1750.175	101	17.328		
	Total	1966.229	104			
Comprehension	Between Groups	253.092	3	84.364	5.250	.002
	Within Groups	1623.042	101	16.070		
	Total	1875.133	104			
Total	Between Groups	2268.871	3	756.290	5.561	.001
	Within Groups	13736.786	101	136.008		
	Total	16005.657	104			

Post hoc tests (both Scheffe and Dunnet C) were run in SPSS Program to identify the specific differences existed between treatment groups. Table 3 presents the results of the post hoc tests.

Table 3: Results of Post Hoc Tests of Scheffe and Dunnett C

Dependent Variable		(I) Groups	(J) Groups	Mean Difference (I-J)	Std Error	Sig	95% Confidence Interval	
							Lower Bound	Upper Bound
Identification	Scheffe	Control Group	Concept Identifying	-4.56*	1.28	.007	-8.21	-.92
			Proposition Identifying	-2.90	1.32	.195	-6.66	.87
			Student generated mapping	-4.42*	1.31	.013	-8.14	-.70
	Dunnett C	Control Group	Concept Identifying	-4.56*	1.28		-7.71	-1.42
			Proposition Identifying	-2.90	1.32		-6.46	.67
			Student generated mapping	-4.42*	1.31		-7.80	-1.03
Terminology	Scheffe	Control Group	Concept Identifying	-3.47*	1.11	.025	-6.64	-.31
			Proposition Identifying	-1.87	1.15	.452	-5.14	1.40
			Student generated mapping	-3.30*	1.16	.043	-6.53	-7.06
	Dunnett C	Control Group	Concept Identifying	-3.47*	1.11		-6.41	-.54
			Proposition Identifying	-1.87	1.15		-5.07	1.32
			Student generated mapping	-3.30*	1.14		-6.17	-.43
Comprehension	Scheffe	Control Group	Concept Identifying	-4.14*	1.07	.003	-7.19	-1.09
			Proposition Identifying	-2.25	1.11	.156	-5.70	.59
			Student generated mapping	-1.50	1.09	.601	-4.61	-1.61
	Dunnett C	Control Group	Concept Identifying	-4.14*	1.07		-7.00	-1.28
			Proposition Identifying	-2.55	1.11		-5.40	.29

			Student generated mapping	-1.50	1.09		-4.06	-1.06
Total Tests	Scheffe	Control Group	Concept Identifying	-12.17*	3.12	.003	-21.04	-3.31
			Proposition Identifying	-7.32	3.22	.167	-16.47	1.83
			Student generated mapping	-9.22*	3.18	.044	-18.26	-.17
	Dunnett C	Control Group	Concept Identifying	-12.17*	3.12		-20.16	-4.19
			Proposition Identifying	-7.32	3.22		-15.90	1.26
			Student generated mapping	-9.22*	3.18		-16.78	-1.65

* The mean difference is significant at the .05 level.

Both post hoc tests revealed that there were significant differences between Treatment 1 (the control group) and Treatment 2 (the concept identifying mapping strategy group) on all the criterion tests; there were significant differences between Treatment 1 (the control group) and Treatment 4 (the student generated mapping strategy group) in identification, terminology, and total tests. Insignificant differences were found to exist among the other comparisons.

A number of factors may have contributed to these results. The significant differences that were found to exist between Treatment 1 (the control group) and Treatment 2 (the concept identifying mapping strategy group) on all criterion tests indicated that concept identifying mapping strategy was effective in facilitating learning the concepts and comprehending the instructional content. By using concept identifying mapping strategy, the students' attention was primarily focused on interacting with those key concepts of instructional material. This meaningful and active interaction with the concept maps not only helped the students remember those key concepts but also to understand other dimension of the content (other than concepts) in instructional material since concepts are foundations based on which comprehension can be built. This also explains that those students who used concept identifying mapping strategy did well not only on the identification and terminology tests but also on the comprehension test.

The significant differences existed between Treatment 1 (the control group) and Treatment 4 (the student generated mapping strategy group) on the identification, terminology, and total tests. This finding indicated that student generated concept mapping strategy was effective in facilitating conceptual learning. The pre-requisite to construct a meaningful concept map was to identify those key concepts and propositions among them. The student generated concept mapping strategy helped the students interact with the instructional material by identifying the key concepts, the propositions, and the structure of the instructional materials. Consequently it resulted in significantly higher achievement on the identification, terminology and total criterion tests. However, the student generated concept mapping strategy did not significantly effect the achievement measured by comprehension test. One explanation for this finding may be that the student generated concept mapping was a very demanding cognitive activity that required relatively long time and sustained efforts. The analysis of the concept maps generated by the students and the observation made during the implementation of the study revealed that most of the concept maps were only of identifying and representing key concepts of the instructional material. They failed to map out the complex relationships among those key concepts identified, which would instigate deeper processing and comprehending of the instructional material. Wachter (1993) suggested that comprehension tended to be enhanced when the students constructed their own associations and elaborations during reading tasks. It was also observed that during the study, a number of students were having difficulties in constructing their concept maps. This also distracted their efforts from active processing of the information needed to comprehend the instructional material in depth during the study.

There were insignificant differences in achievement between Treatment 1 (the control group) and treatment 3 (proposition identifying mapping strategy group) in all criterion measures. This means that Treatment 3 (the proposition identifying mapping strategy) failed to significantly effect the learning. The concept mapping activities in this group appeared too complicated for the students to complete within their attention span. The analysis of the concept maps completed by the students and the observation made during the implementation of the study revealed over one-third of the students in this group did not complete the required concept mapping activities. As a result, it was not effective in eliciting the proper level of cognitive process it had meant to instigate. Consequently, the intensity and quality of the interactions of the students with the instructional material were degraded and no significant results were found on any of the criterion tests.

The above explanation can also be used to explain the results of no significant differences among Treatment 2 (the concept identifying mapping strategy group), Treatment 3, (the proposition identifying mapping strategy group), and Treatment 4 (the student generated mapping strategy group) in all criterion measures. Additionally, the concept mapping activities in all treatments dealt with learning the instructional material in general. They did not aim at helping students to comprehend particular difficult areas of the instructional material, which had greater potential for improvement. As a result, those difficult areas of the instructional material remained untouched in this study

Implications

This study attempted to examine the effects of the three concept mapping strategies in facilitating learning achievement. The alpha level was set at .05. There were statistically significant differences found between the control group and the concept identifying mapping strategy group in all criterion tests. The significant differences were also found between the control group and the student generated mapping strategy group in the identification, terminology and total criterion tests. There were no statistically significances found among the three concept mapping strategy groups. In the future study, it is recommended that in studying the different mapping strategies, the workload of the concept mapping activities in each treatment be carefully considered. Too much workload in the treatment would not likely produce the intended results. Roshan and Dwyer (1998) maintained that when the human information processing systems were under the stress of processing overloading, performance would become degraded. Additionally, the concept mapping strategies should aim at specific difficult areas of learning that have high potentials for improvement. The effective concept mapping activities should help overcome those difficulties the students have in processing, organizing and applying the information. It is highly possible, if concept mapping activities had been properly devised, there might have been the statistically significance found among those treatment groups.

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Impact of Vicarious Learning Experiences and Goal Setting on Preservice Teachers' Self-Efficacy for Technology Integration: A Pilot Study

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Abstract

This pilot study was designed to explore how vicarious learning experiences and goal setting influence preservice teachers' self-efficacy for integrating technology into the classroom. In this pilot study, twenty students from the Teacher Education program at a Mid-western university participated and were assigned into four experimental conditions. Results showed the individual and collective effects of vicarious experiences and goal setting on the participants' judgments of self-efficacy for technology integration. More data were simulated based on the result of this pilot study to detect the effect of vicarious learning experiences and goal setting when the sample size was 80 participants.

Theoretical Framework

Despite the increased availability and support for computers (Zehr, 1997, 1998), relatively few teachers have fully integrated computers into their classroom teaching (Marcinkiewicz, 1996). There is substantial evidence to suggest that teachers' beliefs in their capacity to work effectively with technology, that is, their computer <u>self-efficacy</u>, is a significant factor in determining patterns of classroom computer use (Oliver & Shapiro, 1993). The studies on teachers' self-efficacy beliefs provide sufficient reason to undertake further investigations in this area and to consider approaches to teacher education and professional development that might be effective in increasing self-efficacy for teaching with technology.

Bandura (1986) identified four sources of information used to judge self-efficacy: successful performance attainment; observing the performances of others (<u>vicarious learning</u>); verbal persuasion indicating that one possesses certain capabilities; and physiological states by which one judges capability, strength, and vulnerability. Although performance accomplishments are considered to be the most robust source of self-efficacy information, vicarious learning also provides a powerful source (Bandura, 1986, 1997). That is, viewing others successfully accomplish a particular task can increase one's perceptions of others' efficacy as well as one's own self-efficacy for similar tasks (Bandura, 1997). The effects of vicarious learning merit further examination.

While novice learners can acquire skills and strategies from social modeling, when performing independently they are likely to over- or underestimate their capabilities (Schunk, 2001). However, by making learning goals explicit, students' judgments of progress, as well as their judgments of self-efficacy, increase in accuracy and strength (Schunk, 2001). <u>Goals</u> can motivate behavior and inform people about their capabilities (Bandura, 1997; Schunk, 1996). When students are given or establish a goal, they may experience a sense of efficacy for attaining it.

Based on the literature described above, this study examined the impact of vicarious learning experiences <u>and</u> goal setting on preservice teachers' self-efficacy for technology integration.

Purpose of the Study

This study explored how vicarious learning experiences and goal setting influence preservice teachers' self-efficacy for integrating technology into the classroom. Specifically, this study was guided by the following research question:

What are the individual and collective effects of vicarious experiences and goal setting on preservice teachers' judgments of self-efficacy for technology integration?

Based on the self-efficacy literature described above, it was hypothesized that preservice teachers who engaged in vicarious experiences, related to successful technology integration, would experience a significantly greater increase in judgments of computer self-efficacy than those who did not engage in these vicarious experiences. Furthermore, it was hypothesized that preservice teachers who engaged in goal setting, related to increasing their technology integration skills, would experience a significantly greater increase in judgments of computer self-efficacy than those who did not engage in goal setting. Finally, it was hypothesized that preservice teachers who engaged in vicarious experiences <u>and</u> goal setting would demonstrate the greatest increases in judgments of computer self-efficacy compared to students who engaged in either one of these conditions alone.

Methodology

Sample

Participants were solicited from a four-week three-credit educational technology course at a large Mid-western university. They were sophomores in the Teacher Education program and their age range was from 18 to 25.Thirty-one students signed the informed consent form and agreed to participate, but only twenty of them finally showed up in the study. The thirty-one participants were randomly assigned into four experimental conditions. The numbers of participants who finally showed up for the four experimental conditions were 6, 6, 4, and 4 (Note: The unequal group size was due to the dropouts from the study).

Research Design

A 2 x 2 (Vicarious Experiences: use of VisionQuest software [Note: VisionQuest is an instructional tool designed to provide opportunities for users to explore models of effective technology integration] vs. no use of VisionQuest software x Presence of Goal Setting: goal setting vs. no goal setting) mixed factorial research design was used to examine how vicarious experiences and learning goals individually, as well as collectively, impacted preservice teachers' judgments of their computer self-efficacy. These independent variables were combined to form four experimental conditions: (a) NVQ / NG: no use of VisionQuest software and no learning goals (also defined as control group), (b) NVQ / G: no use of VisionQuest software but with learning goals, (c) VQ / NG: use of VisionQuest software but without learning goals, and (d) VQ / G: use of VisionQuest software and with learning goals.

Data Collection and Analysis Strategies

Demographic data, including information about gender, class, and previous computer experiences were collected from all participating students. A Likert-style survey measuring participants' self-efficacy served as the primary data source and was administered at the end of each experimental condition. The survey was constructed by the researcher after consulting with content area experts. The survey included 21 items regarding participants' confidence for technology use (see the attachment). The participants were asked to rate their level of agreement (from 1-strongly disagree to 5-strongly agree) with statements related to their possession of confidence regarding technology use (e.g., "I feel confident that I understand computer capabilities well enough to maximize them in my classroom." "I feel confident I can regularly incorporate technology into my lessons, when appropriate to student learning."). Cronbach alpha was calculated to determine the reliability of the survey items. The alpha coefficient was 0.9293.

For the groups that engaged in vicarious experiences, participants explored the VisionQuest CD-ROM and observed the exemplar teachers' technology use and classroom management strategies. For the groups that engaged in learning goals, participants were given, at the beginning of the experiment, 3 to 5 specific goals related to learning about technology integration.

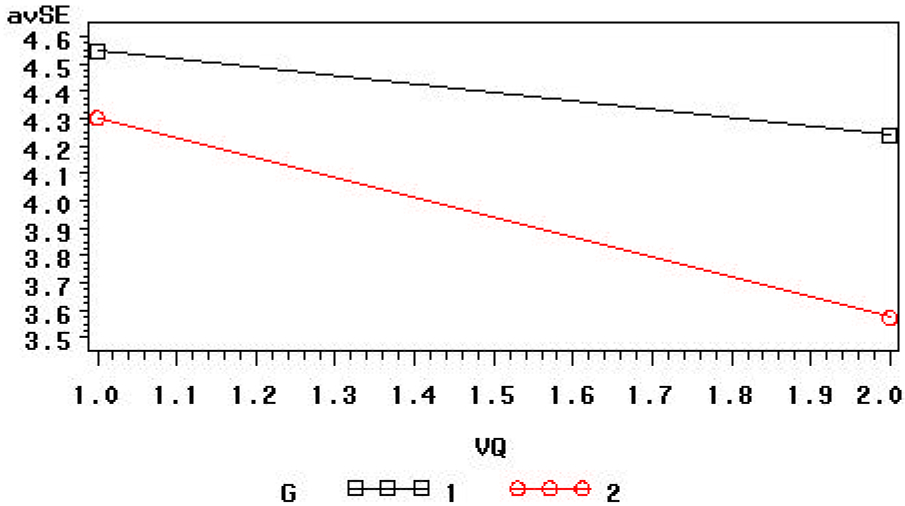
Means and standard deviations for each experimental condition were calculated. Two-way ANOVA was used to determine the main effects of IV_1 (vicarious learning experiences through viewing VisionQuest CD-ROM) and IV_2 (learning goals) and the interaction of IV_1 and IV_2. One-way ANOVA was then used to determine which of the four experimental conditions was significantly different from which.

Results

The four experimental conditions had the following means and standard deviations: VQ / G (mean= 4.55, SD=0.33); VQ / NG (mean=4.30, SD=0.41); NVQ / G (mean=4.24, SD=0.52); and NVQ / NG (mean= 3.57, SD=0.14).

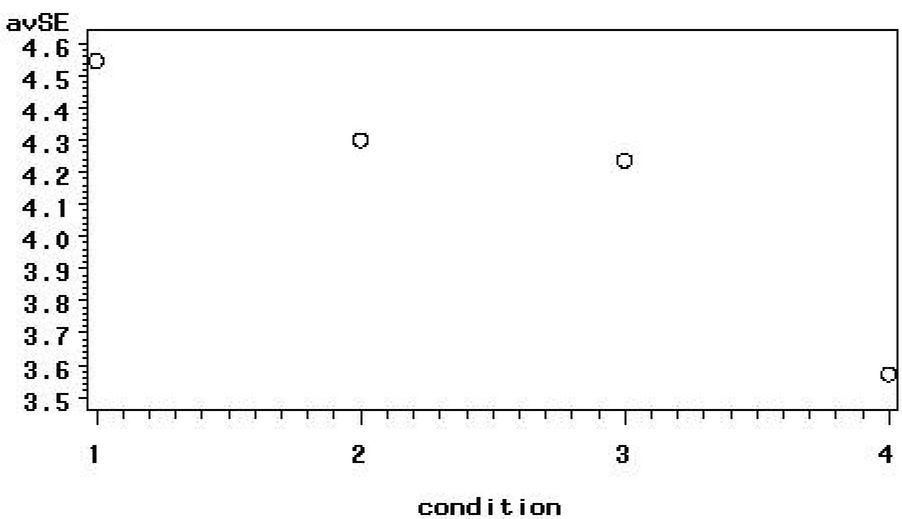
The F value (F=5.57, p=0.0082, df=3, 16) from the two-way ANOVA indicated that there was at least one main effect of the two factors was significant. Then when examining the F values for each of the two factors and the interaction of the two factors, the researcher found that the vicarious learning factor had a significant main effect on the self-efficacy (F=9.18, p=0.0080, df=1, 16), the learning goals factor also had a significant main effect on the self-efficacy (F=6.06, p=0.0256, df=1, 16), but the interaction of the two factors was not significant (F=1.48, p=0.2407, df=1, 16). The following graph helped to illustrate the main effects and the interaction:

Graph 1. Main Effects and Interaction Effect



The F value from the (F=5.57, p=0.0082, df=3, 16) from the one-way ANOVA indicated that the variable—different conditions of the experiment—had a significant effect on the self-efficacy. When examining which conditions were significantly different from which conditions, the researcher found that the following between-condition differences were significant at the 0.05 level: VQ / G – NVQ / NG (the mean difference=0.98), and VQ / NG – NVQ / NG (the mean difference=0.73). The following graph helped to illustrate the difference between the four experimental conditions:

Graph 2. Difference between Experimental Conditions



Because this was a pilot study with only twenty participants, the small sample size of the study could be a factor affecting the results (or at least part of the results). Therefore, the researcher simulated another data set based on the means and standard deviations of the four experimental conditions of the pilot study. After simulation, the sample size was enlarged to 80 participants with 20 participants in each of the four conditions.

The F value (F=27.5, p<0.0001, df=3, 76) from the two-way ANOVA indicated that there was at least one main effect of the two factors was significant. Then when examining the F values for each of the two factors and the interaction of the two factors, the researcher found that the vicarious learning factor had a significant main effect on the self-efficacy (F=40.46, p<0.0001, df=1, 76), the learning goals factor also had a significant main effect on the self-efficacy (F=38.83, p<0.0001, df=1, 76), but the interaction of the two factors was not significant (F=3.21, p=0.0773, df=1, 76).

The F value from the (F=27.5, p<0.0001, df=3, 76) from the one-way ANOVA indicated that the variable—different conditions of the experiment—had a significant effect on the self-efficacy. When examining which conditions were significantly different from which conditions, the researcher found that the following between-condition differences were significant at the 0.05 level: VQ / G – VQ / NG, VQ / G – NVQ / G, VQ / NG – NVQ / NG, NVQ / G – NVQ / NG, and VQ / NG – NVQ / NG.

Conclusion

This study was the pilot study for the researcher's dissertation research. From the results of the data analysis, it can be concluded that the preservice teachers who engaged in vicarious experiences, related to successful technology integration, experienced a significantly greater increase in judgments of computer self-efficacy than those who did not engage in these vicarious experiences. Also, the preservice teachers who engaged in learning goals, related to increasing their technology integration skills, experienced a significantly greater increase in judgments of computer self-efficacy than those who did not engage in learning goals. In addition, the preservice teachers who engaged in vicarious experiences (with or without learning goals) demonstrated significant increases in judgments of computer self-efficacy compared to those who engaged in neither of the two conditions. However, the preservice teachers who engaged in learning goals alone did not demonstrate significant increases in judgments of computer self-efficacy compared to those who engaged in neither of the two conditions. Similarly, the preservice teachers who engaged in both vicarious experiences and learning goals did not necessarily demonstrate significant increases in judgments of computer self-efficacy compared to those who engaged in either of the two conditions alone.

With the findings from the simulated data set, the researcher concluded that the preservice teachers who engaged in both vicarious experiences and learning goals did demonstrate significant increases in judgments of computer self-efficacy compared to those who engaged in either of the two conditions alone, in addition to the significant increases detected in preservice teachers' judgments of computer self-efficacy when only one condition was present.

Educational Implication

The results of this study will contribute to the existing body of literature in two significant ways: (1) by describing how preservice teachers benefit from observing teacher models presented via multimedia case examples, such as those featured on VisionQuest, and (2) by describing how preservice teachers benefit from learning goals for technology integration. From an instructor's perspective, the use of electronic models via multimedia and the incorporation of learning goals can positively impact the authentic nature of a course and simultaneously increase the confidence and integration beliefs of students. This type of modeling and goal setting can help preservice teachers develop a vision for what technology integration looks like in real classrooms as well as strategies for implementing those visions.

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The Nature of Dialogue: A Reconceptualization of Clark and Kozma

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Abstract

Through reconceptualization of the Clark and Kozma debate, this paper attempts to foster an awareness of the need for constructive criticism and define a discipline for an intellectual dialogue in the field of Instructional Technology. Analyzing the differences between debate and dialogue, the authors show how Clark and Kozma's initial debate has grown into a start of a dialogue. Popper's concept of falsification and refutation is one of the possible guidelines for starting the process of dialogue.

Future developments of this paper can continue to refine the process of dialogue to provide a mean for improving the discipline of the dialogue for the purpose of informing the IT field.

Introduction

While theories in the field of Instructional Technology (IT) are proliferating at an alarming rate, there has been little history of criticism or framework of analysis for discussing competing perspectives for the purpose of enriching the field. As Steiner (1988, p. xi) points out "theory is built upon existing theory. Consequently, to build theory one must be able to criticize theory. One must be able to achieve an understanding of extant theory and to judge what needs to be done, if anything, to the theory. Only then is one in position to make constructive moves." One such constructive move would be to engage in intellectual dialogues, allowing for a discussion of similarities and differences which can be brought into focus in order to enrich the field (Schwen, 2001). A lack of dialogue poses a problem both for practitioners as well as researchers in IT. Without explicitly stated constraints or valid frameworks of analysis, the applied usefulness of theories is limited.

The goals of this paper are to foster an awareness of the need for constructive criticism, capture any current dialogue in the field and define a discipline for dialogue. Instances of this dialogue will be illustrated and analyzed and a set of guidelines will be provided that can foster constructive dialogue in the field.

Definition of the terms

While we agree that "theory" and "practice" are not dichotomous, if the two concepts were presented as a continuum, with pure theory at one end and absolute practice at the other, somewhere near the practice end of it, there would be a gap into which falls any relationship that could be established between theoreticians and practitioners. It is a gap that must be bridged if theories are to have any useful application. "We must not negate practice for the sake of theory. To do so would reduce theory to a pure verbalism or intellectualism. By the same token, to negate theory for the sake of practice…is to run the risk of losing oneself in the disconnectedness of practice" (Freire and Macedo, 1995, p.382). Those authors advocate a unity between theory and practice.

Schön's (1983) concept of reflective practice is an attempt to bring both together. He points out that knowledge is implicit in any competent professional. Making judgments and decisions are any professional practice. However, professionals have some difficulty to state the rules or theories upon which are based (Schön, 1983). Schön (1987) calls this practical knowledge as "knowing-in-action". Professionals come to know in action through a process of reflection - "reflection-in-action". Ambiguity, uncertainty, uniqueness, and values conflict characterize practice. It involves thoughtfully consideration of one's own experiences in applying knowledge to practice and transforming indetermination into something that he or she knows how to deal with.

A possibility of fostering environments for dialogue can be found in Karl Popper's concept of falsification. Popper proposes a new kind of critical method in opposition to inductivism, arguing against the inductivists' search for positive instances. Popper emphasizes that a scientific theory can never be "verified" but can only be "falsified". We interpret his concept of falsification as "looking for the data that reveals the instances where the theory doesn't work," and this has resonance of Cronbach (1980, p. 103) who said, " The job of validation is not to support an interpretation, but to find out what might be wrong with it". The aim of researches should be "regulative ideal" of seeking knowledge (Phillips, p.xx). The fact that we are fallible does not undermine the validity of the idea, Phillips emphasizes, “because even if we fail to find an answer or find the answer we have accepted in the past is mistaken, is itself an advance in knowledge.”

In contrast to the traditional definition of theory, which utilizes a verification model, Popper points out that theories are not as firm and strong as we once supposed. He strongly believes that it is easy to obtain confirmations or verifications, for nearly every theory—if we look for confirmations (Popper, 1962). By “testing”, he means testing for refutation. If the theory survives rigorous testing, then it can be said to have acquired corroborating evidence, meaning that the theory does not conflict with the available experiential data. The use of the term “corroboration” in the place of “probability” further shows Popper’s distance from the logical positivists. He also argues that a distinctively scientific approach requires the researcher to look for weaknesses, drawbacks or inconsistency with empirical data. His concept of falsification refers to the procedure that effectively refutes a theory. In order to test a theory through the procedure of falsification, the theory has to assure potential falsifiability, are requirements that guarantees the empirical character of a system of statements (Corvi, 1996).

Popper uses the metaphor of science as a ‘searchlight’ in explaining the role of science. This image is in sharp contrast with the classical theory of science as an accumulation of observations; it emphasizes the theoretical element as the guide and criterion of observation (Corvi, 1996). In this metaphor, Popper points out the dual role of science: (1) solving the existing problem while creating new ones, and (2) using observation as well as encouraging others to consider different ways of interpreting observations already made (Popper, 1962). In Popper’s argument, the scientist’s goal is not to accept the observation of the empirical data as a priori but to posit them as tentative conjecture that can anytime be refuted.

The “sophisticated methodological falsification” presented by Lakatos takes Popper’s concept still further (Lavor, 1998). In this modification, the concept of “research programs” and the methodology of scientific research programs can be interpreted as Lakatos’ attempt to answer Popper’s question of demarcation. A scientific program is the cluster of ideas and discussions, and is comprised of the “hard core”, ideas that cannot be falsified with a single instance and its “protective belt,” the shield against which the attempts of refutation are being bounced. A program is said to be theoretically progressive if modifications lead to unexpected predictions and empirically progressive if some of these predictions are corroborated (Larvor, 1998). An instance of falsified theory will still lead to the progress of the programs through “the regulative ideal.”

The 5 A’s of debate and dialogue

In order to inform the reader of our frame of reference with regard to debate and dialogue, we offer the following definitions. Debate, according to Webster’s Dictionary (1982), is “to fight or contend, to dispute about or to argue”. It carries with it overtones of controversy and strife. In contrast to this, some authors (Boone, 2001; Roth, 1994; Stewart, n.d.), define dialogue as the interchange of ideas that seeks to establish greater learning or understanding in the context of mutual harmony. However, in the literature “dialogue” is often related to concepts such as “conversation”, “interaction”, “communication” and “bridging”. The 5 A’s of debate or dialogue table (Table 1) offers a convenient way to differentiate the two.

	Debate	**Dialogue**
Assumptions	Assuming there is only one right answer (and you have it).	Assuming that other people have pieces of the answer.
Anticipatory	Advance communication is minimal and not specifically linked to what follows.	Advance communication is essential in order to prepare participants for the process.
Audience	Participants speak as representatives of the group; • They are known for propounding a carefully crafted position; and • Their behavior conforms to stereotypes.	Participants speak as individuals from their unique experiences; • They are not outspoken leaders, but have a range of different experiences; • Their behavior will vary from stereotypic images.
Atmosphere	Combative: • Attempting to prove the other side wrong, thus declaring you the "winner." • Defending your views and assumptions • Determination to be right. Hearing (as opposed to listening) • To find flaws and make counter-arguments; • To criticize the other side's point of view. (Belittles others and is divisive)	Collaborative: • Finding common understanding and common ground. • Bringing your assumptions into the open for inspection and discussion; • Admitting that other's thinking may improve your own. Listening • For understanding and finding a basis for agreement; • Being willing to examine all points of view; and • Searching for strength and value in other positions (Involves concern for others.)
Afterward	Seeking an outcome that agrees with your own, which usually offers little new information and is predictable.	Discovering new possibilities and opportunities where new information can surface. Dialogue liberates creativity.

Table 1- The 5 A's of debate and dialogue.

The underlying assumptions in debate and dialogue differ dramatically. In debate, the assumption is that there is only one right answer and that is the one that we possess. Others cannot have a "right" answer unless it is the same as ours. The inverse of that assumption is that if my answer is "right", then your must be "wrong." On the other hands, in a dialogue, it is assumed that many people may have parts of the answer and the goal is to bring all of the diverse pieces together to form one new whole. Diversity is celebrated and sought for as a means of creating something better and more robust than initially imagined.

As a dialogue is anticipated, communication is essential in order for participants to be prepared. Communication sets the stage for a good dialogic process and enhances what follows. In a debate, advance communication is often minimal and lacks congruence with the debate that is to follow. Participants often contribute with their own agendas in mind, with no intention of coming to consensus, but they ultimately seek to persuade people to "join" their viewpoint. Dialogue expands the number of people committed to the process.

Participants in a debate speak as representatives of a "group," whose position is carefully crafted and whose behavior conforms to stereotypes. Questions are used as weapons for stabbing opponents, not as tools for questioning. In dialogue, "the goal is changed from conquering to growing, from silence to knowing, from telling to asking. Questions are used as tools for probing, not weapons for stabbing," (The Conflict Resolution Network, n.d.). Those involved in a dialogue speak as unique individuals, who have a range of different experiences upon which to draw and share. There is no outspoken leader, but contributors on a level playing field.

The atmosphere in a debate is combative, with each side attempting to prove the other side wrong. There must be a winner and a loser. "When we argue or debate, we actually seek to block the other's contribution and limit potential solutions of suggestions, thus limiting world consciousness," (Stewart, n.d.). Participants do not listen, the only hear, with the intent to find flaws, make counter-arguments and criticize. In dialogue, listening and collaborating are all important. Finding common ground and being willing to bring assumptions into the open for inspection and discussion are hallmarks of an open dialogue. In dialogue, participants search for strength and value in each other's positions.

Finally, a debate seeks agreement with the leader's position. The outcome is usually very predictable and offers little, if any, new information on the topic. "In debate, the atmosphere is usually threatening, with interruptions expected. The participants express unwavering commitment to the won point of view. There is often a great deal of heat, but little light" (Stewart, n.d.). In dialogue, the goal is to discover new possibilities and opportunities where information can surface. Dialogue seeks to create creativity in a manner that champions good will and harmony. Dialogue does not persuade, it invites.

The focus of dialogue is not to bring everyone to consensus on one single strongest theory or practice. It is an attempt to further develop, as a growing field, the ability to think critically as well as more flexibly through rich discussions of various, competing viewpoints. Too often, theoretical debates resemble a "dialogue of the deaf" (Fierke & Nicholson, 2001, p.9). In the late Paulo Freire's Pedagogy of the Oppressed, he argues that "dialogue cannot be reduced to the act of one person's 'depositing' ideas in another, nor can it become a simple exchange of ideas to be 'consumed' by the discussants. Nor yet is it a hostile, polemical argument between those who are committed neither to the naming of the world, nor to the search for truth, but rather to the imposition of their own truth…It is an act of creation; it must not serve as a crafty instrument for the domination of one person by another (Freire, 2000, p.89). We argue that there is not only a need for dialogue but also for a framework for that dialogue, which will not block communication or divide perspectives, but will create synergy and dynamic elucidation of issues in the IT field. In order to provide and example, we examine one of the most famous discussions in the field, the Clark and Kozma debate.

The Clark and Kozma debate

At first glance, an examination of some of the Clark and Kozma arguments reveal structures that more closely resemble debate than dialogue.

In 1983 Richard Clark wrote an article in the Review of Educational Research -"Reconsidering Research on Learning from Media" - that has started what is known in the field as "The Media Debate" or "Do Media Alone Influence Learning Effectiveness?" After reviewing research studies from 1912 to the early 1980s, Clark claims that media are "mere vehicles that deliver instruction but do not influence student achievement any more than the truck that delivers our groceries causes changes in our nutrition" (Clark, 1983, p.445).

In 1991 Kozma published an article on Review of Educational Research – "Learning with media," that brings more fire into the debate. The article discusses learning and media as complementary processes "within which representations are constructed and procedures performed, sometimes by the learner and sometimes by the medium" (Kozma, 1991, p.179). This is one of the most influential critiques of Clark's arguments.

Although the Clark and Kozma debate really did begin as a debate, with a very adversarial atmosphere and defensive positions taken by both researchers, the addition of several other authors helped to open the debate toward a collaborative dialogue. This was accomplished through questioning of assumptions (bringing them into the open), broadening of perspectives (there are more than just two opposite viewpoints), and redefining the expected outcomes (creating creativity). The addition of others who were willing to share their thoughts in an open and candid manner has assisted in moving the debate more toward a dialogue (Figure 1).

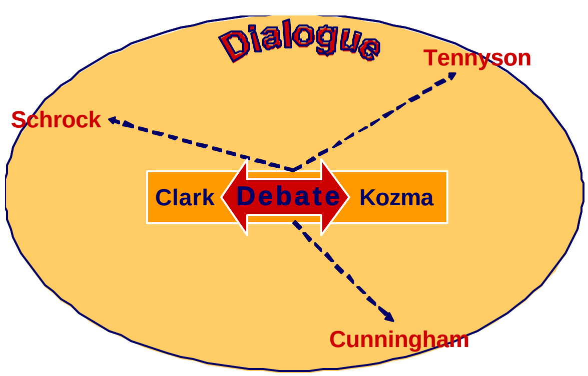

FIGURE 1 - Why Clark and Kozma?

Comparing arguments

According to Clark, it is not the media that influences learning effectiveness, but the instructional method (media and method are two distinct identities). "An instructional method is any way to shape information that compensates for or supplants the cognitive processes necessary for achievement or motivation" (Clark, 1991, p.35).

The media and the systems of symbols associated with them only offer "operational vehicles for methods that reflect the cognitive processes necessary to perform a given learning task" (Clark, 1983, p.454). It is possible to accomplish the same levels of performance by utilizing a variety of media and their correspondent symbolic elements. He addresses the media attribute argument (e.g. "zooming in" in movies and television) by referring to the fact that an array of media attributes can accomplish the same learning goals. This is what empirical evidence seems to imply. Kozma contra-argues by stating that Clark's view of media as "delivery trucks" generates an "unnecessary schism between medium and method" (Kozma, 1991, p.205). He proposes an alternative argument that media can influence learning. He says that, "some students will learn a particular task regardless of the delivery device. Others will be able to take advantage of a particular medium's characteristics to help construct knowledge" (Kozma, 1991, p.205).

According to Kozma, media can have an important role in learning. His main arguments are that media and methods are interconnected (contrary to Clark's argument) and that the media interacts with learning. Learning is influenced by "cognitively relevant characteristics of media – their technologies, symbol systems and processing capabilities" (Kozma, 1991, p.205). Media and instructional method have a complementary relationship – they are an integral part of the instructional design process. "Within a particular design, the medium enables and constraints the method: the method draws on an instantiates the capabilities of the medium" (Kozma, 1991, p.205).

Analyzing the debate

The analysis of the debate clearly shows that both of the researchers follow the verification model. Both point out the studies and empirical data that confirm their own assumptions. The overall tone is verification and adversarial.

- "Clark (1983) contends that media do not influence learning under any condition, but the research reviewed in this article suggests that this position must be modified." (Kozma, 1991, p. 205).
- "When a study demonstrates that media attributes are sufficient to cause learning, the study has failed to control for instructional method and is therefore confounded" (Clark, 1994, p. 25).

Even though the entire debate between Clark and Kozma is around verification of their own theories and does not focus on seeking instances in which their theories do not work, a more attentive analysis, however, can expose some possibilities for falsification. In the final analysis, this debate became, in our opinion, moved toward a start of dialogue. Clark and Kozma did not intend to falsify their own theories, but they put their theories into the public arena where they could be tested by others as their perceptions and arguments evolved.

A close examination of this debate can reveal some glimpses of attempts at falsification and a willingness to dialogue. Following are some examples that illustrate those attempts.

- When Clark started his studies on media research in 1980, he had the expectation that "media were a significant element in any educational reform which sought achievement gains" (Clark, 1991, p.35). However when he started looking at literature that addresses this issue he could not find evidence of his expectations, their expectations were not corroborated by what he found in the literature.
- A clear acknowledgment that there is a confusion on terminologies is recognized by both researchers:
    - "There is a long history of a basic confusion between" (Clark, 1994, p.23) instructional design technologies and delivery technologies
    - Kozma makes a distinction between attribute as a capability of a medium and the variability of its use. He argues, "in the development of theory, Dubin (1996) defines an attribute as the property of a thing distinguished by the quality of being present, while a variable is the property of a thing that may be present in degree (p. 35). The attributes of a medium are its capabilities; the capabilities of a medium are always present" (Kozma, 1994, p.13).
- The need to search for "negative evidence" is pointed out by Clark. Such acknowledgment makes it possible for their "debate" to grow into a "dialogue". His argument is that scholars tend to start with a solution and then look for the problem that can be fixed with this solution:
    - "Part of the problem in my view is that we tend to encourage students (and faculty) to begin with educational and instructional solutions and search for problems that can be solved by those solutions. Thus, we begin with an enthusiasm for media, or individualized instruction, or de-schooling – and search for a visible context in which to establish evidence for our solution (…) We need a great appreciation for negative evidence and to begin with a focus on problems (…)

and then search relevant research literature for robust, research-based theories about the variety of solutions to those problems" (Clark, 1991, p.39).

- A lack of consistency with empirical data provided instances of falsification. This seems to be the basis of the argument done by Cunningham (1986) about Clark's lack of empirically-based claims that instructional methods are responsible for achievement gains:
  - "Of course the data from any particular comparison may show no statistically significant difference between the methods/media, but the basic question (…) is designed to identify differences. Thus, we speak of significant differences, not significant equivalences; after all, we can never prove the null hypothesis" (Cunningham, 1986, p.4).
- Another instance of falsification is pointed out by Cunningham (1986), who referred to the nature of inquiry by stating that we should:
  - "not make the mistake of reifying our data, of assuming that the data are simply measures of reality that our theories will take account of eventually. We must make more modest claims about the validity of our data and not be surprised when what we once regarded as truth changes dramatically. Our interventions must be contextualized to particular times and places and within particular theoretical perspectives. (…) if we come to understand the constructive nature of our knowledge, we can make more modest, context-dependent claims about the "truth of the matter" and be less embarrassed when we are wrong. In other words, there are no good guys and bad guys, only guys." (Cunningham, 1986, p.6/7).

The process of dialogue

So, what would an ideal intellectual dialogue look like? The key concept of Popper's philosophy of science is "objectivity," which he believes can help exercise control against the prejudice inherent in subjective knowledge or feeling of conviction (Stokes, 1998). In Popper's view, the maintenance of objectivity is central to an open society and the critical tradition that fosters social values such as free discussions, and practices such as publications and conferences (Stokes, 1998). In order to increase "objectivity," each party needs to state their convictions up front. Popper argues that individual researchers should adhere to the values of critical thinking and discipline, attaining the publicity of method (Stokes, 1998).

We recommend that the dialogue follow an intentional framework, providing structure for analysis and deleting personal assaults from the conversation. In this manner, dialogue would not be an attack on the author of a theory; it would not be centered on opinions, but would be an effective way to begin talking about essential foundation pieces of the field and engage in intellectual exercise.

First, the foundation of any successful dialogue is mutual respect. This includes respect for people as well as their ideas. Secondly, we would suggest that the goals for the dialogue should be clearly stated. With this we do not mean that the goals cannot evolve throughout the process of dialogue. However, if the goals cannot be stated clearly or are personal in nature ("I want to prove him wrong"), then perhaps the responses are not worth the time or effort, as they will not build the field. Thirdly, a framework of explicitly stated assumptions and clear definitions would be called for. One of the biggest problems in dialogue is the use of terms that are not clearly understood by the audience or participants. Fourth, openness to criticism and willingness to "hear" differing perspectives can bolster the dialogue, making it more robust. Finally, if this process were placed in a shared space, where each voice could be heard, dialogues would be made richer and more accessible to practitioners as well as researchers.

Creating an environment for successful dialogue begins with parties who agree on a platform of mutual respect. Without a level of mutual respect, there can be no dialogue, only argument. The underlying assumptions in a debate are that one person is right, one is wrong, and that I am right, therefore, you must be wrong. This leads to a lack of respect for each other's ideas and in the end, blocks contributions, which ultimately limits solutions and ideas. If the field, as some have suggested is in its infancy, then perhaps acting in selfish, childish ways can be excused. If we wish to advance the field we need to develop a willingness to cooperate and collaborate. "Keeping the spirit of mutuality and respect alive as we converse about our different views, then, is a way of allowing all the differences – which are valuable to creating the best thinking – to come to the surface and be carefully considered" (Stewart, n.d.).

Goals for the dialogue are also essential, as a means of keeping people and ideas focused. Fierke and Nicholson (2001, p.9), although taking divergently discrete approaches to games, clearly state the purpose of their dialogue, which is to "enrich the discussion of the role of games in international relations, while elucidating and recording the differences between the two distinct approaches." This is not only helpful to the reader, but throughout their dialogue, it is a maintained focus. In the end, they find that their dialogue has "strengthened each (perspective) by providing a basis for making explicit that which is implicit in both." (Fierke and Nicholson, 2001, p.25) Having clear goals for every dialogue can assist the participants in collaboratively building the IT field by maintaining focus on the bigger picture instead of the smaller, more personal one.

Contingent to that is the notion that there must be an understanding of the underlying assumptions of a theory. This can be made easier when the theorist makes those assumptions (and biases) explicit to the reader. However, readers are frequently left to deduce assumptions from the conclusions or arguments in a paper. In regards to the Clark and Kozma debate, Schrock (1994, p.49) states, "his [Clark's] assertions do rely on definitions and his definitions imply assumptions that may be worth examining in great detail." The main problem with assumptions is that they are often implicit and even the author is not aware of them, making it that much harder on the reader to understand the perspectives or conclusions. Still, one of the values of a good dialogue is that it can assist in making the implicit explicit. It should be noted that no one is making a judgment about the rightness or wrongness of assumptions, merely arguing that they need to be clear to the "public."

Another one of the most daunting challenges to creating a successful dialogue is the prolific number of definitions utilized in current research. Many terms have not be fully operationalized or made explicit to the reader. Some fuzzy terms are also used interchangeably, adding to the confusion. "Part of what makes the debate difficult is that, while the participants often use the same words, the words do not appear to have identical meanings" (Schrock, 1994, p.49). In addition, Schrock (1994, p.49) states, "the debate is not simple. It has emotional and political elements and some nasty definitional ambiguities." Researchers should be encouraged to define of their terms, constraints and the framework of their analyses so that the readers will be able to understand the logic behind the interpretation. It must be noted that the more explicit the definitions, the easier it will be for the practitioner to utilize the theory. Seels (1997) states that the use of definitions could facilitate theory generation by improving communication within and outside the IT field. In addition, definitions create identity, which contributes to the maturity of the field.

Openness to criticism and a willingness to "hear" all of the sides go hand in hand. In the Clark and Kozma debate, it appears that the reader is left to decide between one or the other, when both stances have merit and problems. Each individual author "feels that his position is in the interest of prescriptive science" (Schrock, 1994, p.51), when in reality, they both share many of the same concerns. In examining the debate, it appears that "Clark could define the debate in a way that would always allow him to win" (Schrock, 1994, p.49), but then, so could Kozma. In a fruitful dialogue, participants would listen carefully and acknowledge the strengths and weaknesses in order to move jointly to a new, stronger, shared perspective.

The notion of "shared space" in a dialogue (Boone, 2001) does not mean that those involved in the dialogue have to be sitting in the same room. They could be in an electronically wired space, or even in a shared print space. Or at a conference, talking together face-to-face. The important point is that everyone is together. From this perspective, print media is one of the most available methods of disseminating and bringing information to the public in a shared space. Journals should publish entire dialogues, not merely one side or unrelated articles. Currently, most dialogues must be carefully researched in order for a reader to follow the discourse. Just for this team of researchers to gather the articles necessary for this paper took hours and hours. Most people do not have or will not spend the time necessary to get a complete picture of the dialogue. Journals should consider different layouts, such as publishing dialogues side-by-side, which would make the conversation both more accessible to readers and simpler to follow. The publication of debates or dialogues in the field should not be exceptional, but part of a discipline featured in a "shared space".

It is also vital that language used by theorists, including explicit examples, be accessible to readers, allowing them to freely join the conversation and assist in creating a feedback loop between theorists and practitioners. Convention planners should also consider designing sessions that invite this kind of dialogue and welcome both theorist and practitioners alike. The more these groups can be together, discussing the theories and best practices of the field, the richer the IT field will become, to everyone's mutual benefit.

Conclusions

We admit this to be a work in progress, but feel that our ideas and research have been in-depth and thorough. By focusing on a single example of a debate and dialogue we were able to examine it in depth and comprehensively. The Clark and Kozma debate has provided a gold mine of instances of verification and/or falsification and we will continue to look at different aspects of that debate as we move forward with our project.

In addition, the Popperian lens of falsification along with the Lakatos' perspective provided a useful background for our analysis of the debate and supported the foundational ideas of dialogue as well, thus providing a consistent method for viewing the construction of our guidelines. Although this is an initial paper we hope that it will foster an awareness of the need for dialogue. Future developments can continue to refine the process of dialogue to provide a mean for improving the discipline of the dialogue for the purpose of informing the IT field.

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Teachers Get into the Groove

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Abstract

Our physical teaching world, once filled with desks and blackboards, has become a virtual teaching world filled with computers and software. Walt Disney Pictures entertained everyone with "The Emperor's New Groove" but as students and instructors get into Groove software, entertainment is replaced by diligent, intense work as they learn processes to create a new environment. Is there a "happily-ever after" with this learning experience?"

Introduction

One of the goals of the Purdue Program to Prepare Tomorrow's Teachers to Use Technology (P3T3) is to provide technology-rich environments for faculty that will provide a model for future teachers. As participants, faculty members attend a "start-up" workshop to introduce them to the project, and to technology in the classroom. At the conclusion of the "start-up" sessions, faculty members develop and share personal technology integration plans. One of the plans conceived by a faculty member in Mathematics education was to incorporate a tool in the classroom that would enable students from the local Purdue site to collaborate with

? students in classrooms in other universities (nationally and worldwide),
? other faculty members, and
? consultants in the field.

Pervious attempts to use traditional distance education media such as videoconferencing using CU-SeeMe, Polycom, and WebCT provided limited capability to meet the goals of the course. As with any desire to change the design of a course, there are successes, failures, and challenges to meet the needs of the students - especially when technology is included in the changes that are made. Throughout this paper we will compare and contrast Groove with other technologies, document skills and attitudes needed to attempt distance education using technology tools, and provide information about other lessons we learned along the way. It is our hope that through this paper we might provide you with insights if you consider using a collaborative tool to expand your realm of educational possibilities so you can experience a "happily-ever after" with your students.

Theoretical Framework

Groove software – a Peer-to-peer networking system

Peer-to-peer (P2P) computing is "currently touted as the next 'killer application' for the Internet" (Gartner Consulting, 2001). Peer-to-peer means that the PC and the server are one and the same thing. Clay Shirky, a leading figure in the P2P community, stated "peer-to-peer is a swathe of applications that harness resources at the far edges of the Internet, where the machines have complete freedom (or, at least, significant autonomy) from the central servers" (Economist, 2001, p. 21). P2P technology is designed to enable shared resources. It provides a way for users to link together without the use of a server and facilitates data sharing, resource sharing, and workgroup collaboration. P2P can be compared with the concept of the World Wide Web - a system of hardware and software that has revolutionized the ability to find, store, and share information. At the same time, the Web can be compared with the use of a dictionary or an encyclopedia. It is a place where information and definitions can be found, but in order to find the information, you must have access to the resource itself (i.e., the book). With P2P networking, each user's computer has a full, personal copy of the resource media. But when used in the classroom, the instructor must apply disciplinary measures to the use of the media; it cannot simply be a place of storage. "To create a working knowledge community, users must make content available and functional, and community members must take the time to search for content, clarify information, and provide feedback as to its usefulness (Hofmann, 2002)."

Groove software is one of the many P2P software programs designed to provide solutions to today's needs to collaborate and integrate partners in the process of education. In an article in Business Week On-line Ray Ozzie states, "A recent Media Metrix report indicates the number of at-work users of Internet Messenger has increased by 22% in the past six months…[this will] drive adoption of peer-to-peer collaboration technologies such as Groove" (Kharif and Salkever, 2001). Groove consists of a comprehensive collaboration platform. The client, called the transceiver, includes a large variety of standard modules for discussion groups, P2P and server-based shared files, a sketchpad, voice and text chat, and scheduling (Yager, 2001). Groove tools include real-time communication using chats, file sharing, browsing together on the Internet, and instant messaging. These tools can be used is such a way that information can be archived in one shared space, improving file management and feedback capabilities.

WebCT

Olsen (2001) indicated WebCT is much more widely used in educational settings than Groove. It consists of four major functional areas: course content, course management, student tools and communication tools. It is a productive resource as long as you understand the creator's philosophy of an instructor's needs to teach a course. The instructor places their own course data into WebCT's interface and for the most part, it is ready to share with students. It is not easy to set up the software to allow outside instructors of professionals to be a visitor/participant for one or two sessions only. The key issues for focus in the WebCT environment are that information originates from one source (the instructor) and it should be monitored (time on-line, quizzes, grades), as in the face-to-face classroom setting. It is assumed that the syllabus doesn't change, that the instructor wants to hold on-line quizzes, that there is one teacher and many students. It is also fairly static - once information is added by the instructor it is assumed that it will not change since it requires a new upload of files each time there is a change. For instructors who use this philosophy, WebCT will provide an adequate mold for traditional distance education even though there are some problems associated with the software. For example, the interface design of WebCT is not intuitive (S. S., personal communication, May 7, 2002). Considering the tracking student function, Olsen (2001) indicated that the data gathered by the tracking system lacks sophistication, and users largely ignore the data. And the threaded discussion in the discussion board, LaMaster & Morley (1999) found that the way the postings were listed chronologically did not cause students to think, and students felt that interactions on the bulletin board were "like a chore."

Whereas WebCT uses a teaching philosophy for its design, Groove uses a business collaboration philosophy. It is assumed that nothing is static - there is need for constant change. Groove has many of the same features as WebCT: discussion boards, calendar, chat room, instant messages, and file sharing. It does not have on-line quiz capabilities or grade posting (although it certainly could be programmed to provide these things); but it does have other tools that are important to the project. It has the means to harness time outside of the classroom by facilitating collaboration on projects and participants can be added at any time so that multi-site project-based learning and coordinated workshops are possible.

Methodology

Who were we?

Researchers consisted of two P3T3 graduate assistants. One was assigned to the faculty member as technical support, the other as a research assistant. The researchers attended class each week and kept intricate records of student comments and interactions with each other and the professor. In addition, surveys and interviews were used to explore student attitudes and comments for Groove-mediated learning environment.

What did we Use?

Hardware	In the classroom a wireless Internet system and Laptop computers. Outside of the classroom the researcher's computer served as a primary resource for file sharing and shared spaces, with the professor's computer as a backup. Students also used a personal computer in their homes.
Software	Groove Preview Edition version 1.2, free from http://Groove.net.
Support	The researcher served as primary contact for hardware/software support. The IT staff in the School of Education, and Groove technical support and forums were also used.

How Was Information Distributed and Collected?

Students accessed the syllabus via a web page linked in one of the shared spaces. Resource materials (such as the book chapters) were provided in an asynchronous file-sharing tool or via an instant message. Students collaborated synchronously and asynchronously on projects using the discussion board and posted their projects there as well. Synchronous chatting on-line and Via Video (a video and audio transmission tool) were used for students who were attending the synchronous learning sessions from a distance. The researchers attended each class during the semester and analyzed student verbal and non-verbal reactions to the use of P2P networking.

Qualitative data were gathered from five sources:

1) the first online survey conducted during the 3rd week (collecting students' perceptions of the advantages and disadvantages of Groove),
2) the second online survey conducted in the last class of the semester (examined students' perceptions about the specific functions of Groove),
3) follow-up interviews conducted with four participants and the graduate assistant of the class (focused on participants' perceptions of differences between Groove and WebCT),
4) the researchers' discussions with student participants, and
5) observations of students' responses during the semester as noted and archived by the researchers.

Groove Integration

Successes

Class sessions were held once a week in the Twenty-first Century Conceptual Tools (TCCT) classroom located on campus. The photo on the right shows how the classroom is designed to enhance student and instructor use of computers in the classroom through the use of an open architecture. During the class sessions, the instructor chose a seat that allowed the best interaction with students. At times this was near the whiteboards to use for sketching, while at other times it was at the rear of the classroom to allow guests to see him during his lecture as they "attended" class using the ViaVideo teleconferencing system located at the television. Typically the professor opened the class session to questions about the assigned readings. After questions were answered, or if there were no questions, he would expand on the content in the readings or discuss application of content. Lectures were kept at a minimum - a forum of discussion was preferred. If conversation was slow, or when many ideas were discussed and the class was ready to move on to new concepts the professor would ask students to use laptop computers (provided for each student) and encourage students to share ideas in a discussion board and comment on postings made by others. This allowed students to convey their own thoughts, communicate them, and gather feedback from other students about their ideas. At specific times student also posted their Model Eliciting Activity (MEA) projects in Groove and solicited feedback from others about their ideas and the processes they used for instruction. This was also done during class time. After class sessions were complete, discussions continued inside of the network and outside of class in asynchronous style. The professor often would pose a question taken from a student response (or question) that was found in the previous class on-line discussion.

Throughout the semester, the researchers also used Groove to determine if a student was online. Groove provides a visual icon to indicate if a user is active on their computer. Since part of the research was designed to provide a preliminary look at the P2P tools rather than as a formative evaluation, the researchers generally did not use a set time or target a specific student. Instead they attempted to gather a sample of information from a variety of students at various times. Here is a sample of the kind of conversation that occurred during the semester:

Researcher: 1/30/02 4:52 PM

Let's try an experiment if you have the time…Yes?

Student: 1/30/02 4:55 PM

Well, thanks for being so patient with me (with all of us) as we adjust to this groove thing. Yes I can try your experiment

Researcher: 1/30/02 4:54 PM

I'm going to send you a new invitation. Give me a minute. Notice on the left column that I'm going to leave the "Active" space (just a tip for future use)...

As noted by the student, there was some difficulty transferring class work to the Groove setting, but the instructor provided a great deal of assistance, technical and time, for them to adjust to the new setting. Both researchers believe this is a key component of designing a course when new technology is a principle factor.

Ultimately, the researcher made the following conclusions:

- The instructor can have more ownership of the class with Groove when compared with Web CT because Groove does not require a central server.
- Learning extends beyond the classroom activities. Using real-time communication, Groove provides students have an opportunity to learn from each other. This can happen inside or outside of the classroom. Two of the students indicated they preferred to share their thoughts with classmates in real-time communication as compared with discussion boards.
- Management of information is improved. In Groove environment, students are able to create their own shared space without the supervision of the instructor. One student stated, "Shared space is helpful to keep your tasks separated."
- Interface design is user-friendly. During an interview, one student said, "In Groove's learning environment, it's much easier to navigate through the windows, you have the various tabs all within one screen."
- Multitasking opens new areas for research and functionality. During the interview, one student said she could do multi-tasking in Groove. For example, she could do a chat with one student and at the same time send information to a student at home. This was perhaps the greatest discovery for the researchers. Students are familiar with multi-tasking. They talk on the telephone, watch television, and type homework at the same time. Using chat rooms on-line, they control more than one conversation at a time. Yet the traditional classroom remains focused on full attention to only one form of communication at a time, whether it is a lecture, a video, or a reading assignment. The truth is, in the traditional classroom students may take notes and appear to transcribe the lecture - but they are, at best, writing notes that incorporate their own thought process and relate the information to their own systems of knowledge.

  In the classroom during synchronous learning sessions, students may have technology-mediated communication with multiple people while remaining task-focused. The simplest example of this was experienced at the beginning of the semester when students used laptops in the classroom. The technology assistant was available in the classroom during the discussion. Without disturbing the class, students would use Groove instant messages to inform the assistant of problems (such as low batteries or software glitches). The assistant responded to the problems on an individual basis with minimal interruption to others. Students became adept at doing the same kinds of things. One student shared, "Being able to use Groove independently fromthe Professor in class is a real opportunity to learn from others and feel more comfortable about sharing thoughts with classmates of the same level of understanding."

  Due to unforeseen circumstances, two students entered one class session remotely. Both attended class using Groove, although one also linked using Polycom. Audio from the local site was available with the Polycom unit, but remote audio did not transmit. The student immediately used a chat function in Groove asking for support and determined the problem could not be fixed before the start of the class. Groove chatting was used to communicate the information instead. Both remote students entered the chat area with the technical assistant who transcribed the lecture for them. At the same time, the support assistant had to manage problems in the classroom. There were times that instant messages or chats from other students were opened and responded to without the remote students' being aware of the interruption. At one point, the technical assistant was managing 3 conversations at the same time while still transcribing lecture notes. This might be considered a remote instance of multi-tasking; but both remote students reported that they were also joining in smaller chats with students at the local site as well. One remote student was very excited about this capability, as it challenged her to remain involved in the discussion and projects that were developing at the local site rather than feeling isolated and uninvolved. It was natural for her to manage multiple tasks at the same time and Groove facilitates this very well.

Challenges

Groove is computer dependent. If a student uses more than one computer (and most do), the software must be loaded on each one. The student must also use identities unique to each computer so that others can determine which location they want a message to send a message. For example, one of the researchers has 4 accounts which are differentiated as follows:

? her name_office,
? her name_class

- ? her name_laptop
- ? her name_home

If a student wanted to contact the researcher, he/she would look at the list of users on-line first to see if the researcher was active. If not, timing would dictate where the message would be delivered, e.g. after working hours, messages were sent to the home account. Switching machines is a real inconvenience. Shared spaces cannot be accessed without an invitation from an active participant, and computers depend upon one another, so if a person is off-line, data may not be transferred when it is needed by the recipient. One student complained, "There were times this year when I was traveling and missed a lot of stuff in Groove simply because I didn't have access to it. It also took up a lot of space on my computer."

To use Groove efficiently and effectively, RAM is an issue on older computers that are not upgraded. It also requires a fast Internet connection or file downloads can keep the user on-line for an hour or more simply transferring files. During chats, the faster computers will "log" messages more quickly and keep the user in the conversation with a real-time presence. Slower computers cause a delay in posting messages in the chat and could cause the message to appear in the wrong place in a conversation.

Even though multi-tasking comes natural to us, one student felt use of the computer to "pass notes" without stopping the class, was still an interruption. Students are aware of computer keyboards being used, and eyes that aren't on the speaker during class discussions or lectures. For this student it was distracting and irritating - they perceived the others who used the keyboard were not paying attention or "telling secrets.". One student who enjoyed multitasking even offered their own problems using the "quiet conversations" in the background saying, "…it also allows for some distractions, especially when those chats turn to other, unrelated topic."

Comparison with WebCT

Groove and WebCT are built on different philosophies. The professor said, "Groove was designed for business settings. Groove encourages informal, unmonitored, off-line communication and provides more open environment. However, WebCT was designed for instructional settings."

There is a difference in course design and management. One researcher's observations and discussions with the graduate technical assistant who designed the course indicated that it takes minimal technical requirements to prepare a course for Groove. At the same time, more effort must be made to transfer knowledge of the way Groove works on multiple computers and the understanding of the hardware requirements to make the tool work for the course. The assistant also indicated that her experience with WebCT requires uploading course materials into a server File Manager. Simple additions and changes require a significant number of mouse movements and clicks to upload the data.

Technical support in the classroom is needed much more when using Groove and videoconferencing. Because, for the most part, WebCT is asynchronous, and Groove partnered with videoconferencing is intended to be synchronous, it is imperative that technical assistance is available for the occasional glitches and failures. Loss of transmission could mean the delay of a class with Groove, but with WebCT students simply log in at a later time to retrieve information they need or read messages they've missed in the on-line discussions.

Students find the word processing capabilities in Groove much simpler. The discussion area allows bold, italics, color changes in text in a fashion similar to a word processor. WebCT requires the use of HTML programming tags to change the font/size characteristics.

Instructors find key components such as on-line quizzes and grade books available in WebCT, but missing in Groove. For instructors who find these tools useful, Groove's testing/grading process is much more difficult and requires additional resources to program the software to meet the instructor's needs.

Outcomes

When students are faced with opportunities to use multiple resources to gain knowledge (all available at their desktop), instructors must be prepared to change their own ways of thinking based upon results apparent from the instruction. No longer does the instructor need to be the major source of information. Instead they must facilitate and mentor students to become problem-solvers (as indicated by the student who contacted others for help when the researcher was not available) and help students develop higher-level thinking as shown by the deductions made by students who used Groove for multi-tasking and recognized their own abuse of the system. In this way students will leave the "classroom" with multiple possibilities for learning. Students may actually develop skills rather than gain specific information - and this is probably the best result.

Additionally, students were asked to provide feedback when the research and projects were completed via the collaborative tools in Groove. Feedback from multiple students gave a much broader sample of potential problems with the student's design or instruction within the project. The diverse responses students provided to each other proved that this system is effective and perhaps even necessary for coursework. It is the agreed opinion of the researchers that students find the collaborative tools a positive means to share ideas and generate synergy as they create their course assignments.

Old ways of explaining concepts via lecture and text must be replaced with new ways of communicating. Considering all of the tools available in P2P software, it is restricting to limit a student's resources to text, lecture and discussion simply sent via distance education tools. Even though these text, lecture and discussion tools are restrictive, they should not be eliminated. Instead instructors should push to become multi-tiered designers and communicators. And because technology changes daily, the instructor will almost certainly be in a position that the course will always be in a state of evolution. It will probably never be designed in such a way that changes become minimal - as they are when textbooks and paper handouts accomplish course objectives. But the success of this course and potential for future collaboration transform obstacles into challenges.

Recommendations

Instructors who prepare for many changes, challenges and opportunities when using technology-mediated communication are rewarded beyond the success of their students; they are also provided with insights for future research and exploration into a new form of "distance education." Many smaller obstacles may still remain such as time zone problems, sometimes overwhelming weekly discussions, and balancing students who have diverse skills with technology, but the four main themes targeted in this paper confirm the need to gather statistical data and continue the research to determine if this evolving form of distance education can be successful for both students and instructors and create a platform for multi-tasking, multi-functional systems for technology, students, and instructors. Instructors who consider using this tool must first consider their needs and the abilities of the students. Without proper control of any technological tool, students will be lost in the technology and gain no content during the instruction.

Here are some questions an instructor should ask before considering this software:

? Should I use outside participants for instructional modules to enrich my course?

? Do my students have the ability to access the software outside of the classroom? (They cannot depend upon PUCC labs for this software or for support)

? Will students be technology proficient enough to follow on-line help or instruction (as indicated in this research) without face-to-face instruction?

? Will students be savvy enough with technology to take the tools beyond a beginner's level and push themselves to utilize the strengths of this system (i.e. collaboration, harnessing work outside of the classroom, multi-tasking, etc.)?

? Am I willing to devote my time for supporting the technology or enlist a support team for my students?

If the answer to most of these questions had been "no," distance education tools like WebCT may be be the best alternative since they are designed for instruction. But since the answer was "yes," then P2P networking provided a source for further research and trial. It has the capability to change not only what is "done," but to also change "ideas about learning" as students challenge instructors with their abilities to go beyond course goals and objectives into a real world of student-centered distance education. And that, we believe, would be a new Groove every emperor (or instructor) would live with "happily every after."

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Acknowledgements

The contents of this paper were developed under a grant from the U.S. Department of Education. However, those contents do not necessarily represent the policy of the Department of Education, and you should not assume endorsement by the Federal Government.

An Examination of the ARCS Model: The Impact of Relevance, Activation and the Model as a Whole on Learning

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The Role of Relevance in Motivation and Learning

Keller maintains that motivation "is the neglected heart of our understanding of how to design instruction" (1983, p. 390), and in response, developed the ARCS Model of Motivation design (1984, 1987a). This model views motivation as the combined effects of attention, relevance, confidence and satisfaction. Keller has supported these elements from a rich psychological research base. The ARCS model has been widely embraced by designers as an intuitive and simple tool to facilitate learner motivation. However, the attention, confidence and satisfaction components seem to have a more robust body of empirical support (e.g. Bandura, 1977; Dweck, 1986; Fleming, 1987; Kanfer & Ackerman; 1989; Schunk, 1985), than does the relevance component. More specifically, attention, confidence and satisfaction have strong links to learning theory, both behavioral and cognitive. This paper presents that while relevance has lagged behind the other ARCS components in research, its impact on learning may be directly tied to recently developed cognitive processes.

The Concept of Relevance

Relevance is a term laden with many meanings. Most commonly it implies perceptions of interest, value and utility, and it has been studied from each of these orientations, although these orientations are often overlapping. For example, Herndon (1987), Deci, (1992), Schiefele, (1991), Small, Dodge & Jiang, (1996), and Dabbagh, (1996) all examine the role of interest in their work on relevance. They all suggest that if something is interesting to the learner it is relevant. For example, Dabbagh (1996) found that by increasing personal relevance (the degree to which the content is tied to previous experiences and interests) reports of motivation increased, as did the time spent engaged in the CBI program.

It is often difficult to distinguish between relevance viewed from the interest-orientation, and attention. Mahoney & Lyday (1984) provide a clear example of relevance; it is important to note that they talk about this factor in terms of learner interests. This obscure distinction between "relevance" and "interests" makes it difficult to discuss the role relevance plays in motivation conclusively, for much of the content that interests learners, interests them specifically because the content has some value to their life. It is often difficult to determine which of these variables is more influential.

Small, Dodge and Jiang (1996) attempted to clarify the overlap that exists among many of the ARCS variables. For example, does the interest variable support perceived relevance or sustained attention? To do so they asked students a series of question about what contributed to their interests and boredom. Their analysis of the responses showed that attention and relevance (or a lack of) accounted for the vast majority of boring and interesting situations. Furthermore, students reported that the value of the learning task greatly influenced motivation. In addition, when asked about boring situations and relevance, students gave a high rating to instructional materials. Indicating that if the instructional materials did not have a high degree of relevance, they were boring. .

Value is also central to a discussion of relevance. Value is best described as utility. One is likely to attribute value to something and deem it relevant if it is useful. Utility is a critical aspect of relevance. Studies have shown that if learners perceive the value of instruction their motivation will increase. For example, Bainbridge-Frymer and Shulman (1995) examined relevance and state motivation (a student's motivation for a specific task, subject at a specific time). Their examination of 470 undergraduate students found that relevance, as reported on a Likert scale measuring elements of interest and value, accounted for a significant amount of the variance in state motivation. In their study, subjects reported a benefit from the learning. Indeed they believed something was "in it for them" and that there would be a reward for their efforts. Indeed rewards are another way to assign value.

Value can also be discussed within the framework of goal orientation (Dweck, 1986; Dweck & Leggett, 1988). Instruction has value if it is useful in aiding one to reach one's goal. Indeed, Hudson (1988) found this indirectly in her work with disruptions and recall. Apparently "relevance to the goal appears to be a better predictor of an actions long term recall" (p. 171-172). Finally, Henderson's (1990) study could be viewed as an example of relevance in that the students' cultural value of money has made money useful. Hence, by involving money into the design of instruction, Henderson has introduced a factor of relevance into the subject matter of accounting.

Questions regarding the utility of a topic may be answered quite differently than questions regarding its interest. In fact, in work related trainings, participants may hold the instruction valuable in utility and its importance to their job; yet, find it of little interest. High ratings of utility and low ratings of interest could both be presented under the larger term of relevance and give very different assessment of the "relevance" of the instruction. Studies that equate relevance with utility or usability are also prevalent (Quilter & Harper, 1988; Mahoney & Lyday, 1984; Cennamo & Braunlich, 1996; Roser, 1990; Sass, 1989; and Bainbridge-Frymier & Shulman, 1995). Quilter and Harper (1988), for example, found that a lack of utility was the main deterrents to success in mathematics of 152 college degreed adults. After conducting both surveys and interviews the highest scoring variable was "relevance of mathematics" thus supporting the importance of relevance in the instructional process.

In an examination of computer-based training, Mahoney and Lyday (1984) further support the importance of relevance. When designing CBT for employees within an organization, the CBT should focus on the learner's organization, as well as on the learner. This dual focus builds in factors of relevance and usefulness so that a CBT learner can immediately see how this training relates to his or her job. Small and Gluck (1994) used a magnitude scaling approach to determine the relationship between 35 related terms and the four ARCS components. Results showed that the closest relationship is between relevance and the related term meaningfulness. This result supports the role of value in determining relevance.

Relevance and Prior Knowledge

Instructional designers routinely assess learners' prior knowledge of an instructional topic and link new content to it, and prior experiences have been previously linked to perceptions of relevance. The relationship between these two learner characteristics, however, is not clear. Smith and Ragan (1999) urge designers to draw on learners' previous knowledge to facilitate the connections between learner prior knowledge and the instructional content. One way to clarify the nature of relevance in instruction and learning may be to draw on its link to cognition and prior knowledge. If the definition of relevance were expanded to include to emphasize one's prior knowledge, then activation of that knowledge may promote perceptions of relevance.

The question of the role of the activation of prior knowledge in learning is also unanswered. Can activation facilitate perceived relevance and expand motivation, and as a result, increase learning? Does awareness of the link between prior knowledge and relevance have any impact on motivation and learning? Researchers have looked at cognition and learning, motivation and learning, but have not systematically studied the relationships of cognition, motivation and learning.

From a definition standpoint, it would no longer matter if instruction is perceived as useful or interesting. What would matter would only be the learner's related prior knowledge. This would determine relevancy. Since many have affirmed that perceptions of relevance increase motivation, one could logically posit that the activation of prior knowledge would also promote motivation, and subsequently learning itself. This was the problem addressed by this study.

Conceptual Model

Figure 1 shows the conceptual model that guided this study. It hypothesizes an explanation of how previous experience with an instructional content combined with activation of this previous knowledge effects relevance, motivation and learning.

FIGURE 1. Conceptual Model

This model was designed to promote further exploration of some of the processes involved in learning. Beginning with the presentation of content, a memory trace may be activated if the learner has had previous experience with that content. The question is whether perceptions of relevance and motivation are extended by activation of previous experience with content, thereby increasing learning. In the case of novel and irrelevant content areas, the question becomes can activation be manipulated to achieve similar effects.

This model also included two metacognitive processes. The learners' awareness of the link brings a new aspect to these complex relationships. Connectionist models posit that new information is linked to prior knowledge with similar features. This mental process happens swiftly and often without awareness. This model suggests that the learners' awareness of any connection or link between their previous experience and the instructional content may influence perceptions of relevance, motivation and learning. It also suggests learners may continually activate knowledge every time they think about the content and/or instructional experience. This repeated activation strengthens the connections within the brain and thus strengthens learning (McClelland, 1988). This model proposes that continued activation may be affected by one's previous experience with the topic, and an individual's awareness how the topic connects to his or her prior knowledge. These may in turn lead to an increase in perceptions of relevance and the other ARCS variables of attention, confidence, and satisfaction. Their role in a this model and their influence on motivation is unique.

Research Design

Population

The population for this study was 142 volunteer Instructional Technology graduate students. These students range in age from mid-twenties to over 60, and are typically employed full-time while pursuing their degrees part-time. They have a wide range of undergraduate degrees and hold jobs in fields such as elementary and secondary education, higher education, nursing, computer technology, automotive production, industry training, and non-profit work.

Research Design

This study used a variation of the Solomon Four experimental design. The independent variables were previous experience with the instructional content, perceived relevance (interest, value & use) of the content, and perceived motivation. The dependent variable was learning as determined by completion of a test of knowledge acquired. The four groups manipulated in this study were:

1. familiar content/ with activation of prior knowledge strategy;
2. familiar content / with no activation of prior knowledge strategy;
3. unfamiliar content / with activation of prior knowledge strategy and
4. unfamiliar content/ with no activation of prior knowledge strategy.

Table 1 presents the research design guiding this study.

Table 1. Study Design

R_1	$P_{E/R//M}$	O_F	2 week delay	R_1	Act. of O_F	$T_{R/M}$	O_T
				R_2	No Act. of O_F	O_T	$T_{R/M}$
$\mathbf{R_2}$	$P_{E/R/M}$	O_U	2 week delay	R_3	Act. of O_U	$T_{R/M}$	O_T
				R_4	No Act. of O_U	O_T	$T_{R/M}$

R	Random assignment into treatment groups
$P_{R/MR}$	Pre- measure of previous experience, perceived relevance of content and motivation to learn
O_F	Presentation of familiar content with which subjects will have had some prior experience
O_U	Presentation of unfamiliar content with which subjects will not have had prior experience
$T_{R/M}$	Post- measure of processing, perceived relevance of content and motivation to learn
O_T	Test of knowledge acquisition

Strategies to Control Prior Knowledge

The most obvious way to control the amount and level of prior knowledge is to control the topic. Subjects are not likely to have much previous knowledge if the topic is novel or fictitious. Hence there will be far fewer units to activate and connect to the new information. (See Machiels-Bongaerts, Schmidt and Boshuizen, 1995.) One can argue that the topics selected in this study represent varying levels of relevance. In the first group, the topic not only activated prior knowledge, but also had interest and value to the subjects. The second group, which had the more obscure topic lacked interest and perceived value as well as extensive prior knowledge. The use of instructional topics with differing levels of prior knowledge will be used in this study to manipulate both relevance and prior knowledge activation.

A list of potential topics was compiled and piloted with a group of 12 Masters students. They were asked to rate each topic on a Likert sale corresponding to the amount of previous experience and knowledge they had on a topic as well as their interest, use and perceived relevance of that topic. The topic, migration patterns of Canadian moose, was identified as the least interesting and least useful. It also had the lowest rating of previous experience and prior knowledge (average rating 4.75 for prior experience and 4.08 for relevance). This sample also indicated that the topic of most interest and relevance was "APA formatting Guidelines" (average 2.4 for prior knowledge and experience and 1.8 for relevance). Therefore, these two instructional topics were selected to control for previous knowledge and relevance.

Treatment and Assignment

Subjects were randomly assigned to one of two groups: familiar/relevant content (APA guidelines) vs. unfamiliar/irrelevant content (migration of moose). Subjects completed a "pre-instruction" questionnaire to identify their knowledge of the topic and perceptions of attention, relevance, confidence and satisfaction for the topic. This questionnaire was based on the instrument created by Keller & Subhiyah (cited in Bohlin, Milheim, & Viechnicki, 1993-94).

Subjects in the unfamiliar/irrelevant content group received instruction on a topic with which they were predicted to have no prior knowledge. The instruction involved a 15-minute presentation on the migration patterns of a herd of Canadian moose. Subjects in the familiar/relevant content group received a 15-minute presentation on how to cite electronic references in APA format. A professional trainer delivered the instruction and used a PowerPoint slide presentation to guide the delivery.

After a two-week delay, subjects were randomly assigned to two sub groups (those who would receive specific activation strategies and those who would not). Subjects completed a post-instruction questionnaire and a test to measure their learning of the content.

Data Analysis

Factorial ANOVAs were used to identify differences in the dependent variable and the treatment groups and differences related to perception of relevance and motivation and learning. MANOVAs were used to identify any relationships between the activation treatment and subjects' perceptions. Finally to test the proposed conceptual model, a path analyses was also completed. This analysis included variables on subjects' awareness of metacognitive processes and continued activation in addition to previous experience, perceptions all to predict learning as the desired outcome. A secondary analysis was also completed to explain selected unanticipated outcomes pertaining to influences on learning, and the role of the individual ARCS variables and the model as a whole.

Results

Effects of Perceptions of Relevance and Perceptions of Motivation on Learning

This study examined the differences in learning between groups with varying perceptions of topic relevance and varying levels of motivation. It addressed differences in learning between high and low perceptions of relevance and high and low perceptions of motivation. A 2 x 2 factorial ANOVA was used with learning as the dependent variable. Perceptions of relevance were taken from the questionnaire and rated as low or high. Perceptions of motivation were likewise used. Table 2 presents the data from this ANOVA.

Table 2 Differences in Learning by Perceptions of Relevance and Motivation

Source of Variance	Sum of Squares	df	Mean Square	F	**Sig**
Explained Variance					
Perceptions of Motivation	.0001	1	.0001	.003	.956
Perceptions of Relevance	.0000	1	.0000	.000	.995
Perceptions of Motivation x Perceptions of Relevance	.017	1	.017	.491	.485
Unexplained Variance	4.23	120	.035		
Total Variance	4.25	123			

The comparison of learning by perceptions of motivation produced an F ratio of .003 which was not statically significant at a .05 alpha level. When perceptions of relevance were compared, the F ratio of .000 was also not significant. The interaction effect of motivation and relevance produced an F ratio of .491 for total learning which was not statically significant. Descriptive statistics were obtained to examine the results between groups. These descriptive statistics are presented in Table 3.

Table 3 Descriptive Statistics for Learning by Perceptions of Relevance and Motivation

Independent Variable	**N**	Mean	SD
Perceptions of Relevance			
High	63	.59	.19
Low	61	.59	.19
Perceptions of Motivation (ACS)			
High	60	.58	.18
Low	64	.59	.19
Relevance x Motivation			
High Relevance x High Motivation	57	.58	.18
High Relevance x Low Motivation	6	.63	.21
Low Relevance x Low Motivation	58	.59	.19
Low Relevance x High motivation	3	.63	.13

There was no difference in the mean scores of groups reporting high levels of relevance (m=. 59, SD=. 19) vs. those who reported low perceptions of relevance (m=. 59, SD=. 19). Likewise there was no difference between groups reporting high levels of motivation (m=. 58, sd-.18) and groups reporting low levels of motivation (m=. 59, SD=. 19). Finally, the interaction between perceptions of relevance and perceptions of motivation did not produce statistically significant differences. These findings suggest that neither perceptions of relevance nor perceptions of motivation were influential in determining learning in this study.

Effects of Activation on Perceptions of Relevance, Perceptions of Motivation and Learning

The effect of activation strategies was also questioned in this study. This analysis examined differences in perceptions of motivation, perceptions of relevance and learning when memory is activated. This analysis also included perceptions of motivation and relevance and learning and but this time examined them in relation to the activation treatment. To determine if there was a difference in perceptions of relevance and motivation and in learning, a one-way multiple analysis of covariance (MANCOVA) was used. The independent variable in this analysis was memory activation, with post questionnaire scores on perceptions of relevance and motivation were used as covariates. Table 4 presents the results of the MANCOVA.

Table 4 Multiple Analysis of Covariance – Relevance, Motivation and Learning by Memory Activation

Hotelling's Trace	F Ratio	Df	Sig of F
.13	5.03	3, 118	.003*

The MANCOVA resulted in a Hotelling's trace of .13. The F ratio of 5.03 was statically significant at an alpha level of .05 with 3 and 118 degrees of freedom. The two covariates, perceptions of relevance $F (3, 118) = 38.45$, $p<.001$ and perceptions of motivation $F (3, 118) = 30.35$, p<001. To determine which of the dependent variables was contributing to the statically significant results, the univariate F test was completed. The results of this analysis are presented in Table 5.

Table 5 Univariate F tests – Relevance, Motivation and Learning by Activation

	N	**M**	Std. D	df	F	Sig.
Perceptions of Relevance						
Nonactivation Group	59	13.42	6.90	1, 120	3.83	.053
Activation Group	65	13.43	7.00			
Perceptions of Motivation						
Nonactivation Group	59	28.19	12.46	1, 120	5.69	.019*
Activation Group	65	28.86	12.09			
Learning						
Nonactivation Group	59	.54	.18	1, 120	8.92	.003*
Activation Group	65	.63	.18			

Two of the three measures, perceptions of motivation and learning differed significantly between students who received the activation strategies and those who did not. The difference between the two groups on perceptions of relevance did not differ significantly.

The F ratio of 5.69 resulting from perceptions of motivation was significant at an alpha level of .05 with 1 and 120 degrees of freedom. An examination of the mean scores showed that students who received the memory activation strategy (m=28.86, ad=12.09) had significantly higher motivation than those who did not receive the activation treatment (m=28.19, SD=12.46)

A comparison of the learning scores between the groups resulted in an F ratio of 8.92, which was statically significant at an alpha of .05 with 1 and 120 degrees of freedom. This result indicates that students who were assigned to the memory activation group (m = .63, as=18) had significantly higher scores than students who were not in the activation group (m=.54, SD = 18). These results demonstrate the positive impact of the activation treatment on learning.

Test of Conceptual Model

This study addressed what the relationships among learning and previous experience with content, activation of memory trace, relevance and motivation. The hypothesized model presented previously in Figure 1was tested using path analysis techniques. Table 6 presents these findings and Figure 2 presents the resulting model.

Table 6 Factors Predicting Learning

Dependent Variable	Causal Variables	b	SE B	ß	T	Sig. T	R^2 for path
Learning	Constant	.525	.077				
	Motivation Factor (ACS)	.054	.026	.288	2.09	.039*	.111
	Perceptions of Relevance	-.015	.005	-.545	-2.91	.004*	.064
	Awareness of Link	.036	.020	.301	1.83	.070	.136
	Memory Activation	.080	.032	.217	2.51	.013*	.063
	R Square = .138						
Endogenous Variable	**Causal Variables**	**b**	**SE B**	**ß**	**T**	**Sig. T**	**R^2 for path**
Motivation Factor (ACS)	Constant	-1.84	.224				
	Perceptions of Relevance	.076	.016	.526	4.66	.000*	.632
	Continued Activation	.036	.017	.156	2.17	.032*	.564
	Awareness of Link	.155	.068	.240	2.28	.025*	.537
	R Square = .632						
Perceptions of Relevance	Constant	.332	1.26				
	Continued Activation	.158	.092	.099	.1.72	.089	.756
	Awareness of Lin k	3.15	.250	.706	12.63	.000*	.750
	Previous Experience	.261	.087	.174	2.99	.003*	.357
	R Square = .756						
Continued Activation	Constant	2.88	1.22				
	Awareness of Link	.823	.235	.296	3.50	.001*	.381
	Previous Experience	.380	.079	.408	4.84	.000*	.317
	R Square = .388						
Awareness of Link to Prior Knowledge	Constant	1.22	.458				
	Previous Experience	.175	.026	.523	6.76	.000*	..269
	R Square = .276						
Alpha = .05	**N = 124**						

FIGURE 2. Resulting Model

Secondary Analyses

The results of the above analyses raised some questions. While the literature predicted differences in learning based on previous experience, prior knowledge and perceptions of relevance and motivation, these results show that learning was only affected by the activation strategy. However, learning was measured by correct responses on an achievement test. A more extensive examination of this learning variable was completed in an effort to understand the unanticipated lack of influence of prior experience and motivation variables. The mean achievement score was 59% with a standard deviation of 0.19. The majority of subjects scored in the range of 55% to 78% correct. These scores represent a lower than average test performance regardless of instructional topic. The lower scores could help explain the lack of significant effects from previous experience and motivational variables. The results pertaining to the influence of motivation variables were also unexpected. To examine the relationship among the motivation variables and learning, a correlation matrix was created. Table 7 presents the results.

Table 7 Correlations for Motivation Variables and Learning

	Learning	Perceptions of Relevance	Perceptions of Satisfaction	Perceptions of Attention	Perceptions of Confidence
Learning					
Perceptions of Relevance					
Correlation	-.033				
Significance	.714				
Perceptions of Satisfaction					
Correlation	.113	.732*			
Significance	.121	.000			
Perceptions of Attention					
Correlation	.105	.639*	.850*		
Significance	.245	.000	.000		
Perceptions of Confidence					
Correlation	.199	.625*	.549*	.430*	
Significance	.189	.000	.000	.000	

N = 124

These data indicate no significant correlation between variables of motivation and learning. In addition, the correlation matrix illustrates how highly correlated the ARCS components are. They act as suppressors to the entry of other independent variables into a regression. It is interesting to note negative correlation between perceptions of relevance and learning. This correlation indicates lower ratings for relevance actually resulted in higher scores on the final test.

Manipulation of ARCS

Secondary analyses were completed due to the manipulation of ARCS. Keller's ARCS model of motivation (1987a) suggests that motivation is made up of an attention variable, a relevance variable, a confidence variable and a satisfaction variable. How these variables are treated can vary. For example, this study combined them in some cases to create one variable for overall motivation. In other situations, they were each treated separately as four distinct variables. Yet, this study was particularly interested in the role of relevance as it relates to prior knowledge, the activation strategy, the other ARCS variables of attention, confidence and satisfaction and finally learning. As such, the variable of relevance was kept separate for much of the study. However, this created a statistical problem. If relevance was separated, any analysis relating it to overall motivation could not use ARCS (all four variables) as a referent due to collinearity. Relevance could not be used in both its own variable and in an overall motivation variable. A series of secondary analyses were completed to understand the dynamic among the ARCS variables.

First a reliability coefficient was calculated for items 6 through 15 on the instruments -- those measuring perceptions of attention, relevance, confidence and satisfaction. The resulting coefficient was .923 with an N of 124 signifying internal consistency and good reliability for the instruments as a measure of perceptions of the ARCS variables. However, when a factor analysis was competed for these items, they loaded as two separate factors but with no logical explanation for the split. Table 8 presents to results of this analysis.

Table 8 Factor Analysis of Questionnaire Items Related to Perceptions of Motivation

Questionnaire Item	Factor One	Factor Two
Item 6 – Relevance	.816*	.353
Item 7 – Relevance	.943*	.150
Item 8 – Relevance	.895*	.286
Item 9 – Awareness of Link	Not a measure	of motivation
Item 10 – Relevance	.861*	.400
Item 11 – Relevance	.219	.913*
Item 12 – Attention	.379	.872*
Item 13 – Attention	.257	.905*
Item 14 – Confidence	.630*	.339
Item 15 - Satisfaction	.397	.823*

These data indicate that Factor One consists of items 6, 7, 8, 10, and 14 (four items related to relevance and one item related to confidence). Factor Two consists of items 11, 12, 13, and 15 (one item related to relevance, two items related to attention and one item related to satisfaction).

An additional factor analysis was completed regarding the variables of perceptions of attention, relevance, confidence and satisfaction. When these four individual variables were loaded they loaded as one variable representing overall motivation. Table 9 presents the results of this analysis.

Table 9 Factor Analysis of Perception of Motivation Variables

	Factor One
Perception of Attention	.888
Perceptions of Relevance	.871
Perceptions of Confidence	.640
Perceptions of Satisfaction	.938

These data support the concept of the ARCS model of motivation as one unified variable; however, relevance was of particular interest in this study. It was a manipulated variable through selection of instructional topic and use of the activation strategy. As such relevance was statistically removed from ARCS and treated as one factor leaving attention, confidence and satisfaction as a second factor representing motivation. Table 10 presents the resulting factor coefficients.

Table 10 Factor Manipulation of ARCS Variables

Questionnaire Item	Factor One – Perceptions of Relevance	Factor Two – Perceptions of Motivation (ACS)
Relevance	.816	
Attention		.888
Confidence		.640
Satisfaction		.938
Item 10 – Relevance	.861	.400

These factor coefficients were subsequently used in the regressions for the path analysis presented in Figure 2.

Discussion

This study examined the degree to which prior knowledge, activation of that knowledge, specific metacognitive variables, and perceptions of relevance and motivation influence learning. It emphasized the role activation, relevance, and motivation play with respect to learning when they are combined and manipulated. By further understanding these relationships, instructional designers and educators may improve their instructional strategies, build a basis for incorporating metacognitive strategies into instruction and enhance motivation itself.

This study sought to apply the concept of activation to instructional design. It tested the utility of building on learners' previous knowledge to facilitate the connections with new instructional content. This study examined activation of prior knowledge as a means of facilitating relevance and motivation. Such a relationship would provide support for existing design practices such as content sequencing, use of advanced organizers, transfer strategies, and applied the recent tenets of connectionism to them. A relationship between the cognitive process of activation and relevance would provide additional theoretical support for relevance as an important element in learning. Finally, the complex relationships between prior knowledge, motivation and their effects on learning might be more fully understood.

The second purpose of this study was to add to the understanding of the ARCS model of motivation (Keller, 1984, 1987a), especially the relevance component. Relevance has less research support and may be related to connectionism if relevant information can act as an activation cue. A main tenet of ARCS is that it influences learning (Keller, 1987a, 1987b). The literature is rich with data supporting the role of attention, satisfaction and confidence in learning, and some data exist that lend support to relevance's influence on learning. Yet, research on ARCS as a unified model of motivation is needed.

The resulting model seen in Figure 2 suggests the role of prior knowledge, activation and motivation in learning. These resulting relationships are consistent with the literature. Activation of prior knowledge clearly has an impact on recall and subsequent learning (Anderson, 1981; Carr and Thompson, 1996; Madler, in Kihlstrom, 1999; Diamond and Rozin, in Kihlstrom, 1999; Burgess and Hitch, 1992; McClelland and Rumelhart, 1988). Motivation also influences learning (Fleming, 1987; Dweck, 1986; Dweck & Leggett, 1988; Mahoney & Lyday, 1984; Small and Dodge, 1996; Schiefele, 1991).

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The role of activation in learning is supported by the previous research. Activation of prior knowledge helps connect new information to prior knowledge. Activation of prior knowledge affected subjects' learning in both instructional topics in this study. Furthermore, instructional strategies to facilitate activation improved subjects' recall of this information for the final test.

This study hypothesized that activation of prior knowledge would influence perceptions of relevance. This belief prompted the isolation of relevance from the other ARCS components, but the results did not support the hypothesized influence of activation on perceptions of relevance. This finding is puzzling, but a possible explanation lies in the collinearity of the ARCS components. Given the high correlation of each component, when relevance was removed, the remaining three elements (ACS) account for so much of the variability that little is left for perceptions of relevance to affect.

The data, however, do support the activation strategy's effect on learning since subjects who received the activation intervention performed significantly higher on the final test. These findings lend additional support to the connectionism literature and may explain the information retrieval process. They support the idea that "retrieval of an item from memory consists of activating its internal representations, that activation of a node spreads through the links to other nodes in the network" (McNamara, 1999, p. 118). In this study, presentation of a cue to subjects in the activation group activated their representations of "Moose" and "APA Guidelines." This activation may have also impacted related knowledge and strengthened information retrieval on the test.

Activation of prior knowledge predicts learning, but it also important in other ways. The results of the experiment suggest that activation influenced perceptions of motivation. Activation also appears to influence changes in subjects' perceptions of relevance, confidence and motivation from pre-to post instruction. Activation of prior knowledge may a powerful tool for instructional designers

This study attempted to build on the work of Keller (1984, 1987a, 1987c) and his ARCS model of motivation. The results of this study greatly aid in the understanding of ARCS. Examining ARCS in terms of its components has some appeal. Bohlin, Milheim, & Viechnicki, (1993), Small & Gluck (1994) and Means (1997) took this approach. However, the findings of this study provide little justification for isolating the ARCS variables. These data do not show that the components relate to learning. What they do show is that the ARCS as a whole does influence learning. The support for ARCS as a unified model of motivation is a significant contribution to the field since there is little empirical research that does so.

Much of the difficulty of studying ARCS lies in determining appropriate measures of motivation. This study used Bohlin, Milheim, & Viechnicki's (1993) variation of Keller's Course Interest Survey. The instrument contained question items pertaining to each ARCS component, but the factor analysis here found that these items did not group as intended. Some questions involving perceptions of relevance combined with questions of attention, while other relevance items joined items that measured satisfaction. For example, questionnaire item 11 asked subjects about their interest in the instructional topics. Interest is usually included in discussions of relevance; however, interest can also be considered a feature of attention. The results of this study suggest it may not be necessary to measure individual ARCS components since ARCS appears to be one unified model of motivation. However, if there is a need to study individual parts of ARCS, preexisting measures may need to be reexamined. How the variables are defined is critical. The influence of prior experience on perceptions of relevance supports a call for a wider definition of relevance – one based on prior knowledge and experience and less on subjective elements like interest and utility.

This study confirms previous research that supports the use of motivation design using the Keller model (1987 b, 1987c, 1999) that emphasizes attention getting strategies, relevance building strategies, confidence building strategies and satisfaction building strategies. While many designers are aware of these strategies, few actually use them in their designs (Shellnut, 1999). Given both the direct and indirect influence of motivation variables on learning, it seems that motivational design should be adopted as standard practice when deigning instruction. This study had conflicting results with regards to the roles of activation of prior knowledge and the influence of previous experience in learning. For example, there were no differences in learning between those who reported previous experience with the topic (the APA group) and those who did not (the Moose group). This might be explained in two ways. First, while the topic of moose migration was not relevant, it was potentially interesting or at least novel. Hence, subjects' interests may have dominated and counteracted their lack of previous experience. Means' study (1997) may help confirm this possible explanation of the results. In her study, she attempted to isolate intrinsic relevance and extrinsic strategies to promote relevance. She found that both factors enhanced learners' motivation. The internal relevance or "interests" compensated for any external motivational design strategies.

Implications for Instructional Design Practice

These findings offer valuable contributions to the to field of instructional design in a number of ways. One contribution of this study is the use of the construct of activation of memory traces in design research and practice. In a sense, this validates the common instructional design practice of stimulating prior learning. It also supports the use of activation as an instructional strategy. Activation strategies, in this study, promoted increases in perceptions of confidence, relevance, and overall motivation from initial measures to post-instructional measures. Activation strategies also directly affected learning. The findings support continued research and use of strategies to activate prior knowledge in learning situations.

A second major finding of this study is the support for ARCS as a unified model of motivation. This experiment consistently found evidence for ARCS as a whole. The study supports Keller's work by continuing to refine measurement of ARCS and learner motivation. It supports ARCS's the role of the ARCS variables to directly enhance learning. While this study also raise questions on ARCS and its manipulation, the data clearly indicate the use of motivation strategies as a way to promote learning.

The conceptual model resulting from this study illustrates that the activation of prior knowledge, metacognitive variables of self-awareness, perceptions of relevance and motivation all have varying degrees of influence on learning. Designers should promote strategies that activate prior knowledge, encourage learners' awareness of knowledge organization and increase perceptions of motivation. Some might ask, "why bother to study cognitive process factors such as prior knowledge or self-awareness of knowledge organization?". By studying even the simplest cognitive activities, it is anticipated that we can eventually understand mental processing as a whole and those processes that ultimately shape learning. It is this quest to facilitate learning that drives the study of instructional design.

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Integrating Technology into a Secondary Education Teacher Preparation Program

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Abstract

This paper presents the rationale and strategies used to integrate the newly mandated State Technology Application Standards into the secondary education program at the University of Texas Pan American without increasing credit hours for pre-service teachers. A review of the literature and an assessment of the local infrastructure facilitated the definition of an action plan and strategies for the restructuring process. Implementation strategies like course alignment to technology standards, incorporating action research processes, use of electronic learning communities and electronic portfolios are discussed.

Introduction

In 1997 in a message to National Council of Teacher Education (NCATE) institutions titled Technology and the New Professional Teacher: Preparing for the 21st Century Classroom (1997) Arthur E. Wise stated: "Two million new teachers will be hired over the next decade. Will these new teachers be comfortable and skilled in using technology? … As technology moves from the periphery to the center in P–12 schools, so must it move from the periphery to the center in teacher preparation."

Nearly half a decade later many teacher preparation programs still grapple with the logistics of creating the conditions by which candidates can teach and use educational technology for greater student learning and achievement. There is significant research that supports the potential of technology to enhance student achievement and teacher learning, but only if it is used appropriately (Dede, 1998). Teacher preparation programs must provide opportunities for preservice teachers to acquire the necessary foundation and skill to integrate technology into the learning process in a meaningful way. And these opportunities must be provided while the demand to produce teachers fast enough to meet the Nation's hiring need of "2 million teachers" within this decade remains unchanged (Darling-Hammond, 2000). Results of a survey of schools, colleges and departments of education in the United States on preparing teachers to use information technology were published by the International Society for Technology in Education (ISTE) in the Milken Exchange on Education Report (1999). The report stated the following obstacles to integrating technology into teacher preparation programs:

a) One third of the institutions surveyed are limited by deficiencies in their IT facilities,
b) Most faculty do not model IT skills in teaching,
c) Distance education affects a small proportion of students in teacher training institutions,
d) Most teacher-preparation programs do not have a technology plan,
e) Most students do not routinely use technology during field experience and do not work with mentors or supervisors who can advise them on IT use and, and stand-alone IT courses are not effective in helping teachers to integrate IT into teaching.

An additional challenge to change preparation programs resides in the perception of contemporary interest groups that question the validity of teacher education programs [1] in general, including their basic structure and even their existence. Current teacher-preparation programs are seen by some as a collection of disjointed courses, field experience and student teaching—taught or overseen by people who have little ongoing communication with each other (Goodlad, 1990), or as programs with inadequate time, fragmented, uninspired teaching methods and a superficial curriculum (National Commission on Teaching and America's Future (NCTAF, 1996). In the face of such scrutiny, teacher educators are nonetheless charged with infusing current research in cognition and instruction into the classroom as well as integrating technology into all coursework without an increase in credit hours.

The advent of new State professional standards that include technology standards for all teachers stimulated the formation of a technology committee to research approaches to technology integration for the teacher preparation programs at the University of Texas-Pan American (UTPA) in the Department of Curriculum and Instruction. Fortunately, the committee found that along with reports that highlight disparate preparation of pre-service teachers (NCTAF, 1996; Betz, & Mitchel, 1996), there is growing documentation of "best practices" that relate how future teachers can develop a professional knowledge base and skills to utilize technology and change the teaching-learning cycle of classrooms (Persichitte, Caffarella & Tharp, 1999; Ropp, 1999; Schrum, 1999). Studies support the idea of infusing technology into teaching and learning as a norm not just as a "need" for teacher preparation programs. Many successful efforts to integrate technology throughout the teacher education curriculum have been reported (Schrum & Dehoney, 1998; Pope, Hare, & Howard, 2002; Snider, 2002; Vannatta and O'Bannon, 2002). As Snider (2002) pointed out "curriculum-wide integration currently represents best practice as it addresses two of the most significant barriers to the institutionalization of educational technology: inservice teacher resistance and faculty inexperience" (Strudler & Wetzel, 1999 as cited by Snider, 2002). A study by Moursund & Bielefeldt (1999) reveals that most faculty did not feel that instructional technology training was adequate or effectively modeled for future teachers and even though many of the faculty members know quite a lot about using the technologies for their own professional work, they are uncertain how to integrate it into their classes.

It is also reported that pre-service teachers need more opportunities to see, use and apply IT during field experience and internships. In 1999, ISTE reported that infusion throughout a teacher education program, including field experience, rather than separate training, was the most effective method. Despite these findings, few education teacher preparation programs require the inclusion of technology in field experience. However, the effective use of technology during field experience practicum has been documented by Powell and Lord (1998) and Anderson and Petch-Hogan (2001). These authors concur that early exposure to technology during field experience may have a positive impact on future classroom practices. Anderson and Petch-Hogan (2001) recommend increased opportunities for pre-service students to "take" technology into their fieldwork experience.

The ongoing trend toward integrating technology into teacher preparation programs is now well documented (e.g., Schrum & Dehoney, 1998; Persichitte, Cafferella & Tharp, 1999; Willis & Tucker, 2001; Vannatta & O'Bannon, 2002). However, there is a continued gap between the advocacy of best practices from higher education and real practice in public schools. It is not surprising that pre-service teachers trained to use and integrate technology into instruction fall into this gap during student teaching.

Literature also indicates that action research imparts approaches and methods that serve to strengthen teacher-preparation programs (Price, 2001) by having pre-service teachers share their field-based research findings to a community of learners. Rock and Levin (2002) have documented how several teacher preparation programs have used action research to promote skills of inquiry, problem solving, reflection and critical thinking. The idea of conducting action research in teacher preparation programs has gained support (Keating, Diaz-Greenberg, Baldwin & Thousand, 1998) because it becomes a way for teachers to teach other teachers (Feldman an Atkin, 1995) in a collaborative mode that fosters the growth of learning communities. Recently Pan (1999) has argued that engaging teachers in action research is also an effective means to learn to integrate technology by enhancing communication and collaboration between teachers and university faculty. He supports the idea that if teachers understand the significance of research and "conduct action-research of teaching with computers" they will hold positive attitudes toward learning by integrating educational technology into teaching. Royer (2002) advocates the use of action research as an "effective professional development strategy" to encourage teachers to integrate computer technology into their teaching.

Faculty members in teacher preparation programs across the country also show increased interest in electronic portfolios as a means to integrate technology and for authentic and performance-based measures (e.g., Bartlet, 2002; McKinney, 1998). As noted by Wright and Stallworth (2002), with the development of National Educational Technology Standards for Students and Teachers, the use of electronic portfolios by pre-service teachers may introduce them to the "skills for teaching and learning in future classrooms". Effective electronic portfolios lead students to learn, teach, and learn to teach with technology as they reflect on the artifacts they select from their teaching experiences (Curts and McWright, 2002). There is evidence that electronic portfolios become an important instrument in the on-going efforts to prepare tomorrow's teachers to use technology critically and reflectively.

Implementation

These findings supported the committee's conviction that the task of ensuring that every new teacher learns how to integrate technology into teaching and learning can only be achieved by removing limitations and creating opportunities for teachers to experience pedagogically sound application of instructional technology in both university classes and field experience. At UTPA there is a technology class for the elementary teacher preparation program but the secondary program was limited by the fact that there is no formalized approach to include technology. The secondary program is based on the professional development school model and includes a field-based component that puts pre-service teachers in area classrooms simultaneous to beginning their courses in the College of Education. The field component comprises 50% of student activity. The secondary courses are divided into three blocks covering three semesters. Courses in Block I consist of nine credit hours that include a foundations course, an educational theory course and a content area reading course. Block II is comprised of six credit hours that encompass methods of planning, instructional delivery, management and assessment. Block III, six credit hours, is the final student internship or student teaching. The secondary program is limited to these 21 hours, so there was no option to add a technology course, nor did research findings support the idea of a stand-alone technology course. The need to restructure the curriculum to correspond to new state standards was evident. The secondary faculty viewed the restructuring process as an opportunity to refine the existing program. Faculty members were particularly interested in reports of how action research methods and electronic portfolios could serve as a strategy to integrate technology. The findings of the Technology Committee and these considerations assisted the secondary faculty in defining the following goals and strategies as the foundation for restructuring the secondary teacher preparation program.

Goal	Strategy
1. The infusion of technology into teaching and learning will be the norm for the UTPA secondary teacher preparation program.	1a. Align courses to the State technology standards for all teachers so that the necessary skills could be distributed throughout the curriculum to allow incremental acquisition. 1b. Education faculty will model and integrate technology that reflects the current needs in both teacher education and K-12 schools. 1c. Provide education specific software, not available in general computing labs, for student use in the COE labs.
2. Establish internal and external support systems for faculty and student development.	2a. Collaborate with the Center for Distance Learning (CDL) for immediate technical support to incorporate web-based activities into secondary courses. 2b. Seek funding through a Preparing Tomorrow's Teachers to use Technology (PT3) grant application to provide additional resources for faculty and student support.
3. Pre-service teachers need more opportunities to see, use and apply IT during field experience and internships.	3a. Seek more involvement with mentor teachers to achieve integration into the field component. 3b. Establish an electronic learning community to enhance communication with mentor and intern teachers.
4. Action research processes will be incorporated into the preparation program to strengthen professional development and as a central activity for the integration of technology in all courses and field experience.	4a. Action research tasks will be identified and distributed throughout the curriculum to result in a project to be completed during student teaching. 4b. Adopt the use of electronic portfolios as part of the assessment process and as a vehicle to demonstrate artifacts from action research projects.

The first and crucial activity toward implementing these strategies was identifying technology activities and products that would require acquisition of the skills defined in the State technology standards. The following table lists how the technology-based activities are matched to the standards and distributed among the secondary course Blocks.

Table 1 Distribution of technology skills within secondary courses

State Technology Standards	Technology Applications	Course Blocks		
Standard III: Use of task appropriate tools		I	II	III
	Word Processing	X	X	X
	Mail merge		X	
	Tables, charts, graphs		X	X
	Spreadsheet /Database		X	X
	Excel		X	X
	EasyGradePro			
	Multimedia (text, audio, graphics)			
	PowerPoint, Scanning, FrontPage (HTML)	X	X	
	Digital Video			X
	Desk-top publishing			
	Draw and paint applications		X	X
	Participate in electronic communities		X	X
	Electronic Learning Community		X	X
	WebCT	X	X	X
	Uploading/downloading. FTP protocols	X	X	X
	Internet search, Web Board Discussion	X	X	X
	Online collaboration, Email, Chats	X	X	X
	HTML protocols	X	X	
	Use of simulations		X	X
Standard IV: Use of technology -based communication and productivity tools				
	Email	X	X	X
	Electronic Portfolio		X	X
	Concept maps on PD competencies		X	X
	Planning aligned to the TEKS		X	
	Online quizzes and tests	X	X	
	examples of simulated student reports		X	
	3 examples of assessment instruments		X	
	Reflections	X	X	X
	Philosophy of teaching statement	X		
	Block III lesson plans			X
	Example letters to parents & students		X	
	Web-based discussion	X	X	X
	Bulletin Brds, Internet Srch, Online Library SRch	X	X	X
	WebCT	X	X	
Standard V: Use technology to plan, organize, deliver, assess and evaluate instruction				
	Inspiration 6.0	X	X	X
	Internet Search	X	X	X
	PowerPoint	X	X	X
	FrontPage		X	
	Online Library Search	X	X	X
	Electronic Learning Community		X	X
	WebCT	X	X	X
	Principles of Instructional Design	X	X	X
	Learner assessment	X	X	X
	Content assessment	X	X	X
	Media selection	X	X	X
	Design of instructional treatment	X	X	X
	Evaluation of process & product		X	X

The secondary faculty felt that technology skills could be acquired simultaneous to actual integration activities situated in teaching contexts rather than isolated to professional development activities. The technology infusion began by building on existing UTPA strengths during the fall semester of 2000. The university setting provides a strong centralized technology infrastructure as well as interest in the infusion of technology into the teacher preparation program. Prior technology initiatives by the UTPA Center for Distance Learning (CDL) contributed a desirable local model for faculty training and support systems that effectively linked the use of technology to pedagogical constructs. The CDL had established that technology skill and implementation could be achieved through just-in-time technical assistance and an ongoing coaching that begins by assisting faculty to augment their traditional courses with web-based activities. This approach fosters incremental skills development specific to content pedagogical need and encompasses most of the web and Internet skills identified in the State standards. The secondary faculty adopted this approach and coordinated efforts with CDL to begin augmenting the Foundations of Education courses during the fall semester of 2000. This augmentation introduced faculty and students to a wide range of web-based technologies linked appropriately to the course of study. Students and faculty alike were encouraged by the enhanced student participation achieved in web-based discussion and the convenience of asynchronous collaborative activities. Faculty tracked student discussion participation in traditional classes as compared to web-based discussion and noted that the average 5% student participation rate in class discussions was increased to 100% by simply assigning discussion comments to be posted to WebCT. By the spring semester of 2001 the other two Block I courses were augmented with WebCT and by the beginning of the fall semester in 2001 all secondary faculty had been introduced to WebCT and used it in their courses for discussions, collaborative group projects and other activities during spring semester of 2001. This augmentation of traditional courses with distance education procedures served as a successful strategy to infuse the use of technology into course activities as a part of instructional procedure and changed the traditional secondary courses to "hybrid" courses that successfully infused web-based communication as integral part of instruction.

With the award of a PT3 grant in the summer of 2001, broader support systems were established within the College of Education based on the successful approach modeled by CDL with individualized technical support and coaching. An instructional developer and a technical assistant and work-study students were hired to expand and continue faculty support in an individualized manner. Initial assistance covered a wide range of activities like basic email, creating group email lists, creating personal web pages, online library searches, web searches, online chats, online quizzes, use of PowerPoint, spread sheets, uploading and downloading documents, file transfer protocols, FrontPage and Inspiration concept mapping software. This individualized approach enabled faculty to seek assistance in a manner that did not endanger their self-esteem or encumber their busy schedules.

At that time surveys were administered to faculty, pre-service teachers and mentors to establish a profile of baseline competencies for faculty, pre-service teachers and high school mentors.

Table 2: Profile of computer usage among faculty, pre-service teachers and high school mentors

Skills/Knowledge	Secondary Faculty [a]	Secondary pre-service teachers [b]	High School Mentor Teachers [c]
General use of computer	100%	80%	30%
General use of a word processor	100%	90%	79%
Advance features of a word processor	80%	N/a	N/a
General use of spreadsheets	100%	50%	84%
Use of formulas, functions and graphs	90%	50%	21%
Create report (query/find) in a database	50%	N/a	N/a
Scan documents	90%	70%	N/a
Email	100%	95%	58%
World wide web to retrieve information	100%	95%	66%
Online database search	100%	30%	47%
Online library services	90%	50%	47%
Teach/or take Online course	50%	N/a	N/a
Multimedia presentations	50%	70%	26%
Creation of Web pages	40%	20%	10%

[a] PT3-UTPA Faculty Technology Use survey was applied on Oct. 16, 2001. Results reported here correspond only to the Secondary Faculty from the C & I Department. The summary statistics report for the whole sample was included in the PT3-UTPA Interim Activity Report, July 01, 2001 – October 31, 2001.
[b] Results reported here correspond to UTPA incoming pre-service students that enrolled into the Secondary Teacher Preparation Program during Fall 2001.
[c] A Mentor Teacher Pre-training Technology Survey , developed by the Center for Applied Research (CARE) at UTPA, was applied to 85 elementary, 47 middle school and 19 high school teachers belonging to the STCPDT collaborative. The data above relates only to the high school teachers.

The resulting profile for UTPA constituencies corresponded to the national profile indicated by research. Indeed, individual university faculty and students were more skilled in most areas than mentor teachers but had not been accustomed to incorporating the use of technology into instruction. The success of the first two semesters and the addition of needed staff through PT3 resources provided continued support for faculty and student activities so attention was then focused on mentor teacher involvement. It was easily recognized that the simple fact of physical separation limited opportunity for faculty and mentor teacher communication. The need to create communication opportunities between faculty and mentor teachers was addressed in the PT3 Grant. One of the primary objectives of the grant was to create an infrastructure for an electronic learning community for Rio Grande Valley teachers. The interest in an online environment was:

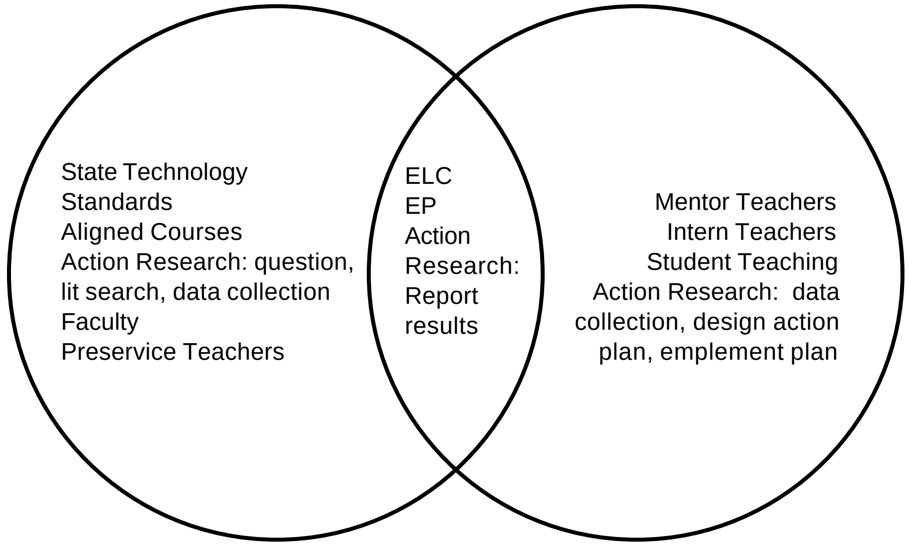
1. to ease communication and consultation among university faculty, mentor teachers and interns separated by distance;
2. to collaborate to conduct action research activities that models skills innate to reflective practice;
3. to affirm the essential relationship between content, theoretical and pedagogical knowledge as the basis for reflective practice;
4. to support development of technological skill and understanding of technology-supported learning;
5. to encourage technology-supported instructional activity in order to expand possibilities for innovative instructional solutions; and,
6. to demonstrate a broader process for professional consultation that provides example of collaboration empowered by web-based communication.

PT3 resources facilitated the acquisition of the already existing infrastructures, the Electronic Learning Community (ELC) and Electronic Portfolio (EP), fromthe Center for Technology in Education (CTE) at Johns Hopkins University (JHU). Acquiring these infrastructures, instead of creating them, accelerated not only the grant activities but also the completion of the program's stated restructuring goals for technology infusion. Arrangements were made with Johns Hopkins CTE staff and training sessions were held for faculty and mentor teachers to introduce them to the use of the ELC and EP. Students were introduced to the ELC and EP as part of the courses in Block I classes. At that time, Yanes and Curts (2002) proposed an online communication model for student teaching to promote the use of action research and reflective practice and provide a vehicle for enhanced involvement of the mentor teachers. The model is implemented in coursework and through the ELC. The ELC serves as a web-based communication tool to bridge the physical distance between university faculty and field placement sites and enables frequent communication between university faculty and mentor-intern teams at remote sites. In this model the 6-step cycle of action research activities (Johnson, 2002) serves as a cohesive element that begins within university courses and culminates during the final internship when it involves the mentor teacher. The electronic portfolio is used to house artifacts produced in action research activities. The six steps of action research are: 1) define a question; 2) review the literature; 3) plan data collection; 4) collect and analyze data; 5) create an action plan; and, 6) share the findings (Johnson, 2002). These steps are infused into the secondary preparation program in the following manner.

- During Block I students create a philosophy of education statement, formulate a research question and commence a literature review. The philosophy activity assists students to identify, synthesize and personalize theoretical and pedagogical constructs into a clear statement. This statement serves as a basis to identify their major educational interests and to formulate a question for investigation from that perspective. The literature review is conducted based on that question.
- During Block II the literature review continues and students are introduced to data collection and analysis procedures.
- During Block III, the student-teaching internship, students cooperate with their mentor teacher to collect data, and to design and enact their action plan. The products of the student teacher's work are placed in the EP and the student teacher and mentor then report the results of their project to their peers using the ELC.

This approach introduces preservice teachers and mentors to a systematic process that brings research to the classroom at an appropriate level and establishes a reflection cycle that encourages ongoing evaluation and improvement of instruction. The following model demonstrates how action research, use of the electronic learning community and electronic portfolio moved to a central position in the secondary teacher preparation program and created a focus for technology infusion. In effect the ELC, the EP, and action research provided the mechanism and the impetus for ongoing communication and collaboration among student teachers, mentors and university faculty.

FIGURE 1. Action research technology integration model.



The end product for each student is the final report of the completed action research project posted to the ELC. The EP houses all action research activities pursued during the three-semester program as well as the final report. Since the final action research project report constitutes 30% of the final grade for student teaching, mentors become more involved in the student interns' success. This higher level of involvement stimulates the mentors' interest in the new technology methods and approaches that the students demonstrate in the electronic portfolio and include in the action research treatment.

Conclusion

To date, the goals stated by the secondary faculty have been achieved and the strategies continue to prove effective. The technology skills acquired through use of distance education procedures and other activities distributed throughout the curriculum allow faculty and students to develop technology skill incrementally while attaining their immediate educational goals. Although the PT3 Grant now provides in-house technical support, the department continues to collaborate closely with the CDL. The creation of hybrid courses, combining traditional and distance education methods, prepares students and faculty to successfully use the ELC as the primary means of communication during the final student teaching internship. One unexpected outcome of the collaboration with CDL is the creation of an online program for the secondary professional development courses. Bringing the mentors into the action research project and the ELC during student teaching introduces them to the convenience of technology-assisted communication and encourages them to communicate with university faculty and other members of the ELC regarding their intern's action research project. It also appears to motivate the mentors' continued activity in the ELC after the internship. University faculty also continue to collaborate closely with the Johns Hopkins Center for Technology in Education to evaluate ELC usage, expand implementation strategies, and conduct research regarding the use of the ELC. This model seems to provide students and university faculty with a shared focus for technology infusion activities. It also appears to regenerate mentor teachers' interest in the infusion of technology into the classroom teaching and learning cycle. Action research has become the common goal for faculty, students and mentors. It is an activity that contributes to strengthening the professional development of teachers and encourages intellectual and pedagogical growth. The ELC collaborative activities in use at UTPA seem to naturally foster the growth of a learning community. In this context, action research can be viewed as a constructivist process in which the ELC provides a social situation where teacher's beliefs about learning, their students and their conceptions of themselves as learners are explicitly examined, shared, challenged, supported and even supervised. These electronic “co-laboratories” provide avenues for geographically dispersed teachers to exchange ideas, information, best practices, and offer support to each other.

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[1] See for example U.S. Department of Education. (2002). Meeting the highly qualified teachers challenge: The Secretary's Annual Report on Teacher Quality. Washington, DC: U.S. Department of Education, Office of Postsecondary Education, Office of Policy Planning and Innovation. In this report, the Secretary argued that teacher certification systems are "broken," imposing "burdensome requirements" for education coursework that make up "the bulk of current teacher certification regimes: (p.8).

Gender Differences in Middle School Students' Attitudes towards the Educational Uses of the Internet and the Internet Usage

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Abstract

One of the most recent technological revolutions is Internet, which provides an opportunity for teachers and students to explore information and to learn at school, at home, or in the community. Since vast amount of information is available on Internet, it will be an inevitable resource for teachers and students in developing countries as in developed countries. In this study, gender differences in middle school students' attitudes toward educational uses of Internet and the Internet usage in Turkey were investigated.

Introduction

The Internet is an international network of computer networks that allows its users to share information and to communicate interactively (Gunderson & Anderson, 1999). Acceptance of the Internet as a potential educational tool has provided rich teaching and learning environments for students and teachers. For example, teachers have used the Internet as a communication tool (Wells & Anderson, 1995), as an information seeking environment (Wei He & Jacobson, 1996), for gathering content information (Sunal, Smith, Sunal, & Britt, 1998), for delivering instruction (Sunal et al., 1998), for linking students to their peers worldwide (Gersh, 2001), and for posting student work on the Web (Branzburg, 2001).

Research that has been done for college students indicated that students who keep track of valuable educational sites on the Internet, share information with their friends, and use the Internet very often for educational and general reasons, had more favorable attitudes toward educational use of the Internet (Duggan, Hess, Morgan, Kim, & Wilson, 1999). Experience with using the Internet can vary for college students. Wei He & Jacobson (1996) indicated that social science undergraduates had less Internet experience than those in other programs. However, all of the participants in this study thought that Internet was very useful tool in education. The general attitude of the undergraduate students reflected that the use of Internet was for seeking information and not for entertainment. Research carried out for 8th to10th grade students indicated that student attitudes toward computers became significantly less positive during their junior high school careers. However, it was argued that the use of the Internet to access very exciting ideas and rich resources and materials were attractive characteristics of the Internet in order to increase positive attitudes toward the use of the Internet for educational purposes. With the help of the Internet, students' attitudes towards the use of computers in their classes could also be increased (McKinnon, Patrick Nolan, & Sinclair, 2000).

Since the availability of the computers and the Internet access in primary, middle and high schools has increased most recently, the research studies in grades 1 to 12 are not as many as in college and university level. Studies investigating the gender issues indicated that male students have more positive attitudes toward use of computer and high self confidence in use of technology than females (Brosnan, 1998; Chua, Chen, & Wong, 1999; Shashaani, 1997). Study of Nachmias, Mioduser, & Shemla (2000) in grades 7 to 12 revealed that there was a significant difference between males and females in terms of time spent on the Internet, preferred location for use, resources downloading, Web site creation, and participation in discussion groups. Similar to previous researchers Nachmias, Mioduser, & Shemla (2000) also argued that extensive use of the Internet in schools and communities will eliminate acceptance of the common idea of the Internet usage is a type of males' activity.

A review of the literature reveals that in Turkey, similar to other countries, there is little information about middle school male and female students' attitudes towards the use of the Internet and computers as an educational tool in their courses. There are a number of reasons why so little is known about students' attitudes towards use of technology in their classes. Technological support, especially for costly technologies such as computers and Internet accessibility, is not provided equally for all schools due to economical constraints in Turkey. In general, students are familiar with the use of video, overhead projector, television, microscopes, and etc. as part of instructional materials in their courses. Since very few of the schools have computer laboratories, the use of computers in courses as an instructional tool is not a common teaching strategy in regular classrooms, especially in public schools. Students are normally allowed to use computers for their computer classes, projects or to seek information in their free times. Yildir (2001) found that access to computers in schools was the most important parameter in having positive attitude towards computers. In addition, it is indicated that gender and age also significantly affected the elementary school students' attitudes towards computers. Clearly, further and more extensive studies are needed to evaluate the middle school students' attitudes towards the educational use of the Internet in Turkey.

Recently the Internet use has experienced a dramatic growth in Turkey (Wolcott & Cagiltay, 2001). Most of the students access to the Internet at out of school places, instead of their schools. For example, they are using the Internet at the Internet cafes, at their homes, or from their friends' computers. In parallel with the huge number of resources available outside the schools, it is clear that students have attitudes towards potential educational use of the Internet.

The purpose of this study was to present the results of attitudinal data from Turkish students with respect to the educational uses of the Internet and the Internet usage. Main focus will be on gender differences.

Methodology

Participants and Data Collection

This study reported data from a sample of Turkish students. All of the students were enrolled in the sixth, seventh, and eighth grades of middle schools and were taught by the same curriculum. All schools were public schools. The schools are located in rural, urban, and suburban areas near and in Ankara, Turkey. For this study, 6 schools were selected randomly among the public schools. For each grade, one classroom was selected randomly in each school. Data were collected from 708 students in 18 classrooms. The age range of the students was 10 to 14.

Instruments

The Attitude Toward Educational Uses of the Internet (ATEUI) scale developed by Duggan, Hess, Morgan, Kim, & Wilson, (1999) was used in this study. The ATEUI scale constituted 18 items on Likert format. Since our participants were middle schools students, we modified some of the items according to level of our participants. Since students' access to the Internet was expected to vary with regard to their school characteristics and students out of school opportunities, we had to determine those parameters to make sound interpretation about the findings. For this reason, we used the Behavioral Correlates Questionnaire (BCQ) developed by Duggan et al. (1994). This questionnaire included 11 items.

Results

Descriptive Analysis of Male and Female Students' Responses to BCQ Items

Table 1 summarizes the percentage of male and female students' responses to BCQ items. The general use of the Internet increased during last two years for males and females. For example, only one girl indicated that she has been using the Internet for more than 4 years while 4.1% of the males indicated so. Similarly 3.3% of males and 1.2% of females said that they have been using the Internet for 3-4 years. However, 19% of males and 16% of females said that they were using the Internet for less than a year. This data revealed that the Internet has become more popular for both males and females most recently.

Among the students 23.3% of males and 14.2% of females indicated that they learnt to use the Internet by themselves and 18.2% of males and 9.1% of females indicated that they learnt it from their friends. Magazines, books, school, and library were not preferred as a way to learn the use of the Internet.

The students (34.5%) prefer to connect to the Internet from their homes and Internet cafés. Even though nearly equal percentage of males (14.6%) and females (9.4%) connect to the Internet from their homes, the analysis also revealed that more males (26.3%) prefer to use Internet cafés than females (8.8%).

Among different features of the Internet, males mostly preferred to use the chat (27.1%), WWW (24.1%), e-mail (14.6%), download (7.6%), newsgroups (6%), and ICQ (5.4%). Females also stated similar usage patterns except for newsgroups: chat (16.2%), WWW (13.9%), e-mail (9.4%), download (4.7%), and ICQ (3.5%). This data revealed that both males and females are using the Internet for communication and search.

Table 1. Descriptive Analysis and Chi Square Analysis for Male and Female Students' Responses to BCQ items

	Gender				
	Male		Female		
Behavioral Correlates	N	%	N	%	Chi Square
How long have you been using the Internet?					
Less than one year	71	19.2	57	16.8	35.45**

1-2 years	32	8.7	15	4.4	35.45**
2-3 years	24	6.5	7	2.1	35.45**
3-4 years	12	3.3	4	1.2	35.45**
More than 4 years	15	4.1	1	0.3	35.45**
How did you learn to use the Internet?					
Myself	86	23.3	48	14.2	9.63**
Books	9	2.4	5	1.5	0.85
Magazines	18	4.9	6	1.8	5.21*
Friends	67	18.2	31	9.1	12.03**
School	5	1.4	7	2.1	0.53
Library	2	0.5	1	.03	.026
Where do you connect to the Internet?					
Home	55	14.9	40	11.8	1.47
School	6	1.6	2	0.6	1.69
Internet café	97	26.3	30	8.8	36.50**
Friend	26	7	15	4.4	2.23
What of the following features for using the Internet apply to you?					
E-mail	54	14.6	32	9.4	4.47*
WWW	89	24.1	47	13.9	11.97**
E-mail list	40	10.8	22	6.5	4.20*
Ftp	8	2.2	1	0.3	4.94*
Newsgroups	22	6	5	1.5	9.70**
Download	28	7.6	16	4.7	2.50
Telnet	6	1.6	2	0.6	1.70
Chat	100	27.1	55	16.2	12.22**
ICQ	20	5.4	12	3.5	1.45
Which of the educational purposes do you use the Internet for?					
Homework	56	15.2	37	10.9	2.81
Term paper	87	23.6	71	20.9	0.70
Consult with instructor	10	2.7	1	0.3	6.74*
Consult with classmates	24	6.5	10	2.9	4.88
Retrieving class notes	61	16.5	45	13.3	1.47
Follow educational sites	33	8.9	21	6.2	1.89

** $p < .01$, * $p < .05$

Even though 66% (465) of the students indicated that they did not connect to the Internet at all, the analysis revealed that 87% (616) of the students used the Internet for educational purposes. The students mostly used the Internet for preparing term papers (males 23.6%, females 20.9%), doing homework (males 15.2%, females 10.9%), following educational sites (males 8.9%, females 6.2%), and doing other educational activities (males 15%, females 7%). These findings suggest that students give importance to get information from the Internet for their courses.

Females' and Males' Attitudes

The t-test analysis ($t = -.657$, $p > .05$) suggested that both females and males have favorable attitudes toward the educational uses of the Internet.

Chi Square Analysis

Male and female students' responses to behavioral correlates were analyzed by using chi square test to find out differences between their Internet literacy. Table 1 summarizes results of all of the chi square analysis. Analysis revealed that male students had significantly more experience in using the Internet than female students. Even though there is still significant difference between male and female students' number in using the Internet during last two years, a great deal of increase in number of female students was easily observed.

Myself, magazines, and friends were found as favorite sources for both male and female students to learn how to use the Internet. However, when we compare the number of the students, significantly more male students used these three sources to get information about the Internet usage.

Both male and female students were connected the Internet from their houses, friends, and schools. However, significantly more male students preferred to use Internet Cafés to connect to the Internet.

Among the different features of the Internet, e-mail, www, e-mail list, ftp, news groups, chat were used significantly more by male students than female students.

Using the Internet for educational purposes was similar for both male and female students. Only significant difference was obtained for consulting instructor. More male students preferred to use the Internet to communicate with instructor through the Internet than female students.

Discussion

Descriptive analysis and t-test analysis revealed that during last two years both males and females have had an interest in using the Internet for different purposes. Our results and other research results show that gender did not create differences in attitudes toward educational uses of the Internet (Duggan et al., 1994). Since most recently both females and males are spending nearly equal time on the Internet (Internet users, 2001; Jackson, Ervin, and Garden, 2001), they have favorable attitudes toward the Internet.

Even though both male and female students had generally positive attitudes toward educational uses of the Internet, significant differences were obtained in terms of their Internet literacy. Similar to Nachimas et al., (2000) findings, this study supported that more male students used the Internet than females for different purposes. Moreover, significant differences were obtained between genders regarding with age of starting to use the Internet, sources to learn the Internet, places to connect to the Internet, activities done by using the Internet, and obtaining the information and communicating with teachers and friends for different educational purposes.

Interestingly, our data suggested that even though only 33.6% of the students indicated that they were actively using the Internet, 87% of the students indicated that they were using the Internet for educational purposes. This finding revealed that even though students had very little opportunity to access the Internet through their school resources, they found different ways (such as Internet cafes, friends computers etc.) to access the information through Internet for their homework and term papers. It is clear that students already involved in using the Internet for educational purposes as a reliable source. Teachers also supported their students to use the Internet for their homework, term papers, and other educational activities. Otherwise students would not use the Internet. This result strongly suggests that school administrators should provide more opportunities for students to easily access the Internet in their schools to increase the effectiveness of teaching and learning. Earlier studies suggest that instruction effectiveness can be increased by using the Internet (Berge, 1997; Follansbee, 1997). This high demand to use the Internet for educational purposes might rapidly increase the Internet access at schools.

Another finding of this study revealed that communication through chat, e-mail, newsgroups and web browsing were other reasons for using the Internet for middle school students. This result indicated that students also use the Internet for entertainment purpose. This finding supports the Nachimas et al., (2000) study.

This study will add to the literature and also will help those actively involved in educational uses of the Internet research and those participating in the improvement of education in developing countries like Turkey. This study suggests that students are using the Internet to obtain information for their courses. School administrators and teachers should be informed about the ways of their students' using the Internet. In this way they can provide more opportunities to the students according to their interests and increase the effectiveness of the instruction and students' success.

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