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Editor: Michael Simonson

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Preface

For the thirty-second 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 Anaheim, CA. A limited quantity of these Proceedings were printed and sold in both hardcopy and electronic versions. Volume #1 is available through the Educational Resources Clearinghouse (ERIC) System. Proceedings volumes are available to members at AECT.ORG.

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 the practice of instructional technology including instruction and training issues are contained in Volume #2.

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 sixty 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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Volume 1 – Selected Research and Development Papers

Teaching with Web 2.0 Technologies: Benefits, Barriers and Best Practices

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Abstract

The purpose of this study was to explore best practices in teaching with Web 2.0 technologies as well as the benefits and barriers associated with the use of Web 2.0. Participants in this study were 14 university instructors who had considerable experience in teaching with Web 2.0 technologies. A Web-based survey was used to collect data for this study. The study results indicate that the major benefits of using Web 2.0 technologies in teaching include (1) interaction, communication and collaboration, (2) knowledge creation, (3) ease of use and flexibility, and (4) writing and technology skills. The major barriers university instructors encounter in teaching with Web 2.0 technologies include (1) uneasiness with openness, (2) technical problems, and (3) time. The survey results also provided insightful guidelines and tips for teaching with Web 2.0 technologies.

Descriptors: Web 2.0; Benefits and Barriers; Best Practices

Introduction

Web 1.0 was read-only where Internet users went online to find information. It was similar to going to the library to find books. With Web 2.0, which is read/write, people have become active participants and content creators. They not only find information on the Internet, but they also create and share content (Thompson, 2007). According to Edison survey (2009), about 15 percent of podcast consumers are also content creators compared to five percent of those who are not podcast consumers.   Web 2.0 technologies – such as blogs, wikis, podcasting, social bookmarking, and social networking sites – have allowed users to easily publish content online and to connect and network with other people from all over the world who have similar interests. The use of tags particularly enables us to collectively categorize and find content easily. In a nutshell, Web 2.0 could be characterized by openness, user participation, knowledge sharing, social networking and collaboration, user-created content, and folksonomy (Alexander, 2006; Brown & Adler, 2008; Downes, 2005; Thompson, 2007; Richardson, 2009).

Web 2.0 in Teaching and Learning

As addressed above, Web 2.0 technologies have "blurred the line between producers and consumers of content and has shifted attention from access to information toward access to other people" (Brown & Adler, 2008, p. 18). Emphasizing a participatory culture, Web 2.0 technologies encourage and enable teachers and learners to share ideas and collaborate in innovative ways. They also force educators to rethink the way we teach and learn and to transform our education practices so that we can support more active and meaningful learning that involves "learning to be" as well as "learning about."

Web 2.0 has the potential to create more interactive and powerful learning environments in which learners become knowledge creators, producers, editors, and evaluators (Richardson, 2009). Learners' critical thinking skills can be enhanced through the opportunity to regularly compare their own contributions to those of their peers, and the affirmation of their relative standing in the class may be powerful motivation for learning (Hurlburt, 2008). Thus, Web 2.0 technologies has the ability to "support active and social learning, provide opportunities and venues for student publication, provide opportunities to provide effective and efficient feedback to learners, and provide opportunities to scaffold learning in the student's Zone of Proximal Development" (Hartshorne & Ajjan, 2009; Vygotsky, 1978). In addition, Web 2.0 provides numerous opportunities for social interactions and collaboration among students, teachers, subject matter experts, professionals in different fields, as well as a host of others with related interests.

The pedagogical benefits of Web 2.0 have been well documented in the literature. However, most of the existing studies on the use of Web 2.0 technologies in teaching and learning environments have been anecdotal in nature or in the form of case studies. Huang, Yoo, and Choi's (2008) study, for example, found that correlation

exists between learning style and learners' preferences and attitudes towards using Web 2.0 technologies. Lambert and Kidd's (2008) explored the potential impact of the design of Web 2.0 environments on cognitive load. While such studies are collectively useful in providing a broader view of issues surrounding instructional uses of Web 2.0 technologies, they are limited in scope, as they address such issues within the context of one or two courses.

Today's students are "digital natives" (Prensky, 2007), and make increasing use of Web 2.0 technologies in their daily lives. The vast majority of educators, on the other hand, still have little or no experience with these new tools. Teachers and instructors need to understand what opportunities Web 2.0 tools provide for teaching and learning, what kinds of barriers they may encounter when using them, and how to effectively implement the new tools in their teaching.

Among barriers to effective use of web 2.0 tools for instruction is the challenge of creating meaningful assignments to promote desired learning outcomes. Ill-designed assignment with no visible connection to the overall purpose of the course not only frustrates students, it decreases students' interest in using the tool, and results in little or no learning (Reynard, 2009). Moreover, educators needs to be conversant of the fact that the social nature of Web 2.0 tools which makes them attractive as potential learning tools is also one of its drawbacks. "The very key to the success of a blog assignment structure, then, is fundamentally counterintuitive. In order to take advantage of the virtual social space that is spontaneously created in the natural blogosphere, course work must dictate the precise level of engagement of the participants, must make the class blogosphere entirely *unnatural* … not spontaneously social…" (Hurlburt, 2008, p. 184). According to Hurlburt (2008), there are "invisible aspects" to facilitating learning in the social network environments. In addition to the visible aspect of designing effective learning environments with these tools, educators also need to serve as coach, mentor, cheerleader, as well as task master to their students when the expected learner participation does not materialize. The affective aspects of teaching with Web 2.0 tools may provide both opportunities and as well as barriers that are yet to be explored.

Currently little research has explored these issues. Therefore, this study attempts to provide a first step in understanding the benefits of and barriers to using Web 2.0 technologies, especially in higher education, and in developing guidelines for teaching with Web 2.0 technologies.

Research Questions

The purpose of this study was to explore best practices in teaching with Web 2.0 technologies as well as the benefits and barriers associated with the use of Web 2.0. Research questions guiding this study are as follows:
(1) What are the benefits of using Web 2.0 technologies in teaching?
(2) What are the barriers to using Web 2.0 technologies in teaching?
(3) What are the best practices in teaching with Web 2.0 technologies?

Research Method

A Web-based survey was undertaken in November 2008. The first author sent out an email invitation, including a link to the web-based survey, to a number of university instructors who were known to have considerable experience in teaching with Web 2.0 technologies. The survey included four demographic questions and 10 open-ended questions. The key questions include the following:

- Describe 1-2 ways you use Web 2.0 technologies in your teaching.
- What are the benefits of using Web 2.0 technologies in teaching?
- What are the barriers to using Web 2.0 technologies in your teaching?
- What instructional strategies or techniques have already worked for you? Please describe best practices in teaching with Web 2.0 technologies based on your direct or indirect experiences.
- What has NOT worked for you in terms of Web 2.0 technologies in teaching and learning?
- What would be effective ways to use Web 2.0 technologies in teaching that you have yet to try but are perhaps thinking about?

Fourteen university instructors participated in this study. The participants, consisting of 64.29% female and 35.71% male, were from a number of different universities in the United States. They ranged in age from 30's to 60's (31-35: 7.14%; 36-40: 21.43%; 41-45: 14.29%; 46-50: 21.43%; 51-55: 7.14%; 56-60: 21.43%; 61-65: 7.14%). The instructors had an average of 15 years of teaching experience and an average of 3.71 years of using Web 2.0 technologies in teaching.

Qualitative data from the Web-based survey were analyzed using the constant comparative method (Glaser & Strauss, 1967; Strauss & Corbin, 1990). All responses were carefully read and reread and were coded and constantly compared to other data. In the process, some coded data were renamed or merged into new categories. A number of categories or themes were identified and were organized under three overarching categories that this

study focused on: (1) benefits of using Web 2.0 technologies in teaching, (2) barriers to using Web 2.0 technologies in teaching, and (3) best practices and tips for teaching with Web 2.0 technologies.

Results

The survey results provided insightful guidelines and tips for using Web 2.0 technologies in teaching. Web 2.0 technologies used by the participants include: blogs, Wikis, Youtube, social bookmarking, podcasts, webcasts, Facebook, Myspace, Flickr, Twitter, Skype, Second Life, and Tegrity. The participants reported how they used these Web 2.0 technologies in their teaching, what worked well, what did not work well, and so forth. The discussion of results is organized around the following three focus areas: (1) benefits of using Web 2.0 technologies in teaching, (2) barriers to using Web 2.0 technologies in teaching, and (3) best practices and tips for teaching with Web 2.0 technologies.

Benefits of using web 2.0 technologies in teaching

The study results indicate that the major benefits of using Web 2.0 technologies in teaching include (1) interaction, communication and collaboration, (2) knowledge creation, (3) ease of use and flexibility, and (4) writing and technology skills.

Interaction, communication and collaboration. Most participants believed that using Web 2.0 technologies in teaching helps build a sense of community, increases interaction and communication among the instructor, students, and other people, and promotes collaboration and resource sharing. The following are some of the comments by the participants:

- *"I think, if used correctly, they can help develop a better sense of connectivity between students and teachers and afford students opportunities to connect and communicate with classmates and resources throughout the world..."*
- *"They reduce the distance between teacher and students."*
- *"Students learn about new ways of collaboration."*
- *"Students and teachers see learning as a more social process. It's not just the book and yourself; it's collaborative meaning making."*

Knowledge creation. 50% of the participants reported that Web 2.0 technologies enable students to "become creators of knowledge." As one noted, Web 2.0 technologies give students "the opportunity to create content themselves instead of just listening to lectures," and this supports active and student-centered learning in which students take responsibility for their learning. Several participants also noted that Web 2.0 technologies create an environment where a teacher becomes a facilitator of learning rather than a distributor of knowledge.

Ease of use and flexibility. About a third of the participants reported that Web 2.0 tools are easy-to-use and flexible. They noted that while some of the traditional course management systems (CMS) are too static, Web 2.0 tools remove time constraints by providing a more flexible learning environment that is not inhibited to classroom walls.

Writing and technology skills. Several participants noted that the use of Web 2.0 technologies help students become more proficient in writing and in the application of technology.

In addition to these four major benefits, the participants also mentioned that using Web 2.0 technologies "helps teachers understand a little more about the world of their students," and "motivates the students."

Barriers to using web 2.0 technologies in teaching

The study results indicate that the major barriers university instructors encounter in teaching with Web 2.0 technologies are (1) uneasiness with openness, (2) technical problems, and (3) time.

Uneasiness with openness. A number of participants noted that the open nature of Web 2.0 technologies is still new to many students. They reported that some students are very uncomfortable with the openness and are reluctant to participate in class activities that utilize Web 2.0.

… And the immediate and public nature of wiki collaboration made some of my students feel more self-conscious and a bit uneasy at times... These students preferred one-to-one teacher-student interaction more than public, peer-to-peer interactions…

Technical problems. Five participants reported that students who have older computers often have technical issues when using Web 2.0 tools. It was also noted that some Web 2.0 tools are "still a little primitive," having technical glitches and might not work well with current course management systems. Several participants mentioned that universities do not provide enough technical support for faculty who are unfamiliar with Web 2.0 technologies.

Time. It takes time to learn and manage new technologies. Time was another barrier identified in this study. Several participants reported that learning new technologies takes time away from learning subject matter content.

Best practices and tips for teaching with web 2.0 technologies

As mentioned earlier, the participants in this study were asked how they have used Web 2.0 technologies in their teaching, what instructional strategies or techniques have worked well, and what has not worked for them. Based on data analyses, the following best practices or guidelines were identified.

Do NOT introduce too many technologies new to students in one semester. A number of participants indicated that using too many Web 2.0 technologies in one semester could lead to surface learning. They suggested that instructors utilize a small number of the tools adding more only as expertise is developed.

Do NOT use multiple technologies that do the same thing. Several participants suggested that instructors should not introduce more than one application that does the same thing. It was noted that students must often manage several email accounts and forums and a new technology, if used like an existing tool, simply creates management problems.

> Students and I also felt at times that Wiki space is just another forum to manage in addition to several email accounts, WebCT, and etc in this busy life. The fact that most of my students were working full time and had several email accounts and other "online message boards" to check added to that feeling, perhaps.

Provide appropriate instruction, tutorials, examples, and frequent feedback. A number of participants emphasized the importance of providing in-class instruction, tutorials, and examples that teach how to use Web 2.0 technologies. They pointed out that Web 2.0 technologies are still new to many students, and support is needed if using them for learning activities and projects. On the other hand, it was also noted that instructors should help their students to become independent learners in keeping abreast of emerging technologies.

> "We can teach them how to use the tools available today, but by the time they graduate from the U., there will be new tools and no one to teach them. So, right up front they need to learn how to find resources on the web to help them learn new technology."

Facilitate collaborative learning. The participants in this study reported a variety of strategies for facilitating collaborative learning using Web 2.0 technologies. Examples of the strategies include the following:

- Using wikis for collaborative writing projects.
- Using a blog as a collaborative reflection space beyond personal journals by requiring students to respond and provide feedback to each other.
- Using a social bookmarking site for sharing resources.
- Using peer evaluation.

Build a sense of community in your classroom first before trying more public collaboration. Web 2.0 is generally characterized by openness, social interaction and collaboration. Not surprisingly, some of the participants used Web 2.0 tools for inter-institutional collaboration. One reported that her students wrote a wikibook on learning theories in collaboration with students in another university. She believed that their inter-institutional collaboration was not very successful because the students' entry level knowledge and focus (research vs. practice) were different. She also mentioned that some students were overwhelmed by trying new technologies with new people. She contended that instructors "have to establish at least a certain sense of community first before trying more public collaboration and social interaction."

Other strategies for teaching with Web 2.0 technologies the participants suggested include: creating an engaging and supportive environment, providing clear goals and objectives for using Web 2.0 technologies, rewarding students for good work and good contributions, and showing YouTube videos to start or end class.

Discussions

Web 2.0 has been one of the major topics in professional conferences and journals. Teachers and instructors in diverse contexts are exploring ways to use Web 2.0 technologies in teaching and learning. Many case studies on integrating Web 2.0 technologies in teaching and learning are providing valuable tips and lessons. However, Web 2.0 is still new to a majority of instructors, especially in higher education settings. This study attempted to present a first step in understanding the benefits of and barriers to using Web 2.0 technologies and in developing guidelines for teaching with Web 2.0 technologies.

Web 2.0 has the potential to provide more interactive and customized learning environments where students create knowledge, rather than passively receive information from instructors, interact and collaborate with those who have similar interests globally, and obtain opportunities to learn to become professionals in communities of practice. However, it appears that many teachers and instructors are not using Web 2.0 technologies to their potentials. Instead of maximizing the benefits of Web 2.0, educators often do the same thing with a new tool much

like early distance education instructors who simply moved their course content to the Web without adapting the course and teaching methods to the new environment.

Instructors should keep in mind that Web 2.0 itself does not guarantee more effective learning and teaching. Simply adding Web 2.0 tools to our traditional teaching practice cannot realize the potential benefits Web 2.0. New technologies can help us improve our teaching and learning only when they are used effectively with clear goals and proper methods (Reynard, 2009; Hurlburt, 2008). The effective use of new technologies requires innovation in teaching methods.

Participants in this study reported that universities do not provide enough technical support for faculty who are unfamiliar with Web 2.0. We agree that it is important to provide faculty with appropriate technical support. However, we believe that it is more critical to help instructors develop new ways of teaching that reflect the capabilities of the new tools and their potentials rather than simply teach them how to use the tools. In addition, institutional reward structure that is commensurate with the time and efforts that instructors invest in exploring these tools will likely remove some of the barriers to instructional uses of Web 2.0 tools.

Students also require some support to effectively learn with Web 2.0 technologies. Today's students integrate technology in their everyday lives and they are constantly connected to their friends, family, and various resources via technology. Therefore, it is easy to assume that they are technologically savvy. However, as Oblinger (2008) contends, "Not all students have computers, not all are skilled users, and not all want to use technology" (p. 18). This is consistent with the findings in this study. The participants noted that many students have technical issues with old computers, are not very comfortable with Web 2.0 technologies, and need instructions and examples on how to use them. In teaching with Web 2.0 technologies, instructors should be prepared to provide appropriate support and scaffolding. Providing step-by step procedural guidance might be necessary in some situations, but we believe that instructors should also help their students find appropriate resources and teach themselves how to use technologies since instructors cannot provide the tutorials forever.

Openness and privacy is another issue instructors should consider in using Web 2.0 technologies in their teaching. As noted in this study, some students are not comfortable with the open and public nature of Web 2.0 tools often preventing them from participating in learning activities. Openness is one of the key characteristics of Web 2.0 and is expected to be increasingly reinforced in the future. There should be more research on this issue to help instructors effectively prevent potential problems and counter students' uneasiness with openness.

Limitations and Future Research

The benefits, barriers, and best practices identified in this study are based on Web–based survey responses from only fourteen university instructors even though they had considerable experience in teaching with Web 2.0 technologies and provided great insights into the use of the new tools in higher education settings. Further studies might survey a large number of instructors and also conduct interviews in addition to the survey with hopes of better understanding participants' experiences. Second, it might be interesting to observe a number of courses that use Web 2.0 technologies and learn about students' perspectives as well as those of instructors. Finally, future research should also explore how Web 2.0 technologies are used in different contexts, including K-12, higher education, corporate settings, and the comparison and contrast of the findings.

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Teachers' Attitudes towards Technology – Considerations for Designing Professional Development

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Abstract

To best design technology integration professional development, one must have a clear understanding of teachers' attitudes and beliefs regarding its practice. Students enrolled in Learning with Technology, a required course in an online Masters in Education degree program, completed a post-course reflection assignment. Students were practicing teachers or certified education professionals. An analysis of 225 responses to an essay question regarding attitude towards technology integration is shared. Results indicated the majority, 52%, had positive feelings about and were integrating technology, 28% had positive feelings but cited obstacles to integration, 13% were fully integrating, and 7%, were not integrating. The most common obstacles to integration included skills, efficacy, access, and time. Implications for the design of technology integration professional development activities are shared.

Background

 "Despite a steady wave of how-to workshops and some longer-duration seminars, infusing technology into curriculum and teaching practices remains elusive for many teachers." (Plair, 2008, p.70). Compared to the availability of technology, technology integration, defined by Lambert, Gong, and Cuper (2008) as "teachers utilizing content and technological and pedagogical expertise effectively for the benefit of students' learning" (p. 386), is often deficient in today's classrooms (National Center for Education Statistics, 2000). According to the National Center for Education Statistics (2000), 99 percent of full-time public school teachers have computer and Internet access in their schools, but only 39 percent integrate technology into their lessons. In general, teachers are comfortable using technology for personal use or developing instructional materials, but they do not integrate it into instruction (Ertmer, 2005). If access is not the problem, what leads to inadequate integration and what can be done about it?

Various factors have been found to explain teachers' integration, or lack thereof; most relate to existing beliefs and attitudes. Hall and Martin (2008), for example, ascribe the lack of integration to self-efficacy. Their research revealed a statistically significant correlation between teachers' self-efficacy beliefs regarding computer skills and their integration of technology into instruction. Similar findings were uncovered by Piper (2003). Others attribute teachers' integration to existing beliefs about teaching and learning (Frederick, Schweizer, and Lowe, 2006; Kanaya, Light, and McMillan Culp, 2005; Tondeur, Hermans, van Braak, and Valcke, 2008). Kanaya et al. (2005), for example found a direct relationship between perceived benefits of technology integration and existing pedagogical beliefs. Chen (2008), on the other hand, assigned the lack of integration to perceived external factors and to limited or incorrect understanding of constructivist instruction. He states, "Teachers may have incomplete or incorrect understanding of proposed ideas and may hold conflicting beliefs without noticing the inconsistency" (2008). For example, Loveless (2003) found that teachers were in support of technology, but believed that technology should be taught as its own subject. How does one modify these conflicting beliefs and correct or complete these understandings?

One way to improve the rate of integration is via professional development (Brinkerhoff, 2006). Professional development provides teachers with opportunities to explore new technologies and develop new skills (Oncu, Delialioglu and Brown, 2008). The support and guidance offered in professional development helps teachers to develop the confidence to practice those skills (Brinkerhoff, 2006; Overlaugh and Lu, 2008). Also to be considered are the words of Ertmer (2005) who states, "If beliefs are formed through personal experience, then changes in beliefs might also be facilitated through experience." By providing professional development for teachers to learn

about and practice technology integration, teachers may come to correct conflicting or complete incomplete understandings.

Even with the best of intentions, however, professional development is unlikely to be successful without a pre-assessment of teachers' attitudes and beliefs. "A greater focus on assessing teachers' attitudes and beliefs," according to Hall and Martin (2008), "during professional development could result in a higher transfer of skills and knowledge to classroom practice" (p. 3).   Content and practice alone cannot make up for the delivery of a training mismatched to its audience. Professional development programs should be designed to complement and build upon existing attitudes and beliefs.

Research Questions

Having a clear grasp of teachers' preexisting attitudes and beliefs could help trainers to design more effective professional development activities (King, 2002; Windschitl and Sahl, 2002).   The current study focused on the identification of teachers' attitudes and beliefs towards technology integration. In addition, the author sought to uncover perceived obstacles. The purpose of the present study was to address the following research questions.

       1. What are teacher's beliefs and attitudes towards technology integration?
       2. What obstacles prevent teachers from integrating technology into instruction?

While question #2 was not directly asked, the author anticipated that this issue would surface in response to question #1.

Data Collection

The analysis was conducted with data collected from May 2008, end-of-course reflections submitted in *Learning with Technology*, a required course in an all online Masters in Education degree program at a Midwestern university. The assignment was part of the regularly assigned curriculum and required students to respond in 100 words or less to the question "What was your attitude towards technology before you took this course?"

Prior to the course, the author knew she was going to analyze the reflections, so she inserted into the directions a declaration of intended research and a waiver. The declaration stated:

> The College of Education is conducting a qualitative research study about teachers' use of technology in their classrooms. All responses will remain anonymous, and associations will not be made to your place of work. You contribution will be used to help teacher education programs better understand technology use strengths, weakness, achievements, and areas of need.

The waiver stated: "I authorize the College of Education to use my responses on this assignment as part of its qualitative research study."

At the time this course was offered, the college offered two degree programs, both leading to a master's in education.   Programs were designed such that all cohorts took the same courses at the same time. In the spring term of 2008, there were 1346 students enrolled in the course, thus offering a large sample from which to draw. Of those students enrolled, 500 turned in this last assignment (worth 5% of their grade). Because the degree programs are completely online, all essays were submitted electronically for grading.   A review of the submissions indicated 450 initialled the waiver, 149 did not, and 5 submitted blank assignments.   A random sampling equal to 50% (225) of submitted, waiver initialled assignments were analyzed.

Analysis and Summary

To group responses, the author used a web-based text visualization tool called Wordle (www.wordle.net). To use Wordle, one simply drops text into the online text box and a word collage image appears. The image allows users to see how frequently words appear in a given text, drawing each word at a size proportional to its frequency. In other words, the size of a word is proportional to that word's frequency.   All sampled essay responses were dropped into the Wordle text box. The most frequently cited words were noted and used to develop coded categories:

- 1A Didn't care, didn't do
- 2A Cared, but saw obstacles so didn't do
- 3A Cared, but just used myself
- 4A Cared, was doing some integration(learning from)
- 5A Cared, was doing integration (learning with)

Regarding categories 4A and 5A, many respondents cited a report from their required readings called *Laptops for Learning: Final Report and Recommendations of the Laptops for Learning Task Force* (Barrios et al., 2004). This report distinguishes between "learning *from*" technology and "learning *with*" technology. Learning from technology "is akin to the old 'sage on a stage' notion of teaching. The technology is used solely to deliver or broadcast information to students" (p. 6). Learning *with* technology, on the other hand, "empowers students with the tools to take responsibility for their own learning" (p.6) and it "requires a higher level of thinking and problem solving" (p. 7). Because this distinction was often explicated, it was built into the coding.

As a result of this analysis, another theme emerged: obstacles to integration. Most respondents indicated a number of obstacles that lead to their attitude and/or prevented them from integrating more technology. The author grouped and coded these responses as well. These categories included:

- 1B Lack of knowledge about/skills to provide
- 2B Lack confidence/efficacy to use
- 3B Lack of resources/access
- 4B Not enough time to learn
- 5B Students are too young or unskilled
- 6B Non-supportive administration

Results
Audience

Participants were practicing teachers or certified education professionals, including librarians and social workers. The majority, 191 (85%), were employed by urban school districts; the remaining were employed by suburban school districts. While there was a distributed sampling of grade levels at which these professional taught/worked, the majority, 96 (42.6%), were at the elementary school level. Of the remaining, 15 (6.6%) were at the pre-kindergarten/ kindergarten level, 39 (17.3%) were at the middle school level, 34 (15.1%) were at the high school level, and 41 (18.2%) did not indicate.

In regards to specialty areas, a wide variety of subject areas taught was represented: librarian (1), math/science (1), nurse (1), technology (1), vocational (1), language arts/science (2), foreign language (3), language arts/social studies (4), art (5), music (5), physical education and/or health (5); English, reading, or language arts (6), social studies (8), science (13), math (15), special education (28), and generalists teaching most subject areas (83). The 42 students who did not indicate their grade level also did not indicate their specialty area.

Some demographics – age, gender, race –could not be determined because they were not requested. The demographics for all students enrolled in the course at that time, however, could be determined based on college enrolment data. The gender report indicated that 95% (1285) were female, 4% (47) were male, and 1% (14) did not report their gender. The ethnicity report indicated that 70% (944) were White, non-Hispanic, 13% (177) were African-American, 6% (82) were Hispanic, 7% (100) did not indicate their race/ethnicity, 2% (29) Asian or Pacific Islander, <1% (6) were "other", <1% (3) was multi-ethnicity, and <1% (1) was American Indian or Alaskan Native. The age report indicated that 8% (106) of students were 20- 30 years of age, 13%(181) were 31-40 years of age, 10% (128) were 41-50 years of age, 11% (152) were 51-60 years of age, 18% (24) were 61-70 years of age, and <1% (1) was 71 plus years of age.

Attitude towards Technology Prior to Instruction

A review of responses to the question, "What was your attitude towards technology before you took this course?" revealed a varied, but not equal distribution of attitudes towards technology integration (See Figure 1). The majority, 52% (117), was using some technology in the classroom, but the level of integration would be best described as "learning *from*" technology, rather than "learning *with*" technology. The typicality of a "learning *from*" behavior mirrors findings in a 2003 U.S. Department of Education's Integrated Studies of Educational Technology report. That report indicated the computer related activities most often exercised by teachers with their students included writing, improving computer skills, doing research using the Internet, using computers as a free-time or reward activity and doing practice drills.

Figure 1 – Attitude towards Technology Integration Prior to Instruction
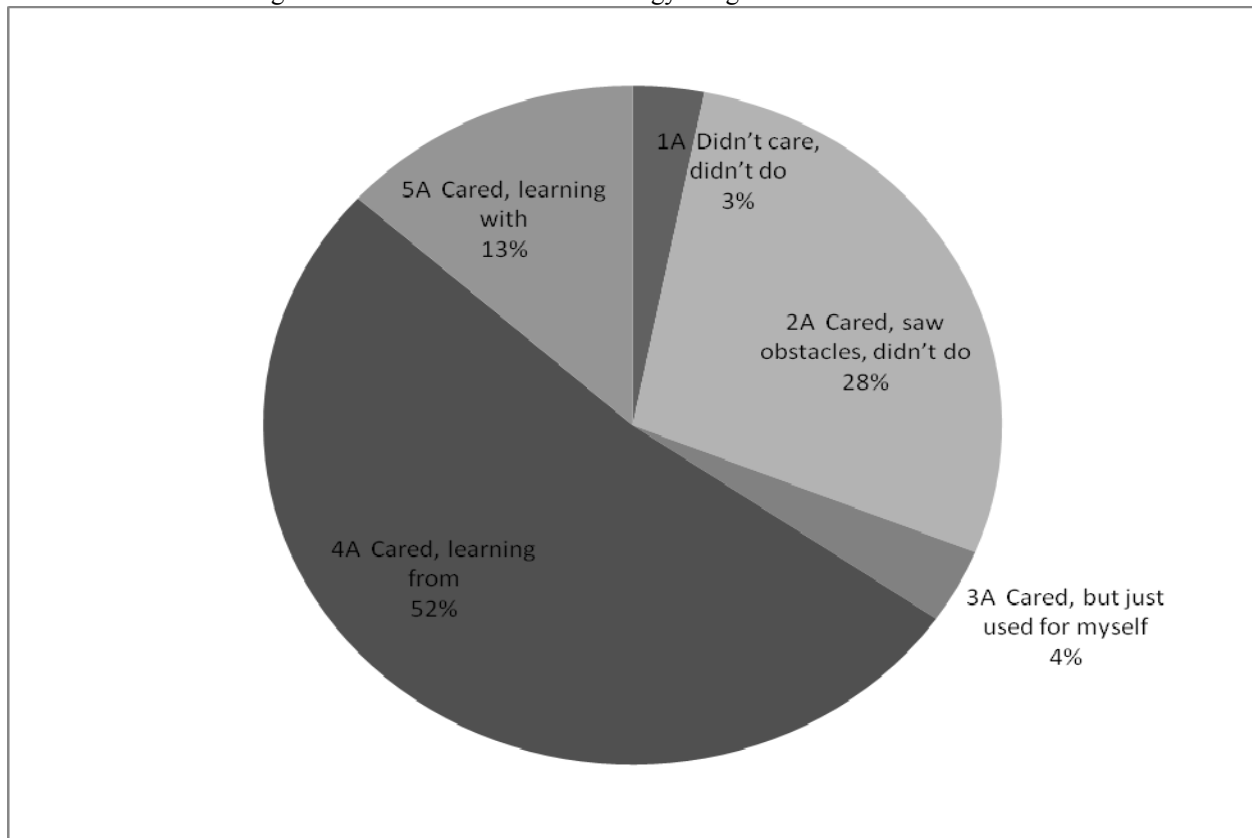
Examples of responses at a "learning *from*" level are:

- "Before I started this course, I must admit that I inadvertently focused more on learning from technology than learning with technology. I would assign Internet projects to my students that wouldn't really teach them much."
- "This class opened up my eyes in regards to what I was viewing as 'embracing technology' in my classroom. What I thought was sufficient, wasn't really sufficient at all."
- "Prior to taking this course, I felt pretty confident of my technology skills. Little did I know that I wasn't even hitting the rim of the basket"
- "I felt technology was an important aspect of my students' lives. Even with these thoughts, I found it difficult to integrate the technology into my lessons without changing everything completely."
- "I don't think I was ever resistant to technology, just unaware of all it can do for me and a teacher and my students in their learning. "

The comments indicated that while these students (teachers) thought that they were adequately integrating technology, they came to realize they could have been doing much more. It is also apparent some of their misconceptions may have stemmed from a lack of knowledge about how to go about integrating technology at a "learning *with*" level.

The next most largely represented attitude was that technology integration was important, but due to perceived obstacles, they did not put that belief into practice, 28% (63). Obstacles cited ranged from non-supportive administration to lack of knowledge and skills. These obstacles are described in the next section.
A small percentage of respondents, 13% (30), were fully integrating technology at a level at which could be described as "learning with" technology. Examples of responses are:

- "I am not a digital native but was a migrant to it long before this course. It started off more than a decade ago with me. I can effectively develop a student centered inquiry based, self-directed learning environment with equitable assessment."
- "I am comfortable using technology in my classroom and actively plan lessons using the computer as a component all day long. I find access to a computer a wonderful and effective way to reach my special ed[ucation] students."
- "The essential question when I begin this course was how do I guide students in ways that put them in charge of showing their understanding and knowledge through activities that provide the context for authentic learning, using technology and at the same time addressing the learning standards required by the district and the state."

In reviewing responses such as the one of above, it was apparent that they were using technology to empower their own students. In all cases, it was also apparent they wished they could be doing more.

As for the remaining coded attitudes, "Cared, but just used myself" and "Didn't care, didn't do" were expressed by 4% (8) and 3% (7), respectively, of the remaining sampling. Examples of responses are:

- "I felt that technology was a part of our culture, but I guess I did not see the real relevance of technology in the classroom."
- "My attitude towards technology before I took this course was negative. I did not understand why it was necessary to incorporate technology into the classroom. I grew up with limited use of technology tools during my elementary and secondary education; therefore, I never saw it as a means necessary to increase student achievement and instructional practices."
- "I believe my attitude towards technology prior to this course was not very important. I do use a computer at home and at work to create documents and send e-mails…"

Respondents appeared to use technology in their own lives, but did not see value in bringing it into the classroom. These findings were consistent with Chen (2008) who found that all teacher participants used various technologies for personal use, instruction planning, and administrative work, but very few used technology to achieve instructional goals other than covering curricular content, preparing students for examinations, and highlighting important concepts. Fortunately, in the current study, every "didn't care, didn't do" or "cared, but just used myself" respondent later expressed in his/her post-course reflection that as a result of what was learned in the course, he/she was now going to take small steps to integrating technology. This change reflects a very positive outcome of technology integration professional development.

Obstacles to Integrating Technology

Rogers (1995) states people are more likely to adopt an innovation if the innovation offers a better way to do something, is compatible with their values, beliefs, and needs, is not too complex, can be tried out before adoption, and has observable benefits. It became apparent, when reviewing responses, the obstacles were rooted in factors conflicting with perceived attributes. The most commonly cited obstacles were: lack of knowledge about/skills to provide (92), lack confidence/efficacy to use (28), lack of resources/access (26); not enough time to learn (11), students are too young or unskilled (5), and non-supportive administration (3) (See Figure 2).

Figure 2 Obstacles to Integrating Technology
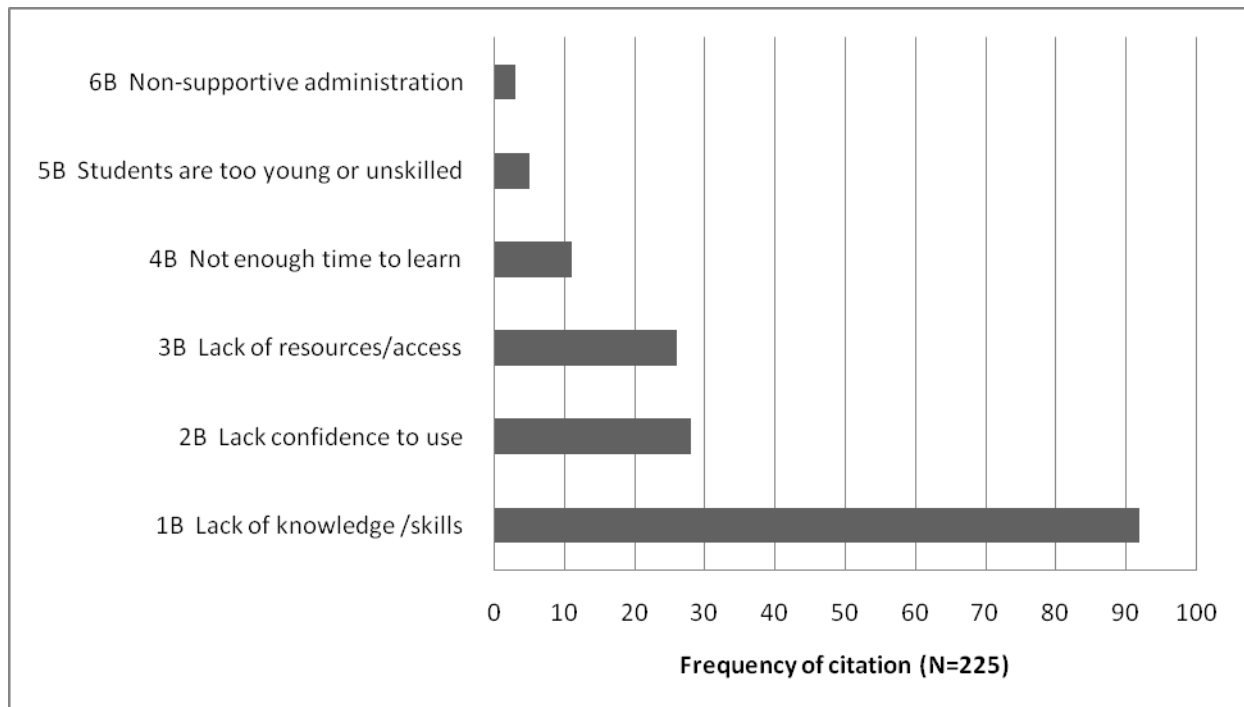
Some respondents reported more than one obstacle and others reported none. Examples of responses are listed below. Next to each statement, in brackets, is the obstacle(s) coded:

- "I have only been teaching for five years, and have always thought about the use of technology. During my first two years I was busy learning the curriculum and trying to manage twenty-eight students. I felt like I didn't have room in my curriculum for technological lessons." [Obstacles: time; knowledge/skills]
- "I was negative toward technology because the resources that are available to me at my school are limited. The computers in my classroom are old and run very slowly. It is also difficult to download any new software and I only have Internet access on one computer. I also didn't have ideas on how to integrate technology in my kindergarten classroom." [Obstacles: access; young students]
- "Five weeks ago if someone were to ask me about technology in my school, I would roll my eyes and reply, 'What technology? We barely have computers.' That would be the end of the conversation and I would move on to a new topic." [Obstacles: access]
- "I have always felt that I have the basic skills needed to work with technology, but the thought of having my students use it to learn scared me! I felt like I did not know where to begin." [Obstacle: confidence/efficacy].
- "I was unaware that standards for teaching with technology even existed." [Obstacle: knowledge/ skills].
- "My initial attitude toward technology before I took this course was negative because the word *technology* reminded me of my deficiencies as an educator." [Obstacle: confidence/efficacy].
- I have always been an advocate for technology and new experiences [but], I was often frustrated by the schools limited resources as well as lack of ideas. [Obstacles: access; knowledge/skills]

It becomes apparent after reviewing these comments and the frequency chart that reasons vary in type and number. Many are consistent with perceived obstacles uncovered by Demetriadis, Barbas et al. (2003). The most commonly obstacles found in their research were: (1) material conditions (including an insufficient number of computers and insufficient technology expertise); (2) difficulty integrating technology into the regular curriculum and instruction; and (3) lack of supervisory and technical staff. Perceived obstacles, real or not, should be addressed in the design of professional development.

Limitations

There are a variety of factors that could keep one from generalizing the results of this analysis to other populations. The first factor that could influence the findings is that students (teachers) enrolled in this course chose to earn their degree online. Students enrolling in an online degree may have a more favourable attitude towards technology than those enrolling in an on-campus degree program. Another factor that could influence the findings is the large percentage of students (teachers) who work for an urban school district. Access to technology, availability of professional development resources, and the study body demographics in urban school districts can vary from that found in suburban or rural districts. A third factor to consider is the timing of this assignment, in this course. Despite the assignment directions requesting students (teachers) to consider their attitudes towards technology integration before the course, their perceptions may have shifted during the course. A fourth factor to consider was the large percentage of females enrolled in this course and degree problem. It is possible females may integrate technology into the classroom to a greater or lesser degree than males.

Implications

Teachers' attitudes and beliefs should be carefully considered in the design of technology integration professional development. This analysis indicates many teachers believed technology integration was important, but didn't know how to do it. It was also uncovered that some had mixed feelings, some of which were rooted in perceived obstacles related to skills, self-efficacy, access, and time. Ideally, the majority of teachers should be fully integrating technology in their classrooms. Incorporating skill-building activities and suggestions for authentic applications into professional development would help to build teachers' efficacy towards and appreciation for technology integration.

Technology integration professional development may require more than the typical lecture and drill method of instruction. As with any new skill, technology integration professional development should delivered in a supportive environment emphasizing authentic practice. Jan Hawkins, former director of the Center for Children and Technology at the Education Development Center, Inc. abides by four primary guidelines when combining professional development and technology:

- Intensive sessions where teachers are able to explore new ideas and materials;
- Follow-up support over an extended period of time with mentors;
- Ongoing, reflective conversations with colleagues doing the same job and trying to make similar changes; and
- Observation of other teachers in their classrooms. (1997, p. 215)

Despite the date of Hawkins' article, 1997, her authentic, collaborative prescription is constructive and consistent with Brinkerhoff (2006) and Overlaugh and Lu (2008). She emphasizes a mode of delivery that develops skills and fosters efficacy, two of the top three primary obstacles indicated in this analysis's findings.

Regarding efficacy, Linnenbrink and Pintrich (2002) indicate its development is facilitated by providing opportunities for success within one's range of capabilities and then gradually developing new skills. This suggestion is in line with Hawkins (1997). Self-efficacy is not the result of will-power, but actual success Beck (2004). To improve self-efficacy towards a given skill, Weiner (1986) suggests linking behavioral outcomes such as engagement with achievement. This means professional development should provide opportunities to link success to strategy use, rather than just effort.

Regarding access, another common obstacle, a teacher may want to integrate technology, but due to a real or perceived lack of resource, cannot. For example, a respondent stated:

> I have always held a positive attitude toward technology. I use the Internet regularly in my personal life, but I did little to integrate it into my classroom. Part of the reason for this was simply a lack of access. I did not have a classroom computer until two months ago.

Lack of access or resources was cited by twenty-six respondents. In most cases lack of access meant having only one computer in their classroom. This means professional development should include tips for integrating technology when access is limited. Kathy Shrock provides a host of resources on her *Guide for Educators* website in a section entitled: "The One Computer Classroom: A Review of the Internet Literature." Integrating thematic station-based work, scheduling, or using a projector, are three simple ways to overcome the one computer, one classroom obstacle. Strategies like these could be incorporated into professional development, particularly when access is a perceived obstacle.

Also to be considered when addressing access is students' (of the teachers) access to technology at home. As one respondent stated in her reflection, "My students are low-income minorities and less than five, when asked, have access to a computer at home."   In such situations, student experiences with technology are more likely to be concentrated on computer basics and support for academic remediation then on using technology to enhance the learning and critical thinking process (Warschauer, Knobel, and Stone, 2004). Teachers, therefore, must be trained how to teach these basic skills within the context of authentic, rich lessons.

The strength of obstacles should not be underestimated because nary was the teacher who was strongly passionate about technology and not integrating technology at a "learning *with*" level. The analysis indicates obstacles, real or not, must be dealt with in professional development. Heeding existing perceptions and attitudes in the design and delivery of professional development will result in a higher transfer of knowledge and skills (King, 2002; Martin and Hall, 2007; Windschitl and Sahl, 2002). The hope, consequently, is that improved knowledge and skills will lead to an increased percentage of teachers who help their students to learn *with* as well as *from* technology.

Conclusions

Ertmer (2005) indicates, "If we truly hope to increase teachers' uses of technology, especially uses that increase student learning, we must consider how teachers' current classroom practices are rooted in, and mediated by, existing pedagogical beliefs" (p. 36). As one respondent so eloquently put it, "I have come to the conclusion that we as educators must accept change in order to implement 21st century teaching so that our students become 21st century learners." Finding ways to elicit that change through well-planned technology integration professional development *is* obstacle that can be overcome.

To better address technology integration professional development for teachers, one should have a clear picture about teacher's attitudes and beliefs towards technology, including their perceptions about how technology can help them to become better teachers and how technology can help their students. Knowing "the motivation to learn depends largely on the learner's personality, the nature of the thing or skill to be learned, and the learner's perceptions of the value and difficulty of learning it" (Keller, 1993, p. 4), considering these perceptions is critical to the successful design of technology integration professional development. Keeping in mind "the most important investment a school board, administrators, and parents can make in a school system is to ensure that teachers continue to learn" (American Federation of Teachers, n.d.), taking extra steps to ensure professional development is effective is well-worth the effort.

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Time and Responsibility: Examining the Volunteer Workload of School-based Personnel in one Distance Education Program

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Abstract: The success of high school distance education in Newfoundland & Labrador, hisotorically, largely depended on the widely known, but rarely documented content-based assistance voluntarily provided by from school-based personnel. Currently, due to continuing enrolment decline, more rural schools find they must rely upon distance education to offer academic-level courses to students with a wide range of abilities, creating new responsibilities for teachers that have also gone undocumented. This study will document the duties and time required to provide support for this new model of distance education

Newfoundland and Labrador is Canada's newest province,[1] the second smallest in terms of population and perhaps the most rural. The total population is around 500,000, the majority of who live in rural areas. Newfoundland and Labrador has always been and remains a province of small schools, most situated in rural areas. Although the number of schools over all has declined from a high of 1200 in the 1960's to less than 300 today, the scale of schooling remains small. The average enrolment of all schools in the province is only 257 while the average for the 179 rural schools is 163 students. Ninety of the smallest of these rural schools are all- grade, K-12 schools and are situated in the more remote and isolated regions of the province. Close to 25% of the schools have less than 100 students and 37 of these have less than 50 (Mulcahy, 2009).

For most of the twentieth century educational reformers in North America believed the problem with rural education was the scale of schooling. The schools were too small to provide quality education for rural children in a cost effective manner. The solution to this "problem" was obvious: institute a policy of closure and consolidation and eliminate as many small schools as possible. Rural students of all ages would be transported to distant communities where they could enjoy the purported educational advantages and opportunities only available in larger schools.

For most of the 20th century educational authorities in Canada (and the United States) in the name of educational reform have pursued a consistent and at times ruthless policy of school closure and consolidation. Nowhere was this policy more "successful" than in Newfoundland and Labrador. Since 1966, 900 schools mostly small rural community schools have been closed. Parallel to the closure policy was an extensive use of bussing that saw increasing numbers of students bussed for longer distances to larger schools further and further away from their home communities.

By the end of the 20th century and increasingly in the 21st century school consolidation had run its course and what schools that could be closed had been reformed out of existence. Increasingly, the small rural schools that remained relied increasingly on various forms of distance education to provide their high school students with access to the programs and courses they need to graduate. As enrolment continues to decline and site based teachers are cut from schools the reliance on distance learning will intensify.

Distance education, in a jurisdiction like Newfoundland and Labrador, has the potential to make the size and location of a rural school irrelevant in terms of its ability to provide students access via the Internet to any program or course they may need or wish to take. However, certain aspects of the existing model in this province must be changed if all students are to have an equal chance of succeeding in this mode of learning.

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[1] Newfoundland and Labrador became a Canadian province in 1949

> The problem is CDLI is being used at our school to teach the core courses ... like math and English and all the sciences, art and writing ... that's all good if you have an above average student who has a great work ethic but if you have a normal student who is easily distracted ... sitting him in front of a screen is not going to work… and we are going to lose a lot of students even average students... their marks are going down ... it don't work if you have no teachers in there and you are sitting them there in front of a screen and they are supposed to work. – *parent* (Mulcahy, Dibbon & Norberg, 2008, p. 15)

In its original conception in Newfoundland and Labrador in 1987, distance education was intended to provide supplementary programming to small rural schools. The intended cliental were the top academic students in the school who were interested in and capable of working in a self-directed and independent way.

Since 1992, with the province experiencing a dramatic decline in student enrolment the need for distance learning has intensified. Hardest hit in terms of enrolment have been small rural schools. As a consequence of this decline increasing numbers of teaching positions have been eliminated from the system. The ability of small rural schools to offer even minimum programs and courses on site has become increasingly problematic. In addition, in recent years it has gotten increasingly difficult to staff the more remote and isolated small schools with specialists in the areas of math, science and foreign language.

The Centre for Distance Learning and Innovation (CDLI) was established (2000) to provide high school courses to small rural schools via the Internet, courses not available on site because of the schools size and/or location. Each year since 2001 CDLI has increased the number of courses available online. In remote and isolated schools, because of the lack of curricular options, almost all students must take one or more distance courses in order to graduate.

This revised mission for the CDLI is a very significant change in the purpose for CDLI and distance education in the province. Whereas before they were providing a service of choice for an elite and selective group of students, they are now operating as a necessary mode of curriculum delivery for even the most academically challenged and immature adolescents. The significance of this cannot be overestimated: students must master the demands of distance learning or compromise their future life chances.

For those adolescents who possess the necessary attributes[2] to succeed in this virtual environment, CDLI provides them with access to a wide range of courses that they would not otherwise be able to take. For those lacking these attributes, online learning is problematic.

One problem that participants in a recent study (Mulcahy et. al., 2008) identified is that many students are just not suited to this type of learning because they are unable to work independently without direct teacher supervision. However, as smaller schools have had to rely more heavily on CDLI, all students have to take one of more online courses.

Teachers are all too aware of the problems that can arise from leaving adolescents unsupervised. However, their on site responsibilities leaves little time to monitor distance students. One teacher explains the complexity of the situation, "I just don't have time to monitor it. I tried but I'd be leaving my own class to check on them and that didn't seem fair" (Mulcahy et. al., 2008, p. 20). Another teacher explains what can happen when you leave students alone in a room, "There are kids fooling around, acting up and distracting others and no one is going to be the person who goes to the principal" (p. 20). Students themselves report many distractions with online learning, "It's just harder to concentrate when you're on the computer. There are too many temptations to go to MSN, Facebook and You Tube" (p. 20)

Clearly there is a need for more supervision and support for students engaged in distance learning. One parent outlined how he envisioned the role of a person designated to work with distance students. He felt the role is more than just supervising:

> Not just supervising but someone who meets with them on a regular basis to ask how their course is going ... someone to say, I notice you have this to do ... you have an assignment due.... you had a test last week and you didn't so well in it ... what's the problem? ...and that person can communicate with the CDLI teacher because you get some kids who don't ask for what they need.. Because they

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[2] A successful online learner needs to be disciplined and have the initiative to study in a flexible environment without the constraints and supervision of a traditional classroom. Important attributes include: the ability to be organized, motivated and self-directed. Although they can study and attend class at their leisure, online learners typically do not procrastinate. They set a pace that enables them to comfortably get their work done. They are usually very committed to their online high school classes. (Mulcahy et al, 2008, p. 16)

don't know what they need and to expect them to ask someone who is just a voice is too much to expect them to do ... that's an additional hurdle to them... It's more than just supervising... (Mulcahy et.al., 2008, p. 20)

The Centre for Distance Learning and Innovation

The method of delivery utilized by the CDLI includes both synchronous and asynchronous instruction. The CDLI provides anywhere from 30% to 80% of the students' scheduled time (which is 10 one-hour periods over a 14 day cycle), depending on the subject area, in synchronous instruction using a virtual classroom. This virtual classroom allows for two-way voice over the Internet, a shared, interactive whiteboard, instant messaging, application sharing, breakout rooms, and interactive quiz and survey management (Murphy & Coffin, 2003). Through this virtual classroom, teachers are able to teach in much the same way they would in a traditional classroom.

The asynchronous instruction is conducted using a course management system (CMS). The CMS provides the teacher and students with a variety of tools, including a discussion forum, a shared calendar, an internal e-mail system, and a place to house the course web pages. The course web pages are designed by a team that includes a teacher acting as a subject matter expert and a multimedia specialist to add images and interactive items into the content. The course web pages are divided into the units called for in the curriculum guide, further divided into sections which are akin to themes, and finally into lessons which can be completed in one to three hours of student time. Teachers regularly use the internal e-mail system and discussion forums to communicate with their students (Barbour, 2005).

The mediating team designed to support this delivery at the school level is officially divided into three distinct roles: administrative, technical, and coach. The administrative m-teacher often proctors tests and exams, monitors student attendance and behavior, and provides for scheduling, enrollment and other macro level items. The technical m-teacher provides initial maintenance and trouble-shooting for the CDLI computers (all major problems are handled by a district-level technician or by the CDLI). Finally, the coach m-teacher provides with supervision and support (although not academic support) and some general support in gaining the independent learning and self-motivation skills that may be needed to succeed in the CDLI environment The coach may also be used to proctor tests and exams, along with monitoring student attendance and behavior. Many schools will assign multiple teachers to perform each of these roles, particularly the role of coach (Barbour, 2007a).

Background on the Mediating Teacher

In their initial evaluation of the CDLI, Coffin and Stevens (2002) indicated:
e-learning of high school students does work. With the present level of connectivity and because on-line high school programming is still in a nascent stage the success of e-learning will be restricted to students with specific traits, habits and abilities" (p. 49).
The difficulty is that, as Haughey and Muirhead (1999) described, the preferred characteristics of students involved in K-12 online learning include the highly motivated, self-directed, self-disciplined, independent learner who could read and write well, and who also had a strong interest in or ability with technology. This seems to justify Mulcahy (2002) concern that web-based distance education may not be accessible be all students.

The problem arises when more rural schools are forced to utilize online learning to offer the regular academic curriculum because of declining student populations. Barbour and Mulcahy (2008, 2009), in their examination of student performance in CDLI courses, found no significant differences in the performance of classroom-based and web-based students. However, the authors have questioned whether their sample of web-based students contains students from the same range of abilities as would be found in the classroom. In many rural schools, students without the preferred or desired characteristics have to enroll in online courses in order to graduate from high school from the academic program. The only alternative is to register for courses in the basic program, which essentially prevents these students from any post-secondary options beyond trade school. Recently, in their study of three rural schools along coastal Labrador, Mulcahy et al. (2008) found that two of the schools had a higher percentage of students enrolled in basic-level courses and speculated the fact that many of the academic courses were only available online through the CDLI as a possible cause. An initial examination of this issue by Mulcahy and Barbour (2009) revealed that from 2006 to 2008 the percentage of students enrolled in basic-level courses was higher in CDLI schools than in schools that did not rely upon the CDLI for its academic courses.

One of the solutions to this potential problem, and one of the suggestions made by Mulcahy et al. (2008) to improve upon the delivery of online courses by the CDLI, was "for increased support and supervision in the school for students taking distance courses" (p. 33). As Coffin and Stevens (2002) originally noted the CDLI "should be treated as a significant innovation that has the potential to transform the teacher-student relationship and, hence, the nature of learning that occurs. Those possibilities need to be explored and accommodations made to online programs and the delivery mode" (p. 24). Cuban (2002) described the process of transforming an educational system as first introducing technology and then "altering fundamental ways of achieve organizational goals…. [and] introducing new goals and interventions that transform the familiar ways of doing things" (p. 229). The use of "volunteerism and good will of overworked teachers" is consistent with the former model of distance education that existed in the province (Mulcahy et al., 2008, pp. 32-33). Models of innovation have shown us that change will only come when it "offers them a better way to do something; is compatible with their values, beliefs and needs; is not too complex; can be tried out before adoption; and has observable benefits" (Surrey & Ely, 2007, p. 106). Clearly more research is needed into the role, responsibilities, and time commitment of the in-school teachers who have volunteered their time and good will to date.

Unfortunately, there has been little research on how these school-based responsibilities are actually being implemented. Mulcahy (2002) was concerned that with less student selectivity, an increasing need for distance education by rural schools, and the nature of the proposed delivery, teachers who were given mediating responsibilities for the CDLI would play a critical role in the success of this new initiative, and that there was a failure to consider the additional workload that would be placed on these rural teachers. This concern was well founded, at least during the initial year of the CDLI. Barbour and Mulcahy (2004) found teachers in one district reported "quite a burden [was] placed upon them due to the wide range of duties and time commitment associated with these new responsibilities" (Conclusion section, ¶ 2). They also found these teachers provided technical and instruction assistance, both of which were outside of the original vision of the ministerial panel. In a similar examination of school-based teachers in the ACCESS Alabama program, Roblyer, Freeman, Stabler and Schneidmiller (2007) found that "facilitators that are directly working with students day by day are key to the success of the [K-12 online learning] program" (p. 11). found Unfortunately, no further research exploring how these additional responsibilities are managed at the school level has been conducted.

Methodology

To begin this study we sought permission from each of the five school districts in Newfoundland and Labrador for permission to conduct research in their district. This was followed by contacting individual school principals, and then m-team members, to seek their participation in this research study. As the researchers were engaged in a separate research project with District 1, the Director of this district declined participation. In addition, some principals in the remaining four districts also declined participation. This resulted in the follow levels of participation.

Table 1. Level of Participation from Schools who Access the CDLI

Schools		M-Team Members	Schools Participating	M-Team Members Participating	Completed	Opted-Out	Not responsive
District 1	10	34	- -		-	- -	
District 2	32	83 18		46 16		7	23
District 3	33	102 33		102 17		27	58
District 4	21	62 20		58 15		9	34
District 5	2	3 2		3 0		1	2
Private Schools	2	5 2		5 1		0	4
Totals	100	289 7	5	214 4	9	44	121

Even without the participation of District 1, the possible sample represented 75% of the schools participating in the CDLI and 74% of the potential m-teachers. We had a 23% response rate, with 21% of m-teachers opted out of the study and 56% who were unresponsive.

The initial method of data collection was a revised version of the survey utilized by Babour and Mulcahy (2004), only adding questions to volunteer for future data collection. Surveys are useful for providing structured responses to many questions (Yin, 2003), and can also be useful tools in obtaining data about characteristics, attitudes, and beliefs about the participants, and for making inferences about a group of participants (Marshall & Rossman, 1999). In addition to the surveys, we also had six volunteers complete weekly logs of the duties that they undertook in relation to the CDLI or students enrolled in CDLI courses and the amount of time it took to complete these duties. Often what people say they have done in retrospect differ from what they actually did in the moment (Rathje & Murphy, 1992), so a written account that was relatively closer to the events in terms of time may have provided a more accurate description of the events.

Finally, we conducted seven semi-structured interviews that are currently being transcribed. Semi-structured interviews allow discussion of a greater breadth of topics than more structured interviews (Fontana & Frey, 2000), and also allow for a natural flow to the interaction (Patton, 2002). This article reports on the data collected from the surveys and weekly logs.

Results and Discussion

The initial questions on the survey explored the list of activities outlined in a 2001 memo sent by the Director of the CDLI to all participating schools and school districts outlining the duties that should and should not be performed by m-teachers. Table 2 provides the percentage of m-teachers who selected each level, along with the results of found by Barbour and Mulcahy (2004) – in grey – for comparison.

In the results from this study, there were a high percentage of m-teachers who selected "sometimes" or "often" for both the monitoring the progress of distance learning students and the following-up with such students to ensure future compliance statements. These two statements also saw a significant increase from the results found in 2001-02, possibly due to the fact that in the CDLI initial year of operation many principals were advised to act as gatekeepers for the online courses that were being piloted. As students with a wider range of abilities are enrolling in CDLI courses m-teachers have to spend more time monitoring their progress and follow-up with these academically weaker students.

Table 2. M-Teachers Feedback of Various Duties (current study and 2001-02)

Never		Sometimes	Often
Supervising distance learning students while they engage in online activities.	17	54	29
0		*80*	*20*
Monitoring the progress of distance learning students, including accepting e-mail notification from the e-teacher which express concern regarding the failure of a student to submit assignments, exams, etc. on time.	8	31	60
0		*80*	*20*
Following-up with such students to ensure future compliance.	13	44	44
0		*80*	*20*
Accepting grades and reports from the e-teacher and ensure that these get entered in the students term/end of year report cards.	17	17	67
0		*60*	*40*
Providing limited assistance to students who encounter difficulty in using asynchronous communication tools (chat, discussion threads, e-mail, etc., web browser, and learning management system).	27	56	17
20		*80*	*0*
Including online students on the teacher's class list and as such follow-up on absences from class as would be the case with other students in that class whom the m-teacher instructs directly.	38	38	25
20		*40*	*40*
Meeting, as requested, with the e-teacher, web-based initiatives facilitator, high school program specialist.	50	44	6
0		*80*	*20*
In consultation with the CDLI, Virtual Teachers Centre of the NLTA and the School District, assisting staff colleagues in acquiring skills necessary for accessing web-based professional development opportunities.	65	35	0
40		*60*	*0*
Participating in district course implementation team meetings upon request.	79	15	6
60		*40*	*0*
Participating in provincial in-services and forums upon request.	60	33	6
0		*100*	*0*

When asked about other duties that m-teachers were known to perform that were not necessarily outlined in the original 2001 memo, the following results were found.

Table 3. Time Spent per Week on M-Teacher Duties

Duty	# of m-teachers	Time spent /week	Adjusted time/week based on % of m-teachers
Supervising tests/exams	40	58 minutes	48 minutes
Tracking down missing assignments/homework	20	32 minutes	13 minutes
Recording attendance or other administrative data	19	18 minutes	7 minutes
Providing content-based tutoring	20	42 minutes	17 minutes
Providing technology-based tutoring	23	24 minutes	11 minutes
Providing technical trouble-shooting	34	36 minutes	25 minutes
[Other] Setting up and/or supervising science labs	8	60 minutes	10 minutes
[Other] Preparing and submitting tests/exams	9	18 minutes	3 minutes
[Other] Encouraging students to attend class	1	60 minutes	1 minutes
[Other] Communication with e-teacher or CDLI	1	60 minutes	1 minutes
[Other] Downloading programs	1	20 minutes	1 minutes

The time adjusted time spent per week based upon the percentage of m-teachers who selected who selected each of the duties indicates that m-teachers spent an average of 139 minutes/week or 2.3 hours/week engaged in duties related to their role as a CDLI m-teacher. The timetable used by the CDLI is a 14x5 schedule (i.e., five one hour classes a day over a 14 day cycle), which allows for ten classes from each of seven courses or slots. A typical teacher in Newfoundland and Labrador would teach six out of the seven slots. An average of 2.3 hours/week equates to 6.5 hours/14-day cycle or approximately two thirds of a full course slot.

The information provided by the six teachers who completed the weekly logs over a four week period found that these teachers were primarily occupied by the following tasks: supervising tests/exams/class, tracking down missing assignments/homework, recording attendance or other administrative data, providing content-based tutoring, providing technology-based tutoring, providing technical trouble shooting, supervising science labs, and preparing and submitting tests/exams. It should be noted that the total time reported on these weekly logs was approximately half the minutes/week that was reported in the surveys (i.e., 148 minutes/week vs. 286 minutes/week). This result may be due to the specific six individuals who completed the weekly logs (i.e., these individuals may not have been as busy as their fellow m-teachers at their own or other schools. It may have also been due to the time of year these weekly logs were completed (i.e., February-March may have been lighter months in terms of CDLI responsibilities). Either way, the total amount of the time reported in the logs was still more than the amount reported by Barbour and Mulcahy (2004).

Based upon these results, m-teachers potentially lose up to approximately two thirds of their preparation time (or would have significant portions of time when they are scheduled to teach other students in the school) occupied with CDLI duties. Barbour and Mulcahy (2004) found that m-teachers spent 105 minutes/week or approximately 5 hours/14-day cycle engaged in their CDLI duties. This represents an increase of 1.5 hours/cycle, which can also likely be attributed to the increase in students who do not exhibit the characteristics outlined earlier by Haughey and Murihead (1999).

Policy Change Needed

The existing policy of CDLI maintains that students taking distance courses do not need academic support and supervision from school based teachers. They, purportedly, receive all the academic support they need from their online instructors and other support put into place by the CDLI (Barbour, 2007b).

However, as the range of students enrolling in distance courses has expanded it has become clear that some students need a great deal more school-based support and supervision than that envisioned in the current CDLI model. Many of these students lack both motivation and self-direction. Left unsupervised they will spend their time chatting with friends on MSN or Facebook, downloading music and playing computer games rather than attending to their online lessons. Many others are lacking in academic ability and find it very difficult to complete their work without teacher support. While there is academic tutoring available online many lack the confidence to initiate contact with their e-teachers or e-tutors.

The few teachers working on site in the remote and isolated schools do as much as they can for these students but their school-based workload is intense. In some situations teachers have to take time away from their existing teaching duties in order to assist an online student. This means they have to interrupt and disrupt their school based classes to provide the needed assistance (Barbour, 2007b). This is unfair to the school based students. In other situations the help has to be provided at recess, lunch time or after school. Rural teachers have to volunteer their precious free time to work with online students. Neither of these situations is pedagogically sound or acceptable. Distance students cannot be dependent on the volunteerism and good will of overworked rural teachers. Nor can their educational needs be defined as an additional assignment for a teacher who already has a full and demanding teaching load.

A modification to the existing CDLI model is appropriate and needed. There especially has to be some provision for increased support and supervision in the school for students taking distance courses. There is a need for someone who would have dedicated time away from other duties and responsibilities to work with a school's CDLI students. This support person would not be primarily academic. CDLI has excellent teachers who make themselves, for the most part, readily available to their students. The academic expertise is in place. The real need is for a person who would monitor and supervise students while they engage in their online courses. This person would act as a liaison between the student, the online teacher, the parents and the school's personnel. They would help students keep track of their assignments and tests, assist with technical problems and facilitate contact between students and their online instructor (Mulcahy, 2002).

In a recent study of teacher work load and allocation in the province, Shortall and Greene-Fraize (2007) recommended allocating one specialist (i.e., teaching professional) to schools "at a rate of one per 175 students to support the areas of… Centre for Distance Learning and Innovation (CDLI) support" (p. 109). Later in that report, in a section entitled "Other Issues", the authors recognized that "CDLI courses need school personnel support for administration, supervision, and subject support" (emphasis added, p. 180), and recommended that the Government consider this issue when considering future plans for growth and development. This change in policy, if the Government accepted it, would ameliorate many of the serious concerns raised by rural teachers, parents and students. There is no question that more and more students are going to have to rely on distance education provided by CDLI simply to graduate from high school. If students are going to graduate with an academic qualification (i.e., the ability to attend college or university), depending on the size of the school they attend, most will have to take a significant portion of their program online. If the right supports are in place more students will avail of the academic programs and, more importantly, have a greater opportunity to succeed.

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Cultural Connection, Online Collaboration and *Moodle*:
Inquiry into Undergraduate Filipino Students' Educational Experiences with Technology

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Abstract. Th is p aper fo cuses o n exp eriences o f un dergraduate Filip ino stud ents with o nline technology from a Man ila-based university (Ph ilippines) resu lting from using *Moodle* (M odular Object-Oriented Dynamic Learning Environment) to collaborate with a group of students located in sout hern United States (Georgia). It di scusses the de sign and de velopment of a virtual space using *Moodle* to facilitate an ed ucational ex perience for in dividuals separated b y great d istance and variance in contexts. Also, it discusses the perceived outcomes of col laborating with another group in completing a c ommon task. Further, it shares insights and implications in designing and developing online experiences for non-U.S. participants based on reported experiences of Filipino undergraduate st udents. Fi nally, t he pa per a ddresses t he im pact of online c ross-cultural experiences on student learning.

Introduction

The continuous introduction of new information and communication technologies that support teaching and learning i n hi gher e ducation has presented new chal lenges t o both fac ulty and students. T hese t echnologies a re transforming higher education at a very rapid rate that make everyone ask with questions like: What are some of the new t echniques I nee d t o know t o us e t hese t ools e ffectively? How effective a re t hese to ols in th e d elivery o f university-oriented curriculum? How does this influence or shape the development and delivery of courses in higher education worldwide ? More im portantly, faculty and students are now asking how their teaching a nd lea rning experiences can b e enh anced by wo rking together w ith their co unterparts in sep arate lo cations ar ound th e wo rld through these technologies.

The promise of a digital world ha s brought a bout i ncreased i nterests fr om diffe rent stakeholders -- administrators, faculty m embers, a nd students -- to ta ke on the c hallenges of onli ne teachi ng a nd learni ng. Moreover, the continuous introduction of instructional technologies in higher education has led to experimentation on wh at work s onl ine fo r different pop ulations and con texts (B rett & Nag ra, 200 5). R esearchers and p ractitioners alike h ave written articles s upporting th e benefits o f distance learn ing (Garrison , 2000; Sch wartzman, 20 07). Students engaged in distance learning experiences gain a gl obal dimension and acquire a competitive advantage on perspective t owards real life situ ations (Cassano , 2008). With distance learning experiences, s tudents h ave opportunities to bring classrooms to gether fro m acro ss cultures and d istances with un ique and ch allenging perspectives.

This case st udy involve d two fac ulty m embers who we re teaching unde rgraduate c ourses for pre-service teachers, and agreed to investigate the impact of collaborative online experiences among their st udents through the use of tech nology and by designing common activities and assignment for students to complete. In addition to the technological and c urricular chal lenges, differences i n learner c haracteristics and cultural back ground w ere considered.

Contexts and Participants

An online learning environment was designed and developed to host the communication, connection, collaboration, and community-building activities of two groups of undergraduate students in two distant locations: Manila, Philippines and Georgia, United States. Although separated by great distance, these groups of undergraduate students worked together in completing their respective assignment of developing a K-12 teaching (instructional) unit by sharing information relevant to completing the task.

Initially, the U.S. faculty member's interest in getting his students to participate in this project was the need for exposure to diverse perspectives. The university's location in a rural part of southern United States limits exposure and interaction with diverse populations. For the Philippine-based faculty member, she was interested in learning more how to use online technology like *Moodle* as well as exposing her students to a technology-rich learning environment.

This paper focuses <u>only</u> on the Filipino undergraduate students' experiences. References to the American students and their experiences are lim ited except when providing context to facilitate a better understanding of the process that occurred between the two groups. The Filipino students were enrolled in an undergraduate course that focused o n the use of t echnology i n pre-school e ducation fr om a M anila-based university. Due t o di fferences i n academic cale ndars between the Philippine s and the United States, the Filipino st udents started in November and completed their term in mid-March of the following year. The American students started their term in early January of the following year, were enrolled in undergraduate technology course, and finished their course activities in early May. Initially, there were a total o f 14 Filipino students enrolled. Data from 1 3 students were used for this research project due to non-completion of online activities by one student. All Filipino students were female and majoring in early childhood education.

Learner Characteristics

The literature id entifies learn er ch aracteristics as an i nfluencing facto r in eng aging in edu cational processes. Th e research ers used th e research on personality assess ment b y Go ldberg (199 2) an d co lleagues th at identified fi ve basic factors: Extroversion, Ope nness, Agreeab leness, Conscientiousness , and Em otional Stability. Extroversion, in comparison to introversion, is th e "people person" factor. It is primarily focused on behaviors that manifest ou tgoingness an d so ciability. Also , it is asso ciated with in dependence and decisiveness. Openness (sometimes called Openness to Experience) looks at being open-minded, curious, creative, artistic, and adventurous.

A high score in the Agreea bleness scale can be in terpreted th at a person is id entified as coop erative, considerate, good-natured, and t olerant. Thi s coul d m ean t hat t hese i ndividuals m ay avoi d co nflict. Conscientiousness e xamines whethe r one i s orga nized, schedule-oriented, accurate, extremely careful, disciplined, and shows ethical behavior and integrity. Emotional Stability (vs. Neuroticism) considers how a person responds to stress, anxiety, and depression.

Table 1
Pattern of Student Responses to Personality Inventory on Extraversion and Openness Scale (N = 13)

Student Response	Extraversion (%)	*f*	Openness (%)	*f*
Extremely	0.8	1	0.0	0
Highly	69.2	9	77.0	10
Moderately	23.0	3	23.0	3
Mildly	0.0	0	0.0	0
Barely or not at all	0.0	0	0.0	0
Total %	100.0	13	100.0	13

Results of the personality assessments for the Filipino students reported moderate to high (92%) in the extraversion scale. Also, all students reported moderate to high (100%) in the openness scale. One interpretation of these results could be that this particular group of students easily make friends and welcome new experiences. These characteristics seem important for those who are trying something different and for the first time as part of the academic experience.

Table 2
Pattern of Student Responses to Personality Inventory on
Agreeableness, Conscientiousness, and Emotional Stability Scale (N = 13)

Student Response	Agreeableness (%)	*f*	Conscientiousness (%)	*f*	Emotional Stability (%)	*f*
Always	30.8 4		15.4	2	0.0	0
Often	61.5 8		38.5	5	15.4	2
Usually	7.7 1		46.1	6	69.2	9
Seldom	0.0 0		0.0	0	15.4	2
Hardly	0.0 0		0.0	0	0.0	0
Total %	100.0	13	100.0	13 10	0.0 13	

Results on the factors were the following: 12 students reported high on Agreeableness, i.e., often to always (92%); 11 reported high on Conscientiousness, i.e., "usually" to "often" (85%); and 9 reported average on Emotional Stability, i.e., usually (69%). Interpretation of these results could mean that this group can be characterized as tolerant for extreme changes in their environment especially with conflicts. Another interpretation suggests that this group is focused on the task at hand. Finally, it seems that this group tend to manage stressful situations very well, i.e., demands for their time and attention in completing the various tasks in the course.

Moodle as a Learning Space

The collaborative virtual space for the two groups to interact was supported by *Moodle*, a server-based and open source application that functioned as a learning management system (*Moodle*, 2008). It was designed as an environment where students interacted with each other while completing the assigned task. *Moodle* was selected for low/no cost, ease of set-up and management, user-friendliness, and server-based functions similar to WebCT or Blackboard (Black, Beck, Dawson, Jinks, & DiPietro, 2007). *Moodle* features allow instructors and students to interact when sharing ideas, building concepts, reflecting on experiences, and constructing knowledge (Corich, 2005). In using Moodle as vehicle for online collaboration, both groups of students were required to complete the same assignment (i.e., develop a K-12 instructional unit collaboratively), participate in threaded discussions, and submit reflection postings/papers.

Research Questions

For this study, the researchers were interested in the experiences of Filipino undergraduate students who participated in an online collaboration with American students. Specifically, the researchers were interested in factors that support online cross-cultural exchanges, such as, learner characteristics (Santiago & Nakayama, 2006) and others (Tyler & Baylen, 1998). Also, the researchers were interested in how Filipino undergraduate students perceive and value their experiences of using technology to enhance knowledge and be successful in completing the given learning tasks.

1. How do the Filipino students perceive their online experiences? What are the similarities and differences of perceptions between the Filipino students and their American counterparts?

2. What component of the online experience was valued by the Filipino students? What are the similarities and differences of valued experiences between the Filipino students and their American counterparts?

3. How can technology support similar online cross-cultural exchanges that enhance undergraduate students' educational experiences from other countries?

Analysis of Data

Narrative texts from postings in online discussions and responses to prompt questions were analyzed for common and recurring themes and patterns. The researchers reviewed the results vis-à-vis current research literature on online teaching and learning as well as international issues related to using technology-based tools. The analysis of completed tasks by the undergraduate Filipino students focused on the quality of technology integration ideas shared, creative planning demonstrated, and types of support received from American students.

Findings and Discussion

Researchers focused on the discussion of findings on the following -- 1) perceptions of online experience as well as similarities and differences of perceptions between the two groups, 2) valued online experiences as well as similarities and differences in what was valued between the two groups, and 3) technology-based tools and experiences that supported learning among groups with varied cultural backgrounds.

Perceptions of Online Experiences

On perceptions of the online experience, the content analysis of reflection postings and papers revealed four online experiences that were identified as significant:

1) being able to share ideas about teaching;

2) receiving feedback and/or comment on the K-12 instructional unit;

3) interacting with students from another country; and

4) realizing that future teachers (even across cultures) have similar concerns. The Filipino group identified an additional significant experience, i.e., meeting new friends.

Both groups indicated that these experiences would not have been possible without the virtual space that *Moodle* provided.

Valuing Online Experiences

Analysis of qualitative data from students identified communication, connection and collaboration as valued online learning experiences. Researchers defined communication, in this context, as an individual's ability to send messages using a technology-based tool. Students expressed that emails and threaded discussions enhanced their online learning experience.

Connection, as defined by the researchers, is the ability to link or relate the messages shared online to one's past, current and future life experiences. There was strong evidence that when sharing what they have seen and experienced in pre-K classrooms through email messages or threaded discussions, students created that connection to individual experiences in relation to self, others, community or the world.

Finally, collaboration, based on the researchers' definition, is the ability to work with others in an online environment and support each other in completing a task. Students were able to give feedback and comments, thus contributing mutually to the development of improved K-12 instructional units and to this online experience becoming a foundation for future experiences.

Technology Across Cultures

It is possible for learners from two geographical locations to successfully work and learn using available technology. Technology-based activities that facilitate students' ability to communicate, connect, and collaborate can enhance students' online experiences. Also, the opportunity to interact with peers from another culture

facilitated the acquisition of new understanding on how the similarities and differences in needs, views or perspectives on issues or concerns that involve work with children.

Implications of the Study

The results of this research project shed light to various factors that instructional designers and developers need to consider when working with non-U.S. population. One factor that needs to be considered is the integration of online collaborative activities that facilitate development of relationship among participants. It is recommended that key activities facilitating communication, collaboration, and community building need to be in place as part of the course design to continuously engage students in small groups and as a class.

The researchers suggest taking a second look at learner characteristics because they can play a major role in impacting student engagement in completing online tasks. Further, it is critical to provide activities where students make connections between their experiences in and out of the classroom to what is happening in their online environments. Tasks need to be neutral and designed to facilitate sharing information and ideas instead of tackling controversial issues.

Finally, in creating a positive learning environment for the students, it is important to provide opportunities for effective planning, building user-friendly interfaces, and identifying alternative communication tools and strategies. If all of these are considered, then the journey to a positive, active, online collaborative experience among students will be realized whether they are from the United States or from abroad.

Conclusion

This paper focuses on further dissemination of information on how *Moodle* supported the collaboration of two groups separated by great distance and variance in contexts. The discussion of this paper focuses on the experiences on Filipino undergraduate students – their perceptions and the things they valued from the online experience and their use of *Moodle*, an open source web-based application.

Insights gained from this study focused on how technology can support similar online cross-cultural and educational exchanges. Lessons learned focused on designing online experiences to enhance undergraduate experience might need to include more activities facilitating communication, collaboration and community building for non-U.S. student populations in order to development relationships among students from both groups. Finally, the researchers conclude that positive educational experiences can be supported by using a learning management system like *Moodle* with non-U.S. students.

Given the small number of Filipino undergraduate students in this study, the results serve as guide in creating a more rigorous design of investigating non-U.S. population's experiences with online learning.

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Educational Games in the PK-12 Environment

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Abstract

The purpose of this research was to determine the effect of learning games on preschool children in terms of learning outcomes, level of engagement and satisfaction. The presenters will discuss the preliminary findings of this research as well as the practical implications of using learning games with young children. Additionally, the presenters will discuss the teacher satisfaction with this intervention as well as future research opportunities and recommendations.

Introduction

In recent years, the computer game and simulation industry has grown fast and become a part of American culture. Computer learning games are not only welcomed as a way to motivate learners, but also can serve as a mechanism for learning. Prensky (2001, 2006), Aldrich (2005), Gee (2003, 2005), and Shaffer (2006) have written extensively about the potential benefits of using computer games for learning. According to Mitchell & Savill-Smith (2004), games assist all different learning styles by supporting confidence and encouraging multimodal literacy through the use of video, audio, and text. Game players, especially children, are more interested in games with good audio and video (Vernadakis et al., 2005). Kirriemuir & McFarlane (2004) identified that the experience of game play seems to be affecting learners' expectations of learning activities. Therefore, the idea of integrating computer learning games into the curriculum is becoming an important research topic in education.

The use of computers has been prevalent in education even at the preschool level. Much of the research conducted in preschools has looked at the impact on the social skills of preschool children (Chen & Chang, 2006). Using computers in a preschool setting has been found to increase the motivation of young children (Mioduser, Tur-Kaspa, & Leitner, 2000). However, there is a lack of understanding whether game-integrated technology tools indeed can enhance student-learning outcomes in the area of literacy as compared to technology tools without games and simulations. There is a growing need to understand, empirically, how well the learning with educational computer games occur particularly in the preschool setting. Limited research has been completed on the impact of computer learning games in preschools (Chen & Chang, 2006; Clements & Sarama, 2003). As a result, a key goal of this study was to investigate how computer games may affect student learning outcomes in the preschool setting.

Literature Review

Computer Literacy Games and Preschoolers

In early childhood education, the use of computer software as both a successful learning tool and teaching method has increased rapidly over the last thirty years (Blok et al., 2002). Preschool children should not be kept away from computer learning games based on their age or developmental levels. Instead computer learning games combined with traditional teaching methods have the potential to enhance children's learning and help them meet educational goals (Vernadakis et al., 2005).

Children's learning through the use of computer software is becoming viewed as a positive learning tool that can be used as a major contributor to a child's education (Plowman & Stephen, 2007). Computers are becoming more accepted by teachers and children in early childhood classrooms (Hinitz, 1989). While there were previous concerns about the ability of very young children to use computers, research has shown that young children can become confident and enthusiastic computer users (Plowman & Stephen, 2007).

Lonigan et al. (2003) examined the effects of Computer Assisted Instruction (CAI) on the phonological skills of pre-school age children who were considered at-risk in their reading skills. Children who participated in the CAI group were found to have stronger vocabulary skills, rhyming skills, and increased overall reading skills after

playing with the computer game as compared to the comparison group. Additionally, the children who participated in the CAI rated the intervention program more favorably than students who were in the comparison group. Macarcuso et al. (2006) studied the effect of *Lexia Phonics Based Reading Program* (2001) and *Strategies for Older Students* (2001) in a public school. While Macarcuso et al. did not find a significant difference between the experimental and control group, there was a trend favoring the experimental group. Macarcuso et al. stated they did not find a significant difference due to the large standard deviation within the groups. Macarcuso et al. conducted a secondary analysis on students who were Title I eligible. Title I students in the experimental group showed literacy growth that Title I students in the control group did not make.

Computer learning games have been effective at increasing the literacy skills of young children (Lonigan et al., 2003; Macarcuso et al., 2006). This research was designed to determine if computer learning games that are available for free through the internet can increase the literacy skills of very young children. Additionally, this study looked at the impact of computer learning games on the letter naming fluency and initial sound fluency skills. These literacy skills are vital to students' success in the area of reading (Kaminski & Good, 1996, 1998; Laimon, 1994, Martson & Magnusson, 1988).

Computer Game Features For Preschool Children

Most educational games are designed to engage children in a virtual environment and through practice with interactive elements children gain knowledge in the subject matter presented in the game. The interactive exercises in computer games should be designed in such a way as to be significantly different than through traditional instruction (Gredler, 1996). These differences are often achieved with the features of computer software to engage children and enhance their learning through the use of color, sound, animation, audio and visual feedback, and age appropriateness (Chute & Miksad, 1997; Kirchner, 2002).

Lonigan et al. (2003) studied the effects of Computer Assisted Instruction (CAI) on phonological skills of pre-school age children who were considered at-risk in their reading skills. The study found, among the software's features were highly digitized speech and colorful graphic images that kept the children's attention while they completed a series of interactive tasks within the context of the game's adventure setting. Throughout the game children heard auditory content using headphones. The game provided clear instructions and tutorials for the children to follow. This required an active response from the child. The children were able to review the instructions at any time during game play. The game allowed the children to practice seven phonological tasks, which included recognizing when words rhymed and matching words by their first, middle, or last sounds. These features performed an important aspect in the children's' learning.

Additionally, computers can assist learning by using the computer's speed to help children recognize words when they are quickly flashed on the screen. This helps the children to see the shapes of the letters and how they are grouped together to form words. A study was conducted to measure the accuracy rate of word recognition by children who saw a word flashed on the screen for a limited period of time (Blok et al., 2002). A sixty-seven percent accuracy rate was achieved consistently with all the participants who used the computer program. While similar to the traditional educational method of using flash cards, the use of a computer for this method of instruction allowed for a consistent interval of time for each word (Blok et al., 2002).

Audio feedback for early childhood educational software is important to provide encouragement, reinforcement and modeling when needed (Chute & Miksad, 1997). Nikolopoulou (2007) noted that feedback to right and wrong responses should be provided in a pedagogically appropriate way so children are encouraged to continue on their work. Many times, audio feedback as a feature of the computer program can provide feedback at a rate that a teacher may not be able.

Children who have been raised in the culture of video games and computers compared to past generations require more stimuli to keep them involved in the learning process (Gredler, 1996). Keeping this in mind, making early childhood software can be a difficult task, but knowing what features to implement and what features to look for in software is a significant step. When all the features of color, sound, animation, gender preference, audio and visual feedback, and age appropriate are used properly, well-designed software is made. This type of software allows children to learn through active exploration and interaction **(**Lonigan et al., 2003). A secondary purpose of this study was to determine the features of the learning games (i.e., Starfall and AOL Learn Your Letters) that had an impact on the engagement of the young children. Engagement in an instructional task is vital for the task to have the desire impact on learning.

Teacher Perceptions Of Computer Software Features

Medvin et al. (2002) examined thirty-eight teachers and day care providers' characteristics influencing the frequency of computer use in their preschool classrooms. The findings showed that the teachers who had more training were more likely to have higher levels of motivation for computer use in the classroom. The results also found that teachers who had both quality and quantity prior experience with computers were influenced by their self-efficacy and anxiety. Teachers viewed computers as an important material in the classroom, but still had anxious feeling about using them. After the workshops in the study, the teacher's computer anxiety reduced while self-efficacy and values enhanced. Chen and Chang (2006) conducted a study that gathered information about 297 state pre-kindergarten and their attitudes, skills, and instructional methods towards the use of computers. The results of the study found that early childhood teachers are not ready to integrate computers into their classrooms yet because more than half of the teachers felt unconfident in using computers in their classrooms. In addition, less than a third of teachers demonstrated the skills to select appropriate children's educational software for their classrooms and only half of the teachers felt comfortable teaching their students how to use computers.

The last purpose of this study was to determine if any of the features of the learning games had an impact on the perceptions of the teachers in the classroom. Positive teacher perception of a computer learning game is important for the teacher to decide to use classroom time for the game. However, positive teacher perception does not necessarily equate to an effective program.

Research Questions

This study had three purposes and from these, the research questions were developed. The research questions were:
1. Is there any significant increase in literacy skills of the two groups?
2. What features of the learning games may enhance student engagement?
3. What features of the learning games enhanced teacher perceptions of student satisfaction?

Methods

Participants

The study started with 21 children and ended up with 15 children who participated throughout the entire study. Six students were lost due to attrition. This was because the children no longer received services at the preschool. The age ranges of the 15 participants were 34 to 60 months old and they attended a Child Development Center preschool. The school had a full time staff and taught pre-school level education to children. The children were selected based on their age and enrollment in the pre-school. All of the parents of the children consented to having their children participate in the study.

Researchers

A five-person research team included two faculty advisors, one from the computer science/information technology department and one from the teacher education department, conducted this study. The three student researchers participating included one from the liberal studies department, one from the computer science department, and one student from the communication design department.

Intervention

The computer learning games used in the study were *Starfall* and *AOL Learn Your Letters*. Both games are early literacy games designed for preschool children and can be accessed free over the Internet. These games were chosen because the content was appropriate for the age of the children in the study and they were easily accessible from online sources at no cost.

Starfall. The authors of Starfall report that it teaches early letter recognition skills and literacy through the use of sound, color, animation, and simple games. Children are able to choose from different letters in the alphabet and a series of activities focuses on the letter chosen. Starfall was created in 2002 by a team of educators and designers. This program addresses the assessed skills of letter naming fluency and initial sound fluency.

America Online (AOL) Learn Your Letters. The authors of AOL Learn Your Letters report that the game teaches letter recognition skills by asking children to choose the words that start with a letter shown to them at the bottom of the screen. This program addresses the assessed skills of letter naming fluency and initial sound fluency.

After a review of the literature and an analysis of each game, the researchers identified features in each of the games to be evaluated. These were evaluated on a scale of 1 to 5, with 1 representing an almost non-existent feature and 5 representing a very prominent feature in the game (See Table 1). Features that were shown to not be significantly different in either game were removed from the table. This significance was determined by comparing the average ranking of the AOL game features from the average ranking of the Starfall features. As seen in the table, all identified features were found to be more predominant in the Starfall game.

Table 1. Differences in Features

Feature	Starfall	AOL	Difference
Randomness of game play (different scenarios depending on student choices)	3.4	1.4	2
Engagement 4.8		2.2	2.6
Student can explore game on their own at their own pace (non-linear game play)	4.0	.6	3.4
Real world activities and situations drawn from life	4.2	0.8	3.4
Surprise elements	4.4	2.4	2
Challenging 4		2	2

Procedure

The parents of the children at the Child Development Center signed consent forms for their children to participate in the research study. All children were pretested prior to the study beginning. The tests used for the pre-test were the two subtests from the Dynamic Indicators of Basic Early Literacy Skills (DIBELS). The pretest consisted of an initial sound fluency component and a letter naming fluency component. Each child was tested by one of the five researchers. The guidelines and procedures of the tests were followed.

Two computers were set up at the center and the children were randomly assigned into two groups. The first group completed the intervention using Starfall. The second group completed the intervention using AOL Learn Your Letters. All children were exposed to the early literacy instruction of the preschool. The games were installed on the computers in a way so that the children only had access to the games and not to the Internet. The names of the children were posted on the desk next to each computer so they and staff members would have a visual reference of which children were on each computer. A sign up sheet was created for each child's name to be checked off as they played each day. Children were assigned to play their game for ten minutes. After ten minutes, the next child played the game until all of the children had played each day. The study ran for six weeks, five days a week. Children who refused to engage in the computer game were not forced to play.

The researchers ran the first two weeks of the intervention. This served as a model to the CDC staff as to how the intervention should be implemented. The staff of the CDC center conducted the rest of the observation with a student researcher making fidelity checks twice a week. The CDC staff recorded on the sign-in sheet whether the children played the game or did not play due to absence or other reasons.

At the conclusion of the study, the children were given post-tests. An alternative form of the DIBELS assessment was used for the post-test. Each child was tested on initial sound fluency and letter naming fluency. Additionally, the pre-school staff and researchers filled out surveys for each game.

Results

Q1. Is there any significant increase in literacy skills of the two groups?

Through the data analysis and T-test results, a significant difference in literacy skills between the computer games Starfall and AOL's Learn Your Letters was found. A total of six T-tests were run with the data. For each

computer game, the pre-test and post-test scores were compared separately, for both initial sound fluency and letter naming fluency.

In the comparison of the Letter Naming Fluency pre-test and post-test scores, a significant difference was found. When compared all 15 kids' pre-test scores to their post-test scores, the one-tailed paired sample t-test returned a *p*-value of 0.016, which is statistically significant at the conventional significance level of *p*<0.05. This result indicated that both learning games increased the children's letter naming fluency skills in general. To further understand the learning outcomes at each game level, the researchers compared the pre-test scores with the post-test scores for each game group. Of the t-test of the preschoolers who played the AOL's Learn Your Letters game showed a *p*-value of 0.023 (p<0.05) while the Starfall group returned a *p*-value of 0.078. These results indicated that the AOL game was more effective in increasing children's letter naming fluency than the Starfall game.

When comparing the growth of initial sound fluency there was no significant growth difference between the two groups. Also, when comparing the growth of letter naming fluency for the computer games there was no significant growth difference.

Overall, the results showed a significant difference in literacy skills of the letter naming fluency test for the computer game AOL Learn Your Letters. The other computer game, Starfall, showed no statistically significant results in either of the letter naming fluency test nor the initial sound fluency test.

Q2. What features of the learning games may enhance student engagement?

The Child Development Center staff and the researchers who observed the study responded to a satisfaction survey. Questions were asked regarding student engagement for each game. The responses were ranked on a 1 to 5 scale, with 1 representing low student engagement observed and 5 representing high student engagement observed. Table 2 shows the average score for each engagement question asked for each game.

Table 2. Teacher Rating of Student Engagement and Satisfaction

Engagement and Satisfaction Questions	Starfall	AOL
The learning game is visually appealing	5	2.8
The audio is appropriate	4.8	3.2
The animation is appealing for my students	5	2.8
It plays smoothly during use	4.7	4.5
The interactive features are appropriate for my students	4.3	3
Overall, it is easy to use	4.3	2.7
Overall, my students are engaged when playing the game	4.7	1.3
Overall, my students are happy to play the game	4.7	1.2

The above results show a significant difference in the perceived engagement of the children between the two games. Starfall was observed to engage the children and keep their attention more than AOL Learn Your Letters. Starfall was seen to be significantly more visually appealing, had better audio, better interactive features, and was easier to use. All of these features contributed to the children being more engaged with the Starfall game. The survey respondents also observed that the children's enjoyment of the Starfall game was much higher than the AOL game.

Q3. What features of the learning games enhanced teacher perceptions of student satisfaction?

Six different educators and assistants at the pre-school were asked to fill out a questionnaire regarding the two computer learning games. Of the two programs, Starfall was the unanimous choice in terms of student engagement and ease of use, earning an average score of 4.5 out of 5. AOL's Learn Your Letters received a much lower approval rating, averaging a 2.5 out of 5. AOL's hardest shortcomings were in the student engagement category (See Table 2). AOL Learn Your Letters was rated 1.2 out of 5 on "Student Happiness" and 1.3 out of 5 on "Student Engagement". Respondents indicated they did not believe that the students learned the content by playing the game, averaging a 1.7 out of 5. Clearly, the educators favored the Starfall game because of its high level of student engagement.

Eight T-tests were performed on each of the eight teacher ratings, comparing AOL Learn Your Letters to Starfall. In t-test results, AOL Learn Your Letters scored significantly lower than Starfall in the categories of visual appeal *(p-value 0.015),* animation appeal *(p-value 0.003),* ease of use *(p-value .04),* student engagement *(p-value 0.00002)* and student happiness *(p-value 0.00001).* Starfall was rated to have superior visual appeal due to its rich and colorful visual style. Starfall's color palette is bright and features primary colors. The AOL game features a dull purple-grey color scheme that may not have appealed to the children. Starfall scored higher on audio as well, because the game featured several dozen audio clips of sound effects and human voices. Each animation was accompanied by an appropriate sound effect. AOL used repetitive sound clips and a short music loop, which may have caused the children to become bored. Starfall also used superior animations. There were two to five animated sequences for each letter in the alphabet, and the children would often repeat the same letter to see the animations again. AOL had two main animations: a transition animation, and one looped animation of a flying cow. After have the children watch these same two animations over and over, they appeared to grow bored and wanted to stop playing.

Starfall was rated slightly higher than AOL on its interactive features because Starfall offered a wide variety of mini games for the students to play. This interactivity appeared to engage the students more than AOL's limited interactivity, which required the students to click matching letters and then play a repetitive item-collection game. The pre-school teachers rated Starfall higher on ease of use, although neither group of children appeared to have any confusion or difficulty in playing. AOL may have received a low score in this category due to the fact that it scored low in all the other categories. AOL's other poor scores may have influenced this score as well. AOL's two lowest marks were in student satisfaction and happiness. This is clear, as several students refused to play the game because it was not engaging enough. Students playing the Starfall game appeared to be happy and deeply engaged. Many of the students expressed complaints when their Starfall turn was over, but the AOL children seemed to be relieved or indifferent when asked to end their turn.

Discussion

The data collected showed a growth in the preschooler's letter naming skills that played the AOL Learn Your Letter computer game only. These results were unexpected due to the engagement observations and the efficacy questionnaire that compared the two computer games. Starfall was rated higher than AOL's Learn Your Letters in both engagement and efficacy. The computer game (i.e., AOL Learn Your Letters) that showed significant enhancement of letter naming skills was the computer game ranked low in engagement and efficacy. This is an valuable finding as it is important to realize that learning games that have high levels of engagement and features (e.g., colors, sounds, animation) may not be the best choice educationally.

Starfall was rated as more engaging for the children to play than the AOL Learn Your Letters game. This is significant due to the fact that the children who played the less engaging game did show significant improvement in their letter naming fluency. Engagement has been seen as an important factor in the ability of a computer game to educate; however, in this study, the Starfall game was observed to be significantly more engaging, yet it did not produce a significant educational benefit. This is likely due to the fact that, while AOL Learn Your Letters was observed to be less engaging, it did provide repeated exposure to multiple letters during the time allotted for each child to play the game. Starfall while possibly more entertaining took much longer per letter for the child to progress through the game. In a ten-minute session, a child might be exposed to one or two letters on Starfall while the child on the AOL Learn Your Letters game may have been exposed to four letters or more. AOL Learn Your Letters also randomly generated the letters, while the children could choose a letter while playing Starfall. This could lead to the possibility that the children playing Starfall chose to view the same letter or letters each session, while the children playing AOL Learn Your Letters were exposed to random letter the program generated. This may have increased the number of letters to which the children in the AOL Learn Your Letters group were exposed to.

The staff of the Child Development Center reported to the researchers and documented on the sign-in sheets as well as observed during fidelity checks, that the students in the second group more often refused to play AOL Learn Your Letters because they did not like or want to play it. This phenomenon was not seen in the other group which played Starfall. The researchers also observed that the children who did play the game seemed to be easily distracted while playing. The children who played the AOL game had post-test scores in letter naming fluency that were higher than their pre-test. Despite a perceived lack of engagement with AOL Learn Your Letters, an educational benefit was still found.

The high level of engagement in the Starfall game was detected. The pre-school children openly showed their feelings about the games. The children had no problem with telling their teacher that they did not want to play AOL Learning Letters. In comparison, the Starfall group of children had very high attendance and almost always

eagerly sat down to play the game. AOL Learn Your Letters earned very low marks for "Learned Content" most likely due to the low engagement level of the students. This assumption ignores the quality of the material learned during the very short periods of engagement on the AOL game. Although the students were far less engaged, they appear to have absorbed higher educational content.

The findings of this study seemed to confirm the meta-analysis results of Means et al. (2009) in one aspect, "… the expansion of time on task for online learners were the only statistically significant influences on effectiveness." The Starfall game was certainly engaged the preschool children, but the games such as the matching, drop and drag, watching the animations often took a very long time to complete and the time consuming parts were often off task activities. For example, when you click on the letter "C" in the Starfall game, there is a cat that will climb up and down the edges of the rectangle display area, which takes up precious educational time. It is clearly an off task engagement since it shows a cat running with an irrelevant background music. On the other hand, the AOL Learn Your Letters game forced the children to be on task by minimizing off task activities. Based on this observation, we conclude that on task engagement is critical for student learning outcomes. Off task engagement does not seem to have a direct impact on the learning outcomes, although it may help increase student satisfaction and overall interest toward the subject matter. Of course, it is important to point out that enhancing study interest and increasing their positive attitude toward learning are important aspects of education. Some may even say that increasing satisfaction and nurturing interest are more important than the actual subject matter learning for young kids. Hopefully, our findings can help increase educational game designers' awareness on the importance of integrating more on task engagement activities for effective learning outcomes.

Limitations and Suggestions for Further Research

Based on the results of this study the following areas are suggested for further research. Further research should focus on variations of this study including longer intervention and maintenance periods, a larger sample size, and participants of different ages. In this manner, research can ascertain the impact of a technology-based intervention overtime, on a larger population, and at varying age levels.

Acknowledgement

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Messages in a Bottle: Accessibility of Georgia Districts' Website Homepages

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Abstract

On-line barriers often limit the accessibility WebPages for students with disabilities. The purpose of this study was to evaluate the accessibility of Georgia districts' home pages. The results of the study show that from a list of 244 district websites, none of them were accessible. Along with the results, including specific reoccurring problems, the presentation will provide the audience with information about how to correct typical accessibility problems.

Messages in a Bottle: Accessibility of Georgia Districts' Website Homepages

The Americans with Disabilities Act (ADA) of 1990 provides the same civil rights protection to individuals with disabilities 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 such as providing ramps to elevated areas and providing accessible signage through height adjustments and raised lettering have become commonplace across the United States.

The potential of technology to impact student learning is consistent with ideas about developmentally appropriate teaching and learning. Further, access to technologies addresses important learning targets that focus on higher order thinking skills such as drawing analogies, inferences, and cognitive mapping (Quinn & Valentine, 2002). In writing the introduction for the Association for Supervision and Curriculum Development's yearbook, Chris Dede (1998) advocates that computer tools, which include access to the Internet, are a powerful means to improve educational outcomes for all students. He further argues that technology can provide success for all students through special measures to aid people with disabilities and those referred to as "disenfranchised."

The World Wide Web (WWW) has become an invaluable resource for many people with disabilities. Accessibility across platforms and geographic distance makes the WWW an ideal universal tool for gathering and disseminating information (Heflich & Edyburn, 1998). Today, the Word Wide Web is almost universally used to disseminate information about a school or a school district. Wong (1997) discussed using the Internet for increased self-advocacy by individuals with physical impairments. It is ironic, however, that while technological developments have enhanced and provided new exciting opportunities for the WWW, they have, simultaneously, complicated and limited the accessibility of the content and resources for individuals with disabilities.

Physical barriers are obvious accessibility concerns. Web page developers need to be aware that on-line barriers can create significant problems for some users. The Americans with Disabilities Act requires that all organizations make reasonable accommodations for individuals with disabilities. With recent judicial rulings such as those against Target Corp (Selvin, 2007) home page developers should work towards designing and building Web sites that are accessible to all individuals. It is important that Web page developers use and follow standards that allow accessibility to all WWW users.

Method

To examine the accessibility of Georgia's district website home pages a descriptive study was conducted. An online school directory of school websites from Georgia provided URLs for the 244 website homepages analyzed for this study. Bobby 4.0.1 (Center for Applied Special Technology, 2000), and the ATRC Web Accessibility Checker (Adaptive Technology Resource Centre, 2009) were used to analyze each website homepage. Both tools allow researchers and other professionals to evaluate Web pages in accordance with the W3C Web Accessibility Initiative's guidelines.

The results of this analysis show that 100% of the home pages analyzed by *Bobby 4.0.1* and 99% of the pages analyzed by ATRC were not accessible. This means that at least one Priority 1 error (seriously affects accessibility) was detected on these pages.

Discussion

Web developers who are developing WebPages for school districts need to examine their Web sites for accessibility problems. It is strongly recommended that validation methods be used in the early stages of Web development, which will help make problems easier to correct and assist developers in avoiding many accessibility

problems. In addition to evaluation tools such as Bobby and ATRC expert and novice users with disabilities should be invited to view home pages and provide feedback about accessibility or usability problems and their severity.

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Elements of Successful Internships.

Carol Brown

Introduction.

Advanced programs in instructional technology are charged with the responsibility of preparing instructional designers, professional development specialists, teachers, and technology facilitators as they enter positions in business, industry, the military, and K12 education. The internship for professional programs is a broad topic that covers many disciplines, yet there are common elements across all professions. One of the strongest attributes of a successful internship experience is the application of theoretical constructs learned in academic settings to best practices in future work environments (Doucherty, 2009; Stichman & Farkas, 2005). The intern must also articulate how their knowledge base has evolved into practical application in their profession (Cunningham & Sherman, 2008). Successful internships are supported through strong mentoring, both on-site and by academic supervisors (Conn, Roberts, & Powell , 2009). Other characteristics that result in good outcomes include carefully designed seminar courses with a theory-based approach (Hsu, 2004); documentation of internship hours and activities (Macchia & Freedman, 2004); a criterion based final report reviewed by faculty (Cunningham & Sherman, 2008); and alignment with professional standards (Early & Glenn, 2009). Accreditation standards have an important function to ensure interns meet basic knowledge and skills associated with their profession. State and national standards are used to assess competency and readiness for the workplace (Darling-Hammond, 2007). Institutions affiliated with the National Council for the Accreditation of Teacher Education (NCATE) adhere to standards recommended by a Specialized Professional Association (SPA) such as AECT and ISTE. These Specialized Professional Associations assess content knowledge, abilities in professional activity, and evaluation of clinical practice (NCATE, online). Evaluation of clinical (internship) experiences is often accomplished through use of artifacts supported by student reflective writings (Ring & Foti, 2003).

Purpose for the Study.

At our university, internships are designed as a culminating experience based on earlier course assignments that are continuously applied to K12 classrooms. The design of our courses is supported by empirical research, thus professional internships are planned using research-based ideologies. Included in the internship experiences are guided discussions that help the intern make a personal connection between activities in the schools with theoretical constructs under-girding the design of the internship. In addition to discussion threads, students prepare reflective writings that focus on requirements for advanced licensure as a technology facilitator. Because the master's degree meets state accreditation requirements, graduates earn an approved licensure area for elementary and secondary schools. Evidence to show competence in areas of licensure appears in artifacts with reflections archived in an electronic portfolio. The portfolio's reflective writings articulate alignment of standards and activities appropriate for the K12 learning environments, and reflect commonly held beliefs in the profession as defined in the published literature. Thus, interns should have a clear and consistent understanding in how the research supports best practice in the field. The purpose for this investigation is to evaluate how well students in an online seminar are able to demonstrate a strong connection between standards : research base : internship experiences. In addition to theory to practice experiences, the investigation was designed to evaluate onsite experiences related to the work of technology facilitators in K12 schools. Functions for this position vary by state and region; however, based on national standards for Technology Facilitators most schools systems expect expertise in three to four job functions. These include: 1. planning staff development for building-level teachers, 2. modeling appropriate use of technology in classroom instruction, and 3. leading initiatives related to technology programs in a school system (Brooks-Young, 2002; Hofer, Chamberlin, & Scot, 2004). Thus an important part of this investigation was to ensure interns have opportunities for a comprehensive experience needed in their future jobs.

Methods.

Design-based research is useful for matching what the literature reports as best practices within a variety of settings and contexts with what is actually occurring within a given educational setting (Reeves, Herrington, & Oliver, 2005; Sandoval & Bell, 2004; Wang & Hannafin, 2005). Based on reports in the literature, internship experiences are grounded in theory yet authentic and interactive. Interns, in any profession, use what has been

learned in their coursework to solve real-world problems. This researcher reviewed 21 articles with empirical research as well as practitioner journals reporting anecdotal experiences with professional internships. Keywords were used to search databases from a variety of disciplines— internship, experiential learning, staff development, professional development, technology facilitators, design-based research, grounded theory, and community of learners. Based on a review of the literature, two main themes, Theory to Practice and Community of Learners, emerged providing a framework for the design of this study.

Theme 1: Theory to Practice.

One of the dominate characteristics of the successful internship is the strong emphasis on interns being able to apply theoretical constructs from classrooms and coursework to best practices in the work environment (Kennedy, 1987; Stichman & Farkas, 2005). Not only must the intern make connections between theory and practice, he or she must also articulate how their knowledge base has evolved into practical application in their profession (Cunningham & Sherman, 2008). Ackerman and others (2009) report a study in which medical interns gain professional identity while reflecting on critical events with patients. The connection between information learned through textbooks to critical incidences experienced during the internship lead to deep understanding of their professional role in healing the sick. Medical interns in Ackerman's study met in focus groups to reflect and discuss experiences. This type of dialog might also be replicated in an online environment.

Macchia and Freedman (2004) reported internship experiences for school library media specialists assigned to a variety of locations. Interns communicated with the university supervisor using email and discussion threads. The conclusions from this study further support design of course work and instruction "relevant to the professional workplace" (p. 208). For the school library media specialist, settings will vary. Each school site provides unique circumstances that require mentoring as interns interpret what has been learned in library school with problems encountered in their internship.

Conn, Roberts, and Powell (2009) suggest an effective method for mentoring interns is through an established learning community. Peer-interns may be assigned to a site in a different county or region of the state, but come together as a Community of Practice through mutual support and knowledge sharing. For students in remote areas or enrolled in distance education programs, the use of email, teleconferencing, and discussion forums has become the lifeline between the university supervisor and the intern in the field. In traditional graduate courses, interns are "out in the field". University faculty might visit schools and internship sites but also must rely heavily on reports coming from onsite mentors and the documentation provided by the student-intern. Internships designed within an online environment, using digital communication tools, might provide a better learning experience for mentoring and feedback.

Theme 2: Community of Practice (CoP).

Education literature reports many successful venues for learning communities. Teachers, undergraduate pre-service interns, and graduate interns have experienced supportive environments in which participants hold each other accountable, encourage the struggling learner, and acknowledge those who excel in achievements (Hough, 2004; Varrati, 2009). Within the CoP, interns can experience positive interdependence among group members. A common way of life (rather than simply sharing goal statements) is important (Fielding, 1999). MacDonald (2008) reports two key components for successful professional experiences within the CoP. First, members must make an intentional effort to become part of the community and secondly, genuine relationships must be formed and reinforced. Personal identity is preserved as learners work within an inclusive environment of equality and positive interpersonal relationships. Being included and engaged are also key to success within a community of practice (Wenger, 1998). Based on reports in the literature, use of digital social networking tools could provide the authentic supportive environment required for successful 21st century communities of practice.

Data Collection.

Design-based research provides options for a variety of methodologies for data collection (Brush & Saye, 2008; Wang & Hannafin, 2005). Several data sources were used to evaluate the design of our program's internship requirements—1. analyses of master's programs in educational technology requiring internship as degree requirement; 2. analyses of discussion threads and reflective writings; and 3. analyses of final reports. The portfolios

requirements for the degree include a final report, mapping activities with state and national standards. We began the analyses by reviewing online documents to determine most common characteristics among educational technology programs. Program websites (n = 14) were reviewed and analyzed for commonalities in requirements for the professional internship. Programs were selected based on accreditation (NCATE) with specialized professional associations (SPA) accredited through the Association of Educational Communications and Technology (AECT) and the International Society of Instructional Technology (ISTE). AECT, as a professional organization, was selected because of the broad perspectives in professional programs in technology (i.e., instructional design, instructional technology in K12 environments, and school library media). ISTE was selected based on national prominence related to computer literacy standards in K12 education. Standards associated with both AECT and ISTE are available through the NCATE website. A list of all advanced programs with NCATE accreditation is also available. Selected programs associated with NCATE were identified and a review of documents accessible through websites was conducted. Characteristics of the various elements were organized into three categories. Table 1 displays elements of internships in 14 institutions and organized by category.

Table 1. Common Elements in Professional Programs in Educational Technology.

Design of Graduate level Seminar	Assessment & Evaluation	Theory to Practice
Graduate credit course; 1 to 3 credit hours	Articulate relationship between internship experiences and professional standards	Standards aligned with theory base
Predetermined requirements for practicum hours	Internship proposal includes clearly defined goals and objectives	Reflective writings to match theory to experiences; standards to experiences
Regular discussion with other interns (community of learners)	ePortfolio [or similar culminating product] or presentation of work samples	Portfolio products and/or research paper
Progression of simple to complex activities performed onsite; Internship leads to job offer.	Sustained feedback from university supervisor and/or onsite mentor	Opportunity to apply theory to authentic work setting
Experiences as instructional leaders [planning and implementation]		
Experiences in design of teacher professional development (K12 sites)		

The design of our internship seminar was compared with common elements identified in the 14 professional programs selected for this study. The results showed correspondence between each of the elements in Table 1 with the design of our internship requirements. Using the elements identified in Table 1, our faculty continually evaluate the design of our online seminar course. In Table 2, see the design of the seminar covering the 3 semester hour credits.

Table 2. Timeline and requirements for Internship Seminar evaluated for this study.

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Major Requirements Timeline for 3 semester hour graduate course.	Total hours for 15-week semester = 150 contact hours	Aproximate Time per week = 9 hrs	Weekly Activities
Contact site mentor, goals/ objectives, proposal	15 hours	15 hrs early in the semester	Contact mentor first two weeks of seminar; prepare written goal statements; plan activities
Discussion with fellow interns	15 hours	1 hr	Online Discussion threads connecting internship experiences with assigned readings.
Assigned Readings	30 hours	2 hrs	Selected theory-based readings aligned with course objectives, standards.
Reflection and writing	15 hours	1 hr	Time logs and reflective journaling
Time applied planning, preparation, implementation, evaluation	60 hours	4 hrs	Meetings, shadowing, workshop, preparation, design of classroom instruction, etc.
Portfolio product with final report - ongoing	15 hours	1 hr	Maintain time-log and journals to document start-end dates; description of activities.

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End of course surveys, informal interviews, and students' final reports suggest interns are able to complete 110 hours of practicum experiences in addition to online discussion, readings, and other supporting activities for the seminar.

Discussion Threads & Reflective Writings: Theory to practice.

Research-based design methods permit the researcher to use reporting from practitioners in complex settings to refine current theories in education (Sandoval & Bell, 2004). Innovative learning environments can then become natural laboratories "to study learning and teaching" (p. 200). Interns were divided into six small groups in 2 course sections. Discussions were managed using Blackboard Small Group Discussion Forum. Each group was assigned identical readings and prompts for discussion questions. Questions were designed to probe thinking processes as these connect activities conducted at the school-site with readings and theory presented in earlier courses. The response in Figure 1 is taken from the third of four assigned discussion forums. In addition to discussion threads, interns posted anecdotal comments and reflections for the final report and formal reflective writings for the final portfolio required for the degree program. In Figure 1 see intern's response to a discussion scheduled early in the internship. The student's comment is focused on the role of the technology facilitator in k12 schools and what is needed to have impact on student learning.

Figure 1. Discussion Forums for Interns.

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Question Prompt—
Meet with small group Jan 26 – 31. Have you observed TF performance in your school system that matches the national standards? Choose from any one of the VIII categories to discuss. How can you overcome obstacles for implementing TF Standards in your school or district? Read the comments of others and offer solutions based on the readings for Quality PD and Effect of PD on Learning.

Discussion Threads—
Time management is probably one of the biggest obstacles to tackle. Trying to maintain a healthy balance of instruction and administrative tasks can at times be overwhelming. . . . I think it is important to keep the needs of the students at the forefront. Instruction should always come first. Planning a schedule and keeping working list of goals helps to keep you on task and also helps you to see your accomplishments. It also helps you to have focus. . . . I also think you have to accept the fact that everything is not going to be perfect at any given time, but by having a focus, and goals (instructional and administrative), you can have an effective and efficient learning environment. . . . Lawless and Pellegrino state that it is not necessarily the "technology that improves education, but that educational improvement comes through coherent instruction and assessment that supports high-quality student learning." . . .

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Using a constant comparative method (Merriam, 2001), we analyzed the 300 paragraphs of data collected from 63 interns hand coding them for recurring themes. We administered a word frequency count to look for clusters of words relevant to recurring themes identified in the professional literature. Comments in the discussion threads included references to well known theorists and models in the field of instructional design and technology. Theoretical constructs from earlier courses were reviewed during online discussions. Interns were prompted to make the connection between experts in instructional technology with what they were experiencing in the day-to-day interactions with teachers, administrators, and students. For example, one intern comments-

> "…one-on-one collaboration between a subject matter expert (teacher) and a technology expert (TF) is needed on a regular basis. Most training is a demonstration in a group setting…which does not get the same results as two people sitting together and planning an lesson, doing a collaborative lesson together…. By following this model, I have the opportunity to impact student learning. ….. Effective PD involves participants in actual hands-on work in the content area, covers enough hours to inspire changes in teaching style, and provides a forum for peer discussion and assistance. …it is extremely important to assess incoming proficiencies (of teachers). … I think the Lawless and Pellegrino article would be interesting reading for any administrator…."

This student didn't identify a particular theorist; however she clearly is grounding her techniques with established research in instructional design and change theory -

> "I have surveyed my staff and are using the responses from the survey to plan my instruction and sessions offered. . . I will offer some sessions for those who are 'innovators', some for 'early adopters', and even sessions that I think will appropriate for the "laggards". I want to try and meet the teachers where they are. I will do my best to differentiate the instruction when needed. I always focus much of the professional development on how it can specifically be used in their curriculum/classes. "

Comments such as these suggest intern's ability to recall lessons in instructional design, collaboration, mentoring, and coaching as an effective method for staff development. In addition interns know it is important to track and measure impact of teachers' staff development on student performance (Creasy, 2005; O'Connell & Phye, 2005).

Teachers need just-in-time mentoring and follow-up with use of technology for classroom instruction (Lawless & Pellegrino, 2007). Planning and implementation of staff development is an important function of technology specialists in North Carolina schools (North Carolina Department of Public Instruction, 2009). The technology facilitator, at the building level, is able to apply knowledge and skills for instructional design to the development of workshops and other formats for teachers' professional development. Many of the discussion threads suggest extensive experiences in planning staff development—

> "…..our staff does not know what their training needs actually are. They either think everything is fine as it is, or they view training as a commitment to something else to do…Needs assessments are usually considered a required precursor to any staff development project… Based on last year's test score we need staff development that will help students increase their reading and math academic level."

The use of state and national standards provide guidelines for ensuring interns are meeting competencies required for licensure. Internship activities are aligned with recommended standards for the position of technology coordinator or facilitator. In Table 3, four reflective writings provide evidence for projects that reflect future job activities. The interns prepare written reports that clearly describe the correspondence between the internship and professional standards. Thus, reflective writings are both theory and standard based discussions of the internship experience.

Table 3. Internship experiences matched to state and national standards for technology facilitators.
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(Intern 1 – Staff Dev.) Throughout the entire internship, I observed, shadowed, and asked the advice of one of our county technology facilitators. . . one of the projects that I have taken the most from is the actual development of our staff development module. We had the opportunity at the beginning of the school year to be a part of a series of 10 technology related staff developments. . . We based our module off of the ADDIE module of instructional design in order to follow a structured plan.	ISTE standards II. Planning and designing learning environments and experiences. Educational technology facilitators plan, design, and model effective learning environments and multiple experiences supported by technology. A. Design developmentally appropriate learning opportunities that apply technology-enhanced instructional strategies to support the diverse needs of learners.
(Intern 2- Computer Skills tests) The NC Standard Course of Study for integrating technology is developed for all grade levels, K-12. . . .The more exposure they receive, the more their students will benefit (ISTE Standard III, Indicator A),	A – Facilitate technology-enhanced experiences that address content standards and student technology standards.
(Intern 3- reflective practitioner) . . . having the opportunity to reflect on each of my experiences has instilled in me the importance of looking at education in new ways and the significance of becoming a reflective practitioner.	TF-V. B. 1. Continually evaluate and reflect on professional practice to make in formed decisions regarding the use of technology in support of student learning.
(Intern 4- going green) Each experiences in this internship has given me the opportunity to showcase my skills as an instructional technologist, but also really help my school community by offering "go green" ways to collaborate, and enhance instruction. Now, many of my colleagues talk freely about "going paperless" because of some of the applications I have shared that they are now comfortable using independently. This has been a great experience and avenue for me to help those present in the 21st Century to actually start living in the 21st Century.	TF-VIII Leadership and Vision Educational technology facilitators will contribute to the shared vision for campus integration of technology and foster an environment and culture conductive to the realization of the vision.

Interns are instructed to prepare a final portfolio with reflective writings that justify activities and projects as representative of competencies recommended by state and national accrediting agencies.

Discussion Threads: Community of Learners.

Interns recognized the characteristics and benefits of forming a community of learners. Though not a formal Community of Practice (Lave, & Wenger, 1991), there was transfer of understanding and the formation of professionals who participate in knowledge sharing, mutual respect, and supportive relationships. One Intern responds to the idea of another intern's PD plans. In response to a PD plans for designing teacher websites, an intern offers the following support to his fellow intern:

"I also think you touch on a very important point and that is reaching out beyond the walls of the school to the greater community around them….thanks for reminding me that we share the same seed-planting approach to change."

Use of discussion threads seems to provide a safe environment for personal reflection. As part of the self-assessment process, one intern reflects on the value of workshops and other professional development activities planned during his internship.

"This ..experience represents my future goals and plans because it allows me to understand and become more confident as an instructional designer and teacher. I have experienced positive experiences with workshops and negative experiences with workshops. I was able to revise and re-teach in order to succeed as an instructor and succeed with teaching the content for learning and comprehension of the learners. I judged the success of the workshops through learner (teachers) participation, conversations and discussions, along with follow-up assistance in developing and designing lesson plans and assistance with facilitating the lessons. As I strive to become a better teacher this …experience has helped guide my success in my future goals."

Discussion and Recommendations.

Partnerships and Community of Practice.

A 15 week semester was the period of review for this study. Two cohorts successfully completed internship requirements for an advanced degree program. Using Blackboard conferencing software, the course timeline was clearly displayed throughout the semester. Interns commented on the importance for having a virtual meeting place, "The Hallway", to track their own progress through the semester. In an online environment, it is important to maintain consistent and frequent contact using email, discussion threads, or other interactive environments. Because of the number of interns (n=63) we discovered, through feedback and students' reflective writings, the importance for articulate and authentic responses. Just as with face to face dialog, students value guidance that speaks to his or her specific experiences. This kind of dialog is facilitated through virtual environments, is beneficial for interns, but requires careful time management, and dedication, by the university faculty. In many ways, online seminars exceed traditional face to face courses by using digital tools to form a supportive learning community leading to an established Communities of practice (CoP). Online discussions provided evidence that interns support each other with positive reinforcement, provide useful feedback on projects, and share ideas for instructional development. These discussions were prompted by the instructor, but often, comments are spontaneous and seem to flow from relationships developed through early discussions used to build social relationships.

The internships resulted in strong partnerships with rural school districts and the local Director of Technology. During this study, 33 local schools partnered with the university to support placement of interns. Through similar partnerships staff development workshops, one-to-one mentoring, and other forms of professional development might be possible at school sites used for the internships. Reports through discussion threads and personal email described valuable experiences in planning and presenting special sessions in a local "technology conference".

Motivation for both teachers and presenters was high as interns worked with the local school system to present their best practices for technology in the classroom. Internships, planned collaboratively with local school administrators can result in a variety of professional development experiences for teachers and interns at the internship site. Several important concerns were reported as a result of dialog between administrator and interns. For example, planning for professional development for teachers was driven by purchasing decisions rather than instructional need. Content for staff development was often determined by purchases for new hardware and software. Interns applied readings in research in professional development to justify proposals that included a formal needs assessment as part of the planning needed for staff development workshops. Discussion threads also described follow-up activities with teachers who implemented integration strategies presented in workshops. Working with administrators in the district offices led to new awareness in the role of the technology facilitation as the designer of professional development for teachers.

Theory to Practice.

Discussions revealed internship activities included references to a theoretical base from courses completed in the degree program. An important goal for the discussion threads might be forming a habit-of-mind that substantiates instructional decisions through use of educational research. As interns model thinking processes that connect theories related to instructional design and technology to a classroom setting, teachers in the field might benefit through a natural transfer from theory to practice. Ongoing and online dialog, facilitated by the university professor, might provide a type of laboratory for developing these kinds of discussions. Ongoing input and thoughtful guidance by the university professor is critical for successful online discussion. (Berge, 1995; Pawan, Paulus, Yalcin, & Chang, 2003). Both motivation to participate and development of good writing skills are related to input from the course instructor (Dennen & Wieland, 2007). The successful use of question prompts with the online mentoring further substantiates the results of earlier studies on the role of mentors for online internships courses (Hew, & Knapczyk, 2007).

Discussion threads provided evidence to show interns connect national standards related to instruction and learning. The standards most frequently referred to Technology Operations and Concepts, and Teaching, Learning, and the Curriculum. This would be a logical outcome for the discussions since interns are required to provide technical support and in addition to mentoring for teachers. Much of the intern's time is devoted to inventory and organization of electronic resources in the school. The growing trend for technology facilitators to become teacher leaders in use of technology for teaching is a hopeful indication that learning, cognition, and instructional design take precedence over technical support.

Professional internships described in the study would add credibility to the technology facilitator position. Becoming credentialed as an instructional leader is also an important characteristic leading to prestige and respect for this important position in K12 schools. The Internship is an important stepping stone from the university (virtual or actual) to authentic experiences in the workplace. Other programs might apply some of the elements reported in this study to revise and enhance internship experiences monitored in an online environment.

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Less is More: Structuring the Content of a Middle-Level Mathematics Technology Course

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Abstract:

A graduate course introducing in-service middle level mathematics teachers to appropriate technologies began initially as a broad survey course. Based on feedback from teacher-participants and instructor reflections, the course was modified to dedicate more time to fewer technology tools. In-depth time was spent on learning to use and teach with LEGO Robotics, Geometer's SketchPad, and spreadsheets. The benefits and limitations of making this change are presented.

Introduction

It is not every day, or year for that matter, that university faculty get to develop new, from scratch, courses. Resources are generally limited and programs are typically set in place with defined curricula. So, when such opportunities do arise, lessons can be applied to and learned from designing and implementing instruction.

Such was the case when, in 2002, the University of Wyoming set about designing, testing and institutionalizing a set of eight new courses to specifically prepare teachers for teaching mathematics at the middle school level, grades 5-8. This effort was in direct response to urging by the National Council of Teachers of Mathematics (NCTM), the Conference Board of the Mathematical Sciences (CBMS), and the National Science Foundation (NSF) for specific, appropriate preparation in mathematics content and instructional strategies for in-service middle school teachers whose formal preparation is either in elementary or a different content discipline.

The need for special preparation of teachers for middle school mathematics is forcefully expressed in the updated NCTM standards (NCTM, 2000). In addition, the CBMS specifically recommends that students should be taught by "mathematics specialists" beginning in grade 5 (CBMS, 2000). Middle-level teachers are often "caught in the middle" in terms of their professional preparation. They typically complete courses in either elementary or secondary education, without coursework and professional development programs designed specifically for working with middle-level learners. As stated in the NCTM standards, teachers require knowledge that "is beyond what most teachers experience in standard pre-service mathematics courses in the United States" (2000, p. 17). They also need specific knowledge and skills that are not included in secondary programs, including adolescent development, pedagogical alternatives, and interdisciplinary approaches to teaching. As a result, NCTM called for special attention "to the preparation and ongoing professional support of teachers in the middle grades. Teachers need to develop a sound knowledge of mathematical ideas and excellent pedagogical practices and become aware of current research on students' mathematics learning" (2000, p. 213).

Specific objectives of this project, funded by an NSF middle-level mathematics program grant, were to:1) Increase the conceptual content knowledge of middle-level teachers; 2) Increase the pedagogical content knowledge of middle-level teachers; and 3) Provide middle-level teachers experiences with exemplary middle-level mathematics curricula and help them to develop skills in implementing them in their own classrooms. The resulting courses were:

- Connecting Geometry with Problem Solving for the Middle-Level Learner;
- Assessment for Middle-Level Mathematics;
- Mathematics of Change and the Middle-Level Learner;
- Numbers, Operations, and Patterns for the Middle-Level Learner;
- Analysis of Data in the Media for the Middle-Level Learner;
- Social and Historical Issues in Mathematics and Middle-Level Learner;
- Methods for Teaching Middle-Level Mathematics; and
- Using Instructional Technology for Middle-Level Mathematics.

The Instructional Technology course focused on introducing in-service middle-level teachers to technology tools which could be used to enhance instruction in meaningful and creative ways.

This course, taught in a three-week period in the summer, was initially designed as a survey course, and as such, introduced a broad range of hard and soft technologies. Technologies were selected which would be student-centered and student-directed, enabling them to solve complex and ill-defined real-world problems. In the exuberance and excitement of developing such a course, with the desire to introduce teachers to a breadth of tools,

an aggressive schedule was set involving 11 technologies (See Fig. 1). These included graphing calculators, Geographic Information Systems (GIS), Global Positioning System (GPS) units, geometry microworlds, several spreadsheet programs, LEGO robotics, and Vernier probeware. Course sessions focused on activities and lessons designed and used by other middle-level math teachers, who actually team-taught the course.

(1-4:30 p.m.)	Mon	Tues	Wed	Thurs	Fri
Week 1	Intros Syllabus SmartBoard Intro Sample Activity	Spreadsheets Inspiration Internet		Fathom	Calculators
Week 2	GIS	GIS		Probeware	Probeware
Week 3	Microworlds LOGO Cabri	Geometer's Sketchpad - Animation		Geometer's Sketchpad - Comparing	Troubleshooting

Fig. 1: Course Schedule for First Iteration

Changes in Course – data used Revised Technology-intensive Survey Course

After the initial course was taught in Summer 2003, data were collected in Spring 2004 to ascertain whether teachers found the technology useful or not useful in their teaching, and to find out what was used and what they would have liked to learn more about. Subsequent survey data from the teacher-participants showed that the course was helpful in exposing them to possibilities, but did little to prepare them for actually integrating any of the technologies into their classrooms. The participating teachers were simply not given sufficient time to become familiar with the tools. One participating teacher made the poignant comment: "Whatever we did in class last summer, I could not make it work. I felt as though I'd been dumped into the middle of a large lake and just told to swim home. It was sink or swim. I sank." Participants also expressed a desire to learn more about calculators, spreadsheets, Geometer's Sketchpad (GSP), and Fathom, a database/spreadsheet program written specifically for middle grade use. They felt these would be useful in their teaching.

The second iteration of the course, taught in Summer 2004, introduced only six technologies (See Fig. 2), with an increased emphasis on Geographic Information Systems (GIS) software, namely ArcExplorer. The potential for integrating social studies, science, and mathematics, including tabular and spatial data analysis, was seen as a major asset of the software. As only two 3.5 hour sessions had been set aside in the 2003 offering, four sessions were scheduled in 2004 to provide more time for deeper and richer instruction, including multiple middle-level learning activities. Calculator and probeware instruction was removed from the Technology course and placed in the Mathematics of Change course, with specific instruction as to how to use the technologies while doing the mathematics. This integrated approach was viewed as being more beneficial to the teachers in the long-term. Additionally, even though GSP had been designated originally to be introduced in the Geometry course, in practice it was implemented at an intermediate level, leaving many students frustrated and confused. To rectify this, the technology course was designated as the initial teaching point for this software.

(1-4:30 p.m.)	Mon	Tues	Wed	Thurs	Fri
Week 1	Introductions Syllabus Spreadsheets	Spreadsheets	Spreadsheets GPS	Fathom	
Week 2	GIS	GIS	GIS	GIS	
Week 3	GSP Cabri	GSP	Calculator Comparison	Advanced GSP: Presentations	

Fig. 2: Course Schedule for Second Iteration

Latest iteration-Focusing on Fewer Still

Little changed in the Summer 2006 iteration of the course, but significant changes were afoot. The instructors were introduced to a newly published book, *Meaningful learning using technology: What educators need to know and do* (Ashburn & Floden, 2006). The frameworks, questions, and examples posed by the various chapter authors were extremely helpful in reviewing and reflecting on the purposes, goals, and outcomes of the course. More specifically, the attributes of meaningful learning using technology (Ashburn, 2006; Wiske, 2006), the affordances for learning and teaching (McCrory, 2006), and the conditions/attributes of better professional development (Zhao, Frank & Ellefson, 2006; Floden & Bell, 2006) played key roles in rethinking the course. In summer 2008 the course was modified so that only three technologies would be introduced: LEGO robotics, GSP, and spreadsheets, with instruction and learning focusing on the central question of, "What is it about *this technology* that will support students in engaging with the big ideas of [mathematics]?" (McCrory, 2006, pg. 147).

Out of twelve 3.5 hour class sessions, four were devoted to robotics, four on GSP, and two on spreadsheets (See Fig. 3). Each was used in a variety of activities, lessons and performance assessments to not only teach the use of the tools, but to model appropriate classroom use in the middle-grades. For example, middle-level GSP activities from *Shape makers: Developing geometric reasoning in middle school with The Geometer's Sketchpad* (Battista, 2003), and *Geometry activities for middle school students with The Geometer's Sketchpad* (Wyatt, Lawrence, & Foletta, 2004) were used. Discussions were facilitated about the use of the tools and lessons from the participants' dual perspectives as students in the class and as teachers, to identify strengths and limitations of each for enhancing learning, to explore strategies for incorporating new technologies in their current settings and circumstances, and to share emerging ideas for modifying their curricula to include the use of technology tools. Course-based feedback from the teachers was positive about the course structure and time spent on each technology tool. Even then, some teachers stated that they wished that they could have spent more time with each.

(1-4:30 p.m.)	Mon	Tues	Wed	Thurs	Fri
Week 1	Introductions Syllabus Robotics	Robotics	Robotics	Robotics	Lab
Week 2	Geometer's Sketchpad	Geometer's Sketchpad	Geometer's Sketchpad	Geometer's Sketchpad	Lab
Week 3	Spreadsheets	Spreadsheets	Presentations	Presentations	

Figure 3: Third iteration schedule

Participant Outcomes

In addition to the course, support has been provided to teachers during the 2008-09, 09-10 school years as they implemented changes in their teaching. The course instructors have made classroom visits to engage students with LEGO Robotics, have loaned robotics kits and laptop sets to teachers to use on an extended basis, and have responded to phone and email requests for assistance in planning and implementation.

While formal data have yet to be collected from the latest teacher participants, initial self-reports and instructor contacts indicate that the teachers are confident in their preparation, with specific plans for integrating the technologies into their instruction. For instance, one teacher responded to an assignment focusing on future plans by stating,

> The first area that I would like to infuse new technology is in my beginning of the year team-building activities. We usually play a variety of games, introduce some short-term problem solving activities, and try to come to terms on how our room should operate. I believe the Lego Robotics and Mindstorms software would be an outstanding way to build community and accomplish procedural goals with a higher level of student thinking. I think that this is a good use of technology because it lends itself so well to small, cooperative groups. The immediate feedback provided by the robot to the students is powerful. They are in charge of their robot, not an all knowing, all powerful teacher. Therefore, they must take ownership and deal with problems that arise. These are early experiences that I, as a teacher, can use to teach kids how to think their way to possible solutions. I also loved the notion of "gracious

professionalism" as we worked on our own projects. Kids need to be encouraged to be kind to one another. If this expected kindness can be paired with the communication of their logical thinking, then we have a more robust activity. Finally, an important tenet of my classroom is "Failure leads to success." Almost invariably you have to fail in order to get feedback. These robots would enhance the learning of that concept.

He has since checked out the LEGO Robotics/computer sets twice to use with his classes. His class even had the local police department bring in their explosive sniffing robot to investigate similarities (See Figure 4) to their projects. He uses the robots in much the same way the 2008 course was taught, as an open-ended problem-solving set of activities.

Figure 4: Sixth grade students and robotics

Another participant initially wrote,

> In Trigonometry, students work with the Law of Sines when covering right triangle trig. To help understand the ambiguous case of Angle-Side-Side, students are shown the relationship between the given sides and or altitude to determine if the ambiguous case will produce 2 triangles, 1 triangle, or no triangle. This concept has been very difficult to demonstrate but I plan on having the class discover the relationships using GSP. The most difficult part of infusing a GSP activity will be providing detailed instructions on how to sketch the triangles and analyzing the relationships between the given sides and/or altitude.

Prior to taking the course, the school had the software for several years but it was used infrequently, if at all. When queried as to why, her response was, "We don't have access to the computer lab—that is for English classes." She has since fought for lab access, and now her mathematics department has days scheduled and one can observe her classes as well as others using the computer lab for GSP on a regular basis.

A third participant in the 2008 class has used the robots and computer sets with her students three different times in the past two years. This teacher used them at the beginning of each year and as an afterschool activity for a LEGO Robotics competition. She initially wrote,

> I currently introduce graphing of linear equations by hand. Based on the information from class I plan to use graphing calculators to introduce linear equations. This is a fairly big step for me because prior to this class my approach has been to teach the topic and algorithms then enhance with technology. I expect the students to acquire a better concept of positive and negative slopes, as well as be able to visualize the behavior of a line as the slope approaches zero, and what it means for a line to have an undefined slope. I then plan to reinforce this concept with Geometer's Sketchpad to have the students display the linear equation and discuss the changing values of the slope as they drag to change the slope. Students will see application of slope using three different modalities. This use of technology will enhance learning because I can alter the nature of the engaging tasks (McCrory, 2006).

> In Consumer Math I teach a section on buying a home. The students use pre-made amortization charts to see payment schedules depending on the percentage rate and pay out period. Students have difficulties understanding the idea that a larger portion of the payment applies to interest initially and a smaller amount to principle. I am anxious to use Excel to have them use a formula to set up their own amortization chart for a mortgaged amount. The demonstration of the variable flexibility in Excel was extremely powerful. I plan to have them set up the mortgage amount, the time in years of the loan, and the interest rate as variables. The dynamics of Excel will allow them to see the effects on payments when changing the mortgage amount, the time of the loan, and the interest rate. Student learning will be enhanced because they should make the connections quicker and at a deeper level from the immediate feedback of changing one variable at a time (Bransford, Brown & Cocking, 2000).

Lessons Learned

        This instructional technology course was planned for practicing teachers who did not necessarily have experiences with technology for teaching middle-level mathematics concepts. For this reason, there was no focus on general technology, as most teachers had familiarity with a computer, calculator, and other general technologies such as overheads, etc. Rather, the course concentrated on software and hardware that were useful in mathematics teaching, including spreadsheet software, GSP, LOGO, GIS, Fathom, and Cabri and LEGO robotics. The primary goal was to generate change in how teachers think about integrating technology into their normal teaching and that teachers would have a more natural flow in considering what would be appropriate, and have a higher comfort level in using technology with their students.

        In the first year the course was taught, multiple instructors were gathered to team teach. As a result, there were up to five instructors in the room trouble-shooting technology problems. This level of support was unsustainable, but has been maintained by two instructors in subsequent implementations. This type of support has been critical to help fix equipment, answer questions, and guide investigations. Also, several laptops were provided initially while some teachers brought their own. This turned out to be challenging as some teachers did not have access codes given to them by their technology administrators, preventing the installation of key software. In the latest iterations a full set of computers has been provided for the class, to which the instructors had full administrative access. The participants are free to check out a computer overnight for homework as requested.

        It was quickly obvious that our effort to teach all of the technologies possible would result in none of the technologies being learned. Our efforts to focus on technologies which teachers found to be the most useful yielded in greater classroom implementation. The teachers are more comfortable with the technologies when they complete the course, and are more willing to integrate the technology use in their instruction. In the end, spending more time on fewer technologies reaped greater rewards in the long run.

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Chinese Online Education into New Millennium

Xiaojun Chen

People's Republic of China is the most populated and the third largest country in the world. Located in Southeast Asia, China is still a developing country because of its low GDP and the weak economic foundation; however, China has surprised the world with its dramatic economic growth and technological advancement in the past two decades. There is a huge expansion of Internet usage in China, which subsequently influenced Chinese education at large. There were forerunners investigating the implications and impacts of Internet in China, however, at present little is known about Chinese online distance education and its sustainable development. The purpose of this article is to discuss the recent changes that Internet and its web-based applications have brought into Chinese education system in higher education, K-12 and professional training.

The author found out that there are urgent needs for Chinese educators to make important shifts when Internet and its web-based applications have penetrated into the current education system. These shifts are the role change from teaching to facilitating for normal pedagogues and the updating the traditional restricting classroom to an open and self-directing online learning environment. The author also believes there is a need for global partnership in Chinese online education system, especially in higher education; at the same time, web-based trainings can be a pioneer in leading the life-long learning strategy in China.

Internet development in China and in Chinese education

The first incident of Internet application in China dated back to September 20th 1987, when an email was sent out by a scientific working group from China to Karlsruhe University in Germany. The Email title was "Across the Great Wall we can reach every corner in the world", which symbolized the new era in Chinese information technology. In the next ten years (1987-1996), China experienced the initial stage of Internet implementation. Four major networks were established in China in this decade: China Network (ChinaNet), China Golden Bridge Network (ChinaGBN), the China Education and Research Network (CERNET) and China Science and Technology Network (CSTNet) (Tang, 2000). China Internet Network Information Center (CNNIC) was established in May 1997. It was not until then that these four national Internet backbones joined to work together. In the following four years (1997-2000) Chinese Internet development was geared by Chinese Open and Reform policy. *Word Computer Congress 2000* was held in China, and it was on this congress that the Chinese government stressed the necessity of setting up Internet pact and also called on people to make full use of Internet. Since October 1997, CNNIC has published 24 S*emiannual survey reports on the development of China's Internet*, reporting an increase of Chinese Internet users from 620,000 in 1997 to 26.5 million by July 2001 then to 162 million by July 2007 (CNNIC, 1997, 2001 July, 2007 July). This number has again been doubled to 338 million in July 2009 according to CNNIC's newest survey (CNNIC, 2009).

Realizing the key role of information technology in national economic growth, the Chinese central government has made a series of changes in its policy regarding the application of technology in education since 1993. The *Guideline of Educational Reform and Development* was issued by the Central Committee of the Communist Party of China in 1993, and shortly afterward, in 1995, *the Educational Law of the People's Republic of China* (Zheng, Ouyang, & Feng, 2002). These two significant policies increased government support in distance learning, in the form of broadcasting, television, and other information-technology-based avenues "to create an environment for lifelong learning"(Chen, 1999).

It was started from the higher education level, where the research force was grouped together, that the application of Internet was integrated and online education became popular. One of the major networks in China -- "China Education and Research Network CERNET", a high-speed backbone network project (1999—2001) -- obtained its qualification from the government. The project was a main element of "the modern remote education project" in "the national education promotion plan of 21st century", and also an important base for constructing the lifelong education system in China. Based on CERNET, the Ministry of Education (MOE) had approved four universities to launch their network educational institutions (later on 67 colleges were included in the list), and also allowed 19 online cooperative research centers to carry out remote education and scientific research through CERNET ("Chinese Modern Remote Education", 2002; CNNIC, 2003). Internet was also implemented in university administrative systems in China. In 1999, over 200 colleges in six provinces used "All-China College Students Recruiting System" on CERNET, and achieved its first success (CNNIC, 2001). It is also reported that more than 300 higher education institutions and research organizations were connected through these four major networks across the

country (Zheng et al., 2002). This gives Chinese universities great opportunities to share research and teaching resources at lower cost, without travel and management expenses. It also helps to build a knowledge sharing foundation for pedagogical and research innovation across China.

Online education in China

When Internet was first introduced into China, Chinese people were overwhelmed by the abundant information provided by Internet (Zheng et al., 2002). However, people are getting more and more comfortable with this new type of medium with the help of the government's promotion and loose in censorship, which allows self-regulated media and foreign investment in Chinese telecommunication services ("New Regulations for Chinese Internet Use", 2000). The most recent survey conducted by CNNIC shows that Internet has become the major medium for people to gain information, over the traditional ways of TV, radio and newspaper (CNNIC, 2009). This laid a foundation of promoting Internet-based education among Chinese Internet users. Another survey conducted by a Chinese research company I-Research in 2005 shows that 75.8% of the experienced Internet users, who have a net age above two, have enrolled in online education or training program (CNNIC, 2006). Although the newest figure in the 2009 survey shows that the overall use rate of online education in 2008 was 16.5%, there is a reported 40% increase rate from 2007 to 2008. It is noticeable that with the permission of government and the availability of funding from business partners, there are three dimensions of Chinese online education:
   1) online learning in higher education, based on CERNET;
   2) online study-help program in Chinese K-12 program;
   3) online work-based training.

Online learning in higher education – a highway to the future?

The Chinese Ministry of Education started to fund distance online-learning programs for Chinese research universities to participate in this innovative way to enable education. Four universities (Tsinghua University, Beijing Posts and Telecommunication University from Northern China, Hunan University from Middle-south China and Zhejiang University from Eastern China) among "211 projects " (100 Key and Research Chinese universities for 21st century) were the pioneers of educational technology in China. These universities began to research on the design of various online courses and the integration of current available technologies into the conventional ways of teaching such as the application of multimedia into the traditional college classroom teaching. Though these universities shared the common vision to enhance Chinese higher education through Internet-based technological education, they had different priorities. Tsinghua University focused on web-learning instructional design; Hunan University and Zhejiang University focused on increasing the accessibility of educational resources among universities and promoting community-based learning in higher education institutions. The outcomes were very positive. Tsinghua University launched its own online learning platform in 2002, while Hunan University established its Distance Learning College (DLC) in 2001. Distance Learning College in Hunan University was one of the earliest institutions offering university degrees for online enrollers. These educational progresses had favorable influence in Chinese economy, politics and community life. There was a reported increase in the number of online course users and more universities started online programs and online courses, such as NanJing University and Zhongshan University and etc. Some international IT companies were attracted to educational technology in China as well. In 2003, Intel signed up an agreement with Chinese government to provide technology and financial support to the increasing demand for educational technology within Chinese universities(CNNIC, 2006).

At the same time, criticism was aroused national wide about administrative issues of online courses, especially online degree awarding. The nature of online learning, i.e. providing a learning environment for users ("whoever") to have equal access ("wherever") to knowledge at their own time ("whenever"), was put into great doubt of its credibility. Although distance education can be dated back in 1950s in China and there were claims of its influences(Carr-Chellman & Zhang, 2000), however, it is still be considered as second-class education. According to Chinese culture, personal academic background plays a vital role in assessing individual's social status; in other words, Chinese people sometimes prefer traditional learning environments (for example, get a degree from a well-known university). Since 2004 Chinese educational technology has experienced a great decline in the higher education setting. For example, Tsinghua University halted on-going development of its learning platform. Furthermore, some extreme incidents that took place during this period put the online degree awarding institutions in an awkward situation. Hunan University ceased awarding online degrees for a two-year period after a plagiarism incident during final exams for an online course ("A Review of Remote Education at Hunan University," 2003).

Challenges and opportunities, offered by Internet and its web-based application, are both open to the Chinese higher education. Cultural influence on public awareness is hard to be changed in a short period of time. However, with the rapid development of technology and globalization in economy, China still has a great and increasing need for online distance learning. With the foreign investment in telecommunication and education, and the partnership with foreign education institutions, Chinese online degree program has more opportunities. Since education abroad at specific institutions has a reliable and good reputation in China (Carr-Chellman & Zhang, 2000; Zhang, 2005), as far as the author concerns, Chinese higher education institutions may consider to take a less traveled road to develop online education, that is -- to make partnership (with government permission, of course) with foreign universities to offer online courses or even degrees. On January 12, 2004, the three nations' project (China-US-Russia) - "Global Ring Network for Advanced Applications Development" (GLORIAD) was accomplished. GLORIAD was funded and constructed by CAS, the National Science Foundation (US) and Russia Ministry and Science Group Alliance. GLORIAD will support the three countries even the global advanced scientific and educational applications (CNNIC, 2006). The initiative of this project can be used as foundation of global educational partnership. The potential development of global partnership can provide more resources to both teachers and students in higher institutions. On the other hand, the pedagogical shift from exam-driven learning environment to more self-directed learning environment is needed in Chinese higher education system. It is the drive force in sustainable development of Chinese online education, the highway to the future.

Online study-help in Chinese K-12 education—a safe way to the future?

Similar to the development of online program in higher education, there is an increased use of web-based application and program at school level. As compulsory education in China, Chinese K-12 Education has a large potential to make use of Internet and its web-based applications in learning and teaching.
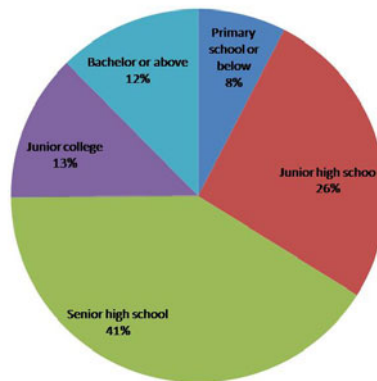
Figure 1 Education Structure of Chinese Internet Users

As shown in Figure 1, CNNIC 2009 July survey reports that nearly 75% of the Chinese Internet users are from high school or below level of education. This trend has aroused attention of government, schools, and business. According to CNNIC, the Chinese K-12 Education has seen a favorable progress in integrating Internet into daily schooling in 21st century. In 2001, the national Internet project of "Every School Accesses the Network" entered the phase of formal implementation; and "the Civilized Internet Pact of All Country Teenagers" was presented to regulate millions of domestic teenagers' behaviors when using Internet (CNNIC, 2003). SOHU and SINA, the two big Chinese portrait website started their Net-School targeting at K-12 level from 2000 and 2001 respectively. ChinaEdu.com, a commercial website providing online study help session for K-12 students, ranked top 10 hits website in 2006. However, not all progress resulted in positive educational value. CNNIC 2007 survey shows students use Internet at the order of following: recreational tool >communication tool> information channel> life helper (CNNIC, 2007 January). The students mainly use Internet's recreational function, even information function comes next. This phenomenon should come into notice. It is necessary to provide more education and guidance to help student know more functions of Internet, especially in the help of study.

Schools and education organizations were encouraged to develop Internet-based instructions and design relative materials for students in the classrooms (He, 1998). Online study help sessions became popular in big cities and some more developed provinces in China, e.g. Beijing, Shanghai, Zhejiang, Guangdong and etc. High ranked

schools in these areas put tutorial programs online for students to have access at their own time and pace. This pedagogical change is a revolutionary step in Chinese education. It calls out the shift from classroom and exam-driven education to skill-developing open education.

Digital divine is inevitable in China with its unbalanced regional economic growth. Internet is a double blaze. It deepens the digital divine at individual level, i.e. between students from more developed areas and those from less developed parts of China. The less developed parts of China usually lack of technology, but more importantly lack of educational resources, such as good teachers, and good facilities. Though the Chinese Ministry of Education has increased the funding to support K-12 education in some remote rural areas, these efforts are far less to bridge the gap completely. The unbalanced development rate challenges the quality of education across the country. However, Internet definitely can be served as a transmission vessel of knowledge. Ideally, with government support policies, it allows students to access resources not available in their classrooms or regions; it gives students more study-help without time or geographical constrains. It can be a safe (promising) way to promote equal education quality (opportunity) across the country, a safe way to the future.

Online work-based training—an innovative way to the future?

Work-based training in this article is defined as training relating to jobs and job-related skills in working environment, including foreign languages, specific IT skills, and etc. Work-based training is one of the forms of informal education, and has been advanced with the help of Internet and its web-based applications (Overwien, 2000; Rossett & Sheldon, 2001). Online work-based training is a new perspective to Chinese Internet users, but yet users adapted to it very well. Job-related training and work-based training became popular in China, as there is an increased profit in educational-related companies. With the development of economic globalization in China, there is a huge demand in foreign language learning and IT certificate training. These are the two most popular online training programs in China at the moment. The online professional training program also witnessed an increased enrolling number in the past three years from 2003 to 2006 (CNNIC, 2006).
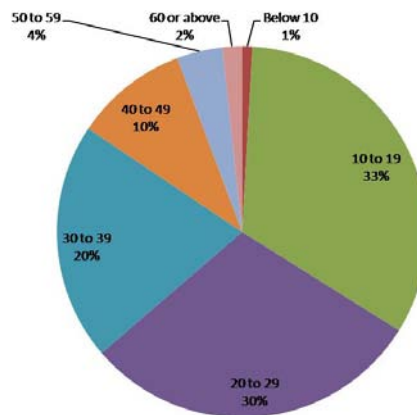
Figure 2.   Age of Chinese Internet Users

As shown in Figure 2, the newest survey report from CNNIC in July 2009 shows that about 65% of the Chinese Internet users are aged below 30. This group of users will dominate the development of Internet in China in the next 20-30 years. This gives an indication of future development leading to life-long education environment. The work-based learning fits into the Chinese government education policy of promoting lifelong learning (Chen, 1999), i.e. sustain people's learning and education through various ways of distance learning program. There is a need to promote online work-based training for Chinese young users and to cultivate their life-long learning habit through training. People no longer hold the same skills for their whole career lives. New skills and new knowledge is always needed on the job and in the labor market.

One of the biggest challenges is the low awareness of the importance of training in the Chinese government or business organizations. There is currently very limited public fund or financial aid for 1) previous laid-off workers to acquire new skills for their new jobs or 2) on-job training for employees who are required to perform new skills.

Who is going to pay for training and learning became the key factor that hinders the development of Chinese online work-based training. Chinese Internet users usually regard the resources on Internet as free of charge, so culturally nobody is willing to pay the bill for online trainings.

However, the fact is that China's fast and stable economic growth provides a huge incubating bed for web-based training. As part of the informal learning based on Internet, it is very important for Chinese policy makers and service provider to facilitate this web-based learning environment. Also, people's perspective on training and lifelong learning needs to be changed in order to match the fast development of economics and the increased demand of knowledge. From college study to lifelong learning can be an innovative way to the future of China.

Final thoughts

Internet has opened a new gate for Chinese education with opportunities and challenges. There are more questions needed to be examined: what is the essential requirement for Chinese online distance learning? What is the possible global partnership for Chinese educational technology industry? How can online distance learning maximize the educational benefits to Chinese society, including formal and informal education, in both school and business settings?

The author believed that 1) Virtual university has a high potential in Chinese education market. Chinese higher institutions have great opportunities to cooperate with foreign universities to offer better and reliable online degree education 2). More funding and pedagogical research need to be provided to school-level education to enhance Internet-based instruction and study-help. 3) In order to offer better education for new generation, who was born and raised up in this information age, Chinese government policy-makers need to bridge the gap between higher education and life-long learning skill set.

Online education development in China is not a linear development process, but a systematic change influenced by economic development, and, at the same time, relating to government policies, pedagogical shifts, and also cultural perspectives. The author believes that despite of the hardships, Internet and its web-based application has been offering Chinese education a high way, safe way and innovative way to the future.

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Communication Issues in a Leadership Team in a School District

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Abstract

   This study describes the communication practices of the Leadership Team (LT) in the Metropolitan School District of Decatur Township (MSDDT), focusing on the members' values and beliefs on communication within the team, communication deficiencies and communication channels and sources. The purpose of the study was to improve the guidance offered by the School System Transformation (SST) protocol to the MSDDT by prescribing preventive measures that could reduce communication deficiencies in their LT.

Introduction

Why systemic change is important

   Over the 20th century, various school reform efforts were made to improve existing educational systems to better serve communities (Schlechty, 1990). However, experience has indicated that school reform as piecemeal change is not enough to improve the overall system, whether the system is a classroom, a school, schools within schools, or school districts (Reigeluth, 1999). A systemic change, which must include all aspects of the system, should be a true transformation. According to Reigeluth and Joseph (2001), a systemic change approach in K-12 settings could bring significant improvements to the educational experience of students and their families, school employees and the entire community.

   Jenlink et al (1998) define systemic change as an approach that recognizes the "interrelationships and interdependencies among the parts of the educational system, with the consequence that desired changes in one part the system must be accompanied by changes in other parts that are necessary to support those desired changes" (p. 219). It also recognizes the "interrelationships and interdependencies between the educational system and its community, including parents, employers, social service agencies and much more, with the consequences that all those stakeholders are given active ownership over the change effort" (p. 219).

Guidance for the systemic change process

   In today's US, a few school- and district-wide systemic change efforts have been implemented. Several design theories were developed to guide change efforts. One big category of these design theories is guidance primarily about what the school should be like, not the systemic change process. These included two nationally recognized educational change methods, the Coalition of Essential Schools (CES) and Success for All–Roots & Wings (SFA). CES (Sizer, 1984; 2002) is a system that promotes ten common and eight organizational principles as the foundation of their philosophy of schooling to restructure secondary schools. SFA (Slavin & Madden, 2001; Stringfield, Ross & Smith, 1996) is a school-wide change model with an underlying principle that promises "every child" will be successful in learning to read through their curriculum. Other design theories about the change products are the School Development Program (SDP), and Knowledge Work Supervision® (KWS). SDP (Comer, Haynes, Joyner & Ben-Avie, 1996) is a model that advocates on behalf of parents and families to have a central role in the change process for the education of their children. KWS (Duffy, Rogerson, & Blick, 2000) is a methodology that assists the redesign of an entire school district from an innovative point of view by recognizing three fundamental principles: a. understanding how systems change, b. working with individuals as well as with groups, and c. developing necessary attitudes and skills of those facilitating the change.

On the other hand, theories guiding school change process include GSTE and SUTE. The GSTE (Jenlink, Reigeluth, Carr, & Nelson, 1996; 1998) is a guidance model to facilitate systemic change in K-12 school districts. Duffy also developed a framework to guide transformational change in school districts, which is called Step-Up-To-Excellence (SUTE). GSTE and SUTE were blended into a new hybrid methodology, which is called the School System Transformation (SST) Protocol (Reigeluth, C. & Duffy, F, 2008). It has some sequential elements and some elements that need to be addressed continuously throughout the transformation process. The elements fall into five phases: prepare, envision, transform, sustain and evaluate. Each step in the protocol is not in a lock-step sequence and should be perceived as a set of flowing activities that converge, diverge and backflow from time to time. Each phase has several steps, and each step has multiple tasks and activities. The SST Protocol has been applied as guidance for the change effort in the Metropolitan School District of Decatur Township (MSDDT) in Indianapolis. One of the phases in the SST Protocol addresses the process of forming and participating in a Leadership Team (LT), which could either promote the success or ensure the failure of a district-wide change effort, and thus is the focus of this study. The performance, contribution and impact of a LT in a system could be strongly influenced by the efficiency of communication among team members.

Communication theories related to systemic change

The traditional definition of communication is the exchange of information, ideas and feelings in order to get a message across (Mclntire., & Fessenden, 1994). There are various types of communication: intrapersonal, interpersonal, public, mediated, organizational, intercultural and mass (Fiordo, 1990). Intrapersonal communication takes place within each of us as we talk to ourselves; interpersonal communication describes communication between participants who are dependent upon one another and have a shared history; public communication refers to the sending of messages to an audience; mediated communication pertains to the use of various technologies to mediate the sending and receiving of meaning and messages; organizational communication refers to messages transacted within, from and to an organization; intercultural communication applies to sending and receiving messages between organizations and individuals from different cultures and societies; mass communication is about how individuals and entities relay information through mass media to large segments of the population at the same time.

Considering the above categorization of communication, given the purpose of this study, in this phase of the SST, attention will only be given to interpersonal, public, mediated and intercultural communications because they are directly related to communication skills the team members are expected to acquire, communication channels and sources desired by the team and how to improve communication deficiencies among different stakeholder groups. In the later phases of the research, organizational communication will be touched upon since the findings from the analysis of the current data collected strongly suggest a close relationship between the internal LT communication and the LT's communication with other stakeholder groups outside the team. Intrapersonal, intercultural and mass communication will be skipped in this study because it specifically focuses on communication within the leadership team under analysis.

Although issues related to leadership communication have been well researched in both school and corporate settings, researchers usually tend to focus on communication strategies or skills leaders or executives are supposed to have in order to guide, direct, motivate and inspire people through effective communication. For example, Deborah Barrett summarized and proposed several leadership communication frameworks, arguing that leadership communication consists of layered, expanding skills from core strategy development and effective writing and speaking to the use of these skills in more complex situations (Barrett, 2008). However,

some of the frameworks and skills might not apply to the LT of MSDDT, because the team consists of different stakeholders in the school district, including administrators, teachers, parents, community members, support staff, school board and ministerial staff.

The composition of the team reflects the application of the stakeholder participation concept. Stakeholder participation has been defined as "a process whereby stakeholders – those with rights (and therefore responsibilities) and/or interests – play an active role in decision-making and in the consequent activities which affect them" (SDD, 1995, p. 5). Stakeholder participation in the decision-making of educational systems can potentially improve their design and implementation by improving ownership, building consensus, helping to reach disadvantaged groups, mobilizing additional resources, and building institutional capacity (Colletta & Perkins, 2007).

Research questions

The LT in MSDDT was formed under the guidance of the SST protocol to fulfill the mission of guiding the change process in the township. This kind of LT is significant in today's educational setting. An industrial-age mindset of decision-making has prescribed change in education for many years through a top-down decision-making structure that functions with little input from its stakeholders. The introduction of decision making teams (comprised of diverse stakeholders in the organization) into the leadership of organizations has revolutionized the way these organizations function and produce (Reigeluth & Duffy, 2008).

Senge (1990) argues that a learning team within an organization has the capacity to think together and dialogue with the purpose of learning together. He states that team learning is the process of aligning and developing the capacity of a team to create the results its members truly desire. Duffy and colleagues (2000) proposed a systemic change process to transform school systems into high-performing organizations of learners through team-based design work. Some advantages of using teams in systemic change efforts include: a) teams increase participation and collaboration, which could increase motivation, job satisfaction, and commitment, b) teams dissolve hierarchies within institutions, creating opportunities for communication and collaboration, c) teams promote conditions for creation and diffusion of knowledge, and d) those who are closest to the work understand best how to improve it (Duffy et al., 2000). It can be observed that communication permeates in all these factors in order for them to be successfully achieved. In addition to communication skills each member is required to possess, this study seeks to investigate whether the team culture and climate are conducive to communication and whether communication channels and sources are supportive of team communication. These issues were developed into research questions to examine the current status of internal communication within the LT of MSDDT.

The research questions are:
1. What are the implied communication patterns of the LT (who do members share ideas with and how often)? What characteristics of communication exist within the team?
2. What are team members' values, beliefs and perceptions about their team communication?
3. What are the means and sources of communication within the team?
4. What are the communication deficiencies and how they can be improved?

Methods

This research study employed a formative research methodology, which follows a case study methodological approach in qualitative research (Reigeluth & Frick, 1999, p. 637). According to Reigeluth and Frick, formative research asks three basic questions: 1) What is working? 2) What needs to be improved? And 3) how can it be improved? Formative research is a kind of developmental research or action research that is intended to improve design theory for designing instructional practices or processes (Reigeluth & Frick, 1999).

This methodology is useful in identifying what worked for communication at Leadership Team (LT) meetings in MSDDT and how communication could have been improved, indicating possible additions to the SST Protocol to improve communication at LT meetings.

Formative research classifies case studies as either designed or naturalistic cases. According to Reigeluth and Frick (1999), formative research is a designed case when a theory/model is instantiated and then formatively evaluated. In contrast, formative research is a naturalistic case when the case selected was not specifically designed according to the theory but serves the same goals and contexts (Pascoe, 2008). According to Reigeluth and Frick (1999), in naturalistic cases the formative evaluation of the instantiation is done during its application. Therefore, this research study was a naturalistic case, primarily because the theory did not offer guidelines to enhance communication at LT meetings, and it was studied post facto, whereby formative evaluation occurred after the case had already taken place. A naturalistic study is usually conducted based on the following procedure: 1. Select an existing theory; 2. Select a case; 3. Collect and analyze formative data on the case; 4. Offer tentative revisions for the theory (Reigeluth& Frick, 1999). With this procedure serving as the basic framework of the current study, the researcher aims at revising the current SST theory relevant to the communication of the LT.

School district

The school district selected for this study was the Metropolitan School District of Decatur Township (MSDDT) in the State of Indiana, US, with an approximate population of 24,000. It was one of eleven public school corporations in Indianapolis Marion County, and at the time of the study served approximately 5,500 students. MSDDT offered one centralized early childhood program, four elementary schools (grades 1-4), two intermediate schools (5-6), one middle school (7-8), and one central high school having five academies (9-12). At the time, students were served by almost 260 full-time teachers and more than 280 professional staff members. Approximately 90 percent of MSDDT students were considered white, and some 40 percent of the student population received free or reduced lunches and textbooks (Pascoe, 2008). In 2001, MSDDT and Indiana University established a partnership to enhance the educational opportunities offered to students, their families, and the community-at-large through a district-wide systemic change process using the SST.

Leadership Team

In the spring of 2001, a predecessor of the Leadership Team, named the Core Team, was formed. They met as a team to identify core values and ideas that could guide the MSDDT to improve its educational process and include all stakeholders in reaching consensus on the changes that could most benefit their students. This Core Team met almost every week until the end of the fall of 2002, at which point they expanded into the LT, though they continued to meet as a Facilitation Team for planning the LT meetings. In February 2003 the newly formed LT had a broad representation of MSDDT stakeholder leaders, including community members, to work together to design better learning experiences for students in this school district.

From mid-November 2003 through April 2004 a second phase of the LT took place. The LT was reconstituted and expanded, and devoted time to reviewing data gathered from stakeholders in the school system about the need for systemic change in their school district. Next, the LT developed a Framework of mission, vision, and ideal beliefs about education, developed in collaboration with the community, which became prominent throughout the MSDDT. The current LT has forty members, including eleven administrators, eleven teachers, seven parents, four community members, two support staff, one school board member, one ministerial member and three facilitators.

66

Data Collection and Analysis

In the study, observation, survey, focus group and individual interviews, and documents were used as main techniques for data collection. Hand analysis was used as the analysis approach and findings were validated through triangulation and member checking.

Observation

Assuming a role of nonparticipant observer, the researcher observed LT meetings, which were held once a month. The researcher attended meetings and observed discussions to further inform the development of the protocol. Field notes were produced during three observation sessions in November and December of 2008, with each lasting 2 hours, about communication and types of information considered and used. The field notes were used for identifying themes related to communication in the LT and for informing the survey questions and interview protocols later developed.

Survey

A short survey questionnaire with three questions was sent out to the entire LT to capture the characteristics of the team's communication and the members' perspectives on good communication and leadership skills. In order to get the most responses from the team members, the survey was made as short as possible. It was sent out via email together with a participant information sheet, and participants were reminded to reply only to the researcher to protect their confidentiality. The survey was sent out multiple times, and twelve out of thirty seven members (excluding the facilitators) filled out the survey. The twelve respondents include five administrators, four teachers and three community members. The sample has limited representativeness of the whole LT, but the majority stakeholders of the LT were included in the sample. The information about which stakeholder group each person was in is known. The three questions asked were:

1. Within the LT, name the people with whom you are most likely to share new ideas. What is the frequency you communicate with each other related to the LT issues? (the number of times per day or per week or per month)

2. Within the LT, what people would you be most likely to choose as the team leader if you were to work on a team project? And why?

3. If you were going on a vacation, name the members on the Leadership Team you would like to go with. Why them?

Interviews

Eight members of the team were interviewed. Three of them were teachers, three of them were community members, one person was on the school board and one was a school principal. It is noticeable that this sample is not sufficiently representative of the whole leadership team. The generalizability of the study results is thus reduced. The years they had been on the team ranged from one to seven years. The community members included parents, retired teachers and people who were from a university located in the same city as the township. All of them had been living in the township for more than fifteen years. Two focus groups were conducted with three teachers and two community members based on a semi-structured interview protocol. Each focus group lasted about 30 minutes.

Three one-on-one interviews were conducted with a principal, a community member and a member from the school board, with each lasting about 40 minutes. Semi-structured interview protocols were used, and open-ended questions were asked to allow maximal flexibility for participants' responses. The researcher took brief notes during the interviews, and all the interviews were audio taped and transcribed.

Documents

Public documents, such as minutes from LT meetings, official memos, newsletters, notes, records, and physical and on-line archival materials were collected as sources to make sense of communication channels and

patterns in the group. Notes were taken about the documents to record information from them. The documents were used to gain a sense of the context and language used and to trace the linkages of discourse related to key themes.

Data analysis

All the notes and materials obtained were organized by type, participant, site and combinations of these categories. Duplicate copies of all forms of data were kept. All the interviews and observational notes were transcribed. The data analysis was conducted following data analysis activities of data reduction, data display, and conclusion drawing (Miles & Huberman, 1984). Data reduction is "selecting, focusing, simplifying, abstracting, and transforming the 'raw' data...." (Miles & Huberman, 1984, p. 21). Summary information could be placed in a series of matrices which specify relevant situational characteristics and array categories of data (Miles & Huberman, 1984). Guided by this process, the researcher read the data, marked them by hand, divided them into parts and created a database. To narrow the text data into a few themes, the coding process followed was to make sense of the whole data, divide them into text, label the segments with codes, examine codes for overlap and redundancy, and collapse these codes into broad themes. The researcher scanned theory and methods literature for ideas that would help make sense of emerging themes and concepts. Analytic memos and theoretical notes with commentary about emerging themes, anomalies of inconsistencies and relationships were created. Portrayals of each theme were written, and tables and charts were produced to represent the findings.

Validating findings

The findings were validated through the strategies of triangulation and member checking. As stated in the data collection section, the researcher triangulated among different data sources to enhance the accuracy of the study. With different types of data (observational field notes, interviews, notes on documents), and different methods of data collection (observation, interview, document analysis), the information was drawn from multiple sources, which enhanced the accuracy and credibility of the findings. The researcher also checked notes and transcriptions with participants in the study to determine and enhance credibility.

The findings will be checked back to participants, and they will be asked via email about the accuracy of the report, whether the description is complete and realistic, and if the interpretations are fair and representative. The report will be sent to them when the study is finished.

Findings

The findings are organized in relation to the research questions. They start with the characteristics of the team's communication, communication skills admired by the team members, followed by the team members' values, beliefs and perceptions about their team communication, the means and sources of communication within the team and the communication deficiencies detected by the members.

Team communication characteristics

The researcher intended to capture the characteristics of the team's communication by asking questions examining who the members were that most team members would like to share ideas with. After analyzing the answers given by twelve members, five people from the administrator group and three teachers from the teacher group were most frequently chosen as people to share ideas with. It also implies that people intended to choose people from the same stakeholder groups as themselves. Although the result was not based on the responses from all the team members, it appears that communication based on hierarchical ranks still plays a role in the team. However, another explanation is that since the LT only met monthly, the administrators were the team members who met most often, or administrators were in charge of the meeting planning and management, including member recruiting, therefore they were more familiar with most of the members. It needs to be noted that none of the community members, parents, support staff or school board members were chosen, which means there must have been some communication breakdowns between teacher and administrator groups and

the members outside the school. Another explanation to this phenomenon could be that a group of the most influential people has emerged in the team. These discoveries shed light on developing the interview protocol at the later stage of the study and the reasons underneath were explained in the later section.

For all the respondents who did reply that there were certain people with whom they would like to talk about LT issues, most of them only met each other once or twice a month, with only a few exceptions for some teachers, but most teachers were in different schools, so they could not see each other very often. It appeared that, except for the monthly LT meetings, there was not enough face-to-face communication for team members, even with the ones with whom they would most like to share ideas.

According to the answers respondents gave to the survey, it was found that, other than formal relationships developed based on working relations between the team members, informal relationships did emerge within the group. Nine out of twelve respondents chose some team members as their vacation partners. However, 3 of them refused to choose anyone as a vacation partner because they didn't know anyone well enough. The reasons people chose others as vacation partners included: same hobbies and interests, sense of humor, same age, fascinating personalities, know them longest. Furthermore, the partners chosen were always within their own stakeholder groups, which means teachers tended to choose teachers and administrators tended to choose administrators, and people working in school never choose community members.

Leadership and communication skills admired

According to the answers to the survey, four people from the administration group and two from the teacher group were chosen as team leaders, for they possessed certain leadership and communication skills desired by other members. These skills are summarized below: stays on top of the issues; would do their share and designate out some responsibilities; work in a professional and respectful manner; will not sugar coat information; accept the ideas of others; understand my job; thorough; efficient; creative; hard working; high work ethic; have access to many resources; passion for students and learning; make a person feel needed and appreciated; organization skills; knowledge of district; not afraid to do work themselves; out of the box thinking; keep the team focused; not hesitant to speak; not beat around the bush.

Team members' values, beliefs and perceptions on team communication

Interviewees were asked about the leadership role and the team vision, mission and products to examine if this information had been effectively communicated to the members. Most of the interviewees agreed that the LT provided them with a framework and a bigger picture of where the township needed to go. It helped them look at a more global picture of all the stakeholders involved in the reinvention process and come to know different perspectives from stakeholders. Although not every member was clear about the vision, mission and products of the LT, the members who provided answers agreed that the mission of the LT was to assist the rest of the school system with guidelines to improve schools. In addition, they were also aware that the mission of the LT might change over time.

Compared with the vision and mission of the LT, the members' opinions on its products varied from person to person. The vision and mission statement was considered a major product of the team. Some considered that the major product was sharing ideas and getting feedback from different stakeholders, and some believed the products of the leadership team were the tools or guidelines that support the schools to form their teams and drive their reinvention processes. The inability to state the vision and mission of the LT and the mixed understanding of its products reflects that these concepts were not effectively communicated to the members, which was again confirmed by the answers given by some interviewees. Two members emphasized that the vision and mission of the LT was really cloudy at one point.

However, both of them also pointed out that the goal of the team had been defined in recent months and the team had been back on the right track. That largely was due to stronger leadership from the central office, which

69

worked hard to reenergize, refocus and redirect the team. Other members expressed the opinion that the LT had had thorough conversations and follow-up concerning its vision, mission and products. The seeming ineffectiveness might have been caused by some individuals not taking an active role or by gaps due to absences from the meetings.

In order to examine if the team had effectively communicated among its members about their particular roles in the team, participants were asked about this. Almost every member interviewed was clear about their particular role in the team, at least conceptually, since some community members were not very positive as to whether they had met the requirements of their roles. Generally speaking, the participants thought that they were expected to actively participate in the meetings, bring in their ideas and thoughts and share their point of view with each other. They were specifically clear about their bridging role to communicate between the LT and their own stakeholder group, although this clarification was reinforced only six months earlier, which is consistent with the time talking points were sent out through email to each member. This demonstrates that the team had been making efforts to emphasize the importance of communicating with all stakeholder groups.

It is worth noting that the teachers interviewed universally considered themselves as an integral part of the reinvention process and had high demands on themselves in terms of changing mental models, communicating within the team, learning related knowledge, and being supportive in their own buildings to move the reinvention process forward. Some mentioned that they attended administration courses or went to retreats. By comparison, although community members were clear that each was expected to bring an outsider perspective, they stated their concerns that sometimes they felt lost and didn't really know whether they were making contributions to the team. The researcher further explored this issue and examined the reasons by asking questions related to these communication deficiencies.

Sources and means of communication

For the sources and channels of communication within the leadership team, all the members interviewed shared the opinion that key people on the team, especially those on the Worker Bee team, served as communication sources. In addition, a new communication strategy, which had only been adopted six months earlier, had proved very effective. That is the central office staff summarized the "talking points" from each meeting and sent them to all members via email. According to them, the talking points had been useful because they served as a good reminder of what they did in each meeting and provided a good way for them to share what they had done in the LT with their stakeholder groups. And to a large extent, those talking points were produced particularly for the members to take back to their own stakeholder group members.

It needs to be noted that, although every participant was notified before the interview that the study was to examine the internal communication within the LT, almost every participant touched on the issues of communication between the team and other stakeholder groups and provided suggestions. That feedback, although not the initial focus of the study, was good to have in that the issue of communication with other stakeholder groups was consistent with the participants' understanding of the LT role and the composition of the team itself.

Communication deficiencies

The lack of informal communication was mentioned by every member interviewed as one of the communication deficiencies on the team. It is consistent with the survey results presented above. As introduced by the members above, the LT meeting itself served as the primary source of communication. However, the meeting was only held once a month, therefore most members interviewed felt there was a lack of understanding of people on a personal basis. Some of them didn't even know who the team members were and what they did. This issue is more obvious with community members, because most of them are not directly involved in school and have fewer opportunities to meet with other community members.

The members felt that there had been too many mental activities and idea exchanging taking place, which had been effective to learn knowledge but ineffective to get to know the members' needs. Though members were divided into small groups to work on certain activities almost every meeting, they didn't get the opportunity to work with every member and get to know them. The lack of informal communication and less understanding of other team members contributed to a team culture that is more alien and intimidating for community members to the extent that several of them started to question their function and contribution to the team.

It has to be highlighted that all the community members interviewed felt uncomfortable offering their ideas and questioned their own value on the team, and they also analyzed various reasons behind that. In addition to the lack of informal interaction among team members and individuals' personality traits, they deemed the structure of the team (25 educators and four or five outsiders) and the jargon used by the team were primary impediments to communication between members of the LT. They thought the setting of mostly educators in the group not only was intimidating for people who were not so used to talking in front of big groups, but also got them stuck in a mode that they were just sitting there as advisory members watching internal people really doing the work.

Management of LT meetings

All the participants provided positive feedback about the management of the LT meetings. The time of the meetings worked for everybody's schedule. Though the meetings were held monthly, most interviewees thought this frequency was enough because they understood that things needed time to develop. They also praised the organization of the meetings and activities. However, people also acknowledged that, since too many things were going on in each meeting, quite often they felt like they didn't quite understand the goals of each meeting and got nowhere in some of those meetings. One common opinion was that the agenda of each meeting was too packed.

The participants acknowledged the importance of the activities designed by the Worker Bee team for each meeting, and some of them were deemed very effective. For instance, several of the interviewees mentioned the activity in which they shared the middle school redesign process. However, there were complaints that sometimes it seemed they were doing an activity that was well planned by the Worker Bees but was not very relevant to the real world or its purpose was not so clear, and they did not feel they could play an active role in it.

The participants also expressed mixed opinions on the leadership of the LT. On the one hand, some had seen the meetings as teacher-directed because the teachers usually facilitated and directed the activities. On the other hand, some stated the concern that they felt more like followers than leaders in the group because often the Worker Bee group planned all the activities.   This indicates that the LT has not encouraged the members to have input in planning the meetings or activities. Though time might be an issue with most of the members, being provided with some degree of decision making in the activities they will do in the meeting was not considered a bad thing.

Discussion

The descriptions from the interviewees reflect communication issues existing both within the team and between the team and other stakeholder groups. One the whole, the suggestions provided are helpful to address several of the eighteen continuous processes in the SST Protocol, namely sustain motivation, develop and sustain appropriate leadership, develop group-process and team-building skills, build team spirit, engage in reflection, communicate with stakeholders, and foster organizational learning. These suggestions will be discussed in relation to the research questions explored in the study and the implications for the SST Protocol.

Improve communication deficiencies & communicate with stakeholders

One member suggested that assigning stakeholder jobs in the team might be a solution to bring in more parents or community members, which is also a good way to increase opportunities for meeting other members more informally. Another member suggested that, in order for people to have a better idea of how each member is communicating back to their stakeholder group, the LT should allocate special time for discussing this issue and make it transparent rather than continuing to keep it secretive. To help people know each other much better, they expressed a strong hope to allocate special time to dealing with members' questions and feedback, providing clarification if it's needed. A list with updated member information was highly welcomed. Moreover, the members expressed their willingness to see more mixed or shifted groups so that they would have the chance to meet and work with more members on the team. This is consistent with communicating with stakeholders, which is specified in the SST Protocol. More representatives of stakeholder groups in the team will bring more perspectives into team discussion and activities and facilitate the communication between the school and community. Since community participation is so important in the whole change process, it is suggested that stakeholder participation should be emphasized in each phase of the five phases specified in the SST Protocol.

Improve communication deficiency & sustain motivation of community members

Sustaining motivation is an important process out of the 18 processes listed in the SST Protocol. To encourage community members to contribute to the team, the following solutions were suggested:

1. Be provided with a clearer understanding of the function of community members on the team and historically what contribution community members made to the team.
2. Visit schools and classrooms in order to have a better idea about what is going on in the school.
3. Recruit student members on the LT to provide more concrete information to the community members.
4. Rather than sitting in a large group meeting, one-on-one or two-on-two meetings in informal surroundings (such as a coffee shop) might be more comfortable for most parents and community members.
5. The mentality needs to be changed from expecting people to come to school to going out and talking to families.

Improve communication channels and sources & develop group-process

The participants identified various communication channels and sources that they thought might help address communication deficiencies within the team. These suggestions are thought to improve group-process developing in the leadership team with better record of group activities. For the problem of not remembering team members' names, one member suggested that the team keep a case of people's name tags so that each one can put it on during the meeting and return it afterwards. Another suggestion was to give each member a binder or a notebook and provide updated information about group members. Through the interviews, the researcher learned that there had been a binder for each member several years ago to keep related readings and information sheets. However, the binder got too heavy, and people just ceased bringing them to the meetings. An effective solution might be keeping the binder with limited pages, but no matter how the information would be stored; the members need to receive updated information on each member.

To facilitate communication both within the LT and with the outside stakeholder groups, it is suggested that a website could be built holding podcasting and vodcasting of each LT meeting so that not only the team members, but everyone in the township could be able to know what is going on in those meetings. This would be a good way to spread the vision of the LT, keeping the teachers and community informed and would even act as a good way to introduce team members.

LT meeting management & foster team learning

Team learning within the LT has tremendous significance for the whole district, given the steering role it assumes. Several suggestions were made on the management of the meetings in order to foster team learning

and for all the members to be clear about not only what they had done and what they needed to do in each meeting, but more importantly, what they had gained from what they had done and what they still felt fuzzy about and needed more clarification on.

1. Use dinner time to have dinner conversation, reviewing what they did last time and the agenda of the meeting on that day.
2. Pair the members with different people each time during dinner time.
3. Allocate reflection time every meeting to give anyone who didn't speak the chance to speak up.
4. Assign one person in charge of the meeting each month. Let the members know who the go-to person will be if they have problems or questions. More consistency would be added to the meetings in this way.
5. It may take more than a meeting every month to make community members feel involved in the team. Therefore, aside from the LT meetings, three or four key members of the LT should go out to meet with community members and build stronger relationship with them.
6. If the LT decides the meeting frequency is not enough for the team, it is suggested to make each meeting longer rather than having another one each month.

To give the participants a clearer sense of those meeting activities, one implication the researcher got from the interviewees is that after each activity, the team should get members' feedback or at least provide them with an evaluation form and then decide whether to keep the activity or not. A successful activity would be the one that is relevant to educational issues, such as having discussions about how the high school work has informed the middle school work.

One of the implications for team member recruiting is that the potential member should be someone who is proactive, aware of their role and driven to assume it, comfortable with large group discussion and willing to be integrated into the bigger group, and motivated to learn about different fields of knowledge. It's better if they have kids or someone who is involved in the school system.

Conclusion

Communication is one of the most important factors that determine participants' contribution in any team effort, particularly an effort as complex as a district-wide systemic change process. The communication breakdowns that LT members experience could potentially deny the success of the effort. This research study addressed what those communication deficiencies are and how to improve them. When members of a LT are not effectively communicating, opportunities to contribute, grow as a group, and continue the progress that this particular team is providing to the system-wide change are put at risk. Hence, studying and improving the communication of LT members is important to the successful implementation of a change effort in a school district.

For the eight participants who did accept the interview, four of them were community members, whose perspectives on the communication problems in the LT are definitely different from members of other stakeholder groups. Therefore, more information needs to be collected from other stakeholder groups to verify the interpretation the researcher has so far.

The study also discovered some related research topics, such as how communication affects team members' performance, how the LT should improve its management for better communication to take place, and who should assume the leadership role within the LT. Therefore, this study should be considered as a stepping stone in a long series of research studies to inform LTs and school districts about team membership interactions and communication. More research is needed.

Limitations of the study

The limited number of respondents to the survey and limited number of members who accepted being interviewed greatly impact the credibility of the study results. Unwillingness to participate in the study was

partly due to bad timing (the survey and interview were arranged between late November and early December, when most of the administrators and teachers were especially busy with their school work) and perhaps partly due to team members being reluctant to talk about or even to address communication issues they were having. Another possible reason is that they were just not interested in the research study itself. To make the study complete and more valid, the researcher planned a second phase of data collection, and tried to arrange more interviews with the teachers and administrators, in order to depict a more thorough picture of communication within the Leadership Team. However, the second phase of interview did not materialize due to the LT members' reluctance to accept interviews. A legitimate explanation for this could be that the LT members were too busy with their current professional roles to consider volunteering. Another explanation could be that the other LT members were not so aware of communication issues. It could be further explained that other team members, different than some community members and some teachers who accepted most interviews of the study, did not consider communication was a big issue for the team. Hopefully more data could be gathered in the future to enrich the findings from the current study.

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A System for Developing Case-based Learning Environment

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Abstract: We report on the design, development, implementation, and evaluation of a cased-based instructional environment designed for learning network engineering skills for cybersecurity. We describe the process of design and development research, the societal problem addressed, the theory-based solution, and the evaluation and testing of that solution. We identify a structure for scaffolding case-based learning for problem solving. Findings inform design and instructional practice as well as support grounded theory for design and development of case-based learning environments.

Overview

The research we report on is of design, development, implementation, and evaluation of an instructional environment for teaching and learning network engineering for cybersecurity. Computer Science programs need to prepare the cybersecurity workforce by engaging students in interactively solving intellectually challenging cybersecurity problems. The Virtual Network Engineering Laboratory (VNEL) provides students with opportunities for hands-on network engineering experience by using a virtual laboratory. We have developed and disseminated the online VNEL to community colleges for teaching students how to solve cybersecurity problems. Through the VNEL, we currently engage network engineering students in fifteen underserved community colleges around the country in case-based cybersecurity problem-solving. Students focus on technical solutions in network management. The VNEL is instructionally innovative and differs from conventional teaching laboratories in that it does not require students to be physically located with the network equipment they are learning to manipulate. Instead, the VNEL offers a technologically innovative environment for computer engineering instruction in which students

remotely manipulate equipment in a real network and conduct cased-based problem-solving exercises in a controlled, high-fidelity environment via the internet using their web browsers. The VNEL enables instruction to be efficiently and effectively distributed across geographic regions, thereby reaching greater numbers of students than would be possible through traditional face-to-face or on-site laboratory instruction.

Case-based learning was chosen as the instructional model because novices needed to learn how to gain and refine their expertise at solving cybersecurity problems. Constructivist learning theory suggests that such problem-solving is best learned in the context of problem, project, or case-based learning environments which provide experiences that facilitate knowledge construction (Jonassen, 1999). When network engineering students build experience through authentic cases they learn to manage complexity and think like network engineers. In effective learning environments, experience is scaffolded with expert case knowledge.

Approach: Design and Development Research

A growing body of educational researchers argues that design and development research, also called design-based research, be conducted to bridge theoretical research and educational practice (Collins, A., Joseph, D., & Bielaczyc, K. 2004; The Design-based Research Collective 2003). Richey and Klein (2007) define design and development research as "the study of design and development processes as opposed to performing [those processes]," (p. xvi). Such research generates usable knowledge about design and development of innovative learning environments and contextualized applications of theories of learning and teaching. Explications of design and development experiences in the real-world provide lessons-learned regarding instructional design, development, and implementation of learning environments and interventions in education.

Design and development research follows these four steps: (1) analysis of a practical problem by researchers and practitioners; (2) development of solutions with a theoretical framework; (3) evaluation and testing of solutions in practice; and (4) documentation and reflection to inform design and development of instruction in other contexts (Reeves, 2000, p. 25). Goals of design and development research are to generate (a) guidance for both designers and practitioners, and (b) theory that is grounded in practice. Guidance and theory generated from design and development research emerges from long-term collaboration among researchers and practitioners.

The Practical Problem

Harnessing the potential of the Internet requires that current and future generations of scientists, engineers, and educators be trained to design, develop, deploy, and operate medium- to- large-scale networked cyberinfrastructure. The security of our nation's technical infrastructure depends upon individuals and people running businesses, particularly small businesses, coming to understand the cyber landscape and how to protect their investments and assets as managed on computers. Such audiences are spread across America and are served by community colleges that often cannot afford to design or run cyber security programs of their own. America's comprehensive strategy for cyber security requires training individuals and small businesses to secure their own parts of cyberspace, as gaps in the security of one group of cyber participants can be a conduit through which other participants are attacked. In light of this, the need for training individuals who manage small enterprises is particularly acute, as they frequently have the least knowledge of cybersecurity, and thus are among the most vulnerable.

Unfortunately, there is a dearth of instructors with expertise in cybersecurity, particularly in rural parts of our nation. In addition, traditional hands-on laboratories on network equipment are inherently expensive, both in terms of capital outlay for equipment and in terms of labor cost for operations and management. Without expert instructors or laboratory equipment for hands-on learning, students, and subsequently the workforce, are ill prepared to address cybersecurity problems.

The Solution Framed in Distributed Cognitions and Cognitive Flexibilty Theories:

Design of the case-based VNEL is framed by two synergistic learning theories, distributed cognitions theory (Salomon, 1997). and cognitive flexibility theory (Spiro, Fletovich, Jacobson, Coulson, 1991). According to distributed cognitions theory, learning is driven by the wish to solve problems perceived by the learner, and ability to solve problems is achieved through real-world experience. Today's instructional designers advocate for learning environments where instructors require students to engage in performance-based activities such as collaborative

problem-solving (Jonassen, 1997). Distributed cognition is a critical tenet of engaged learning – where a social learning community is energized by learning, by contributing to others' learning, and by personal responsibility for one's own learning and contributions. Engaged learning features tasks that involve active cognitive processes such as creating, problem solving, reasoning, decision-making, and evaluation. Distributed cognitions theory proposes that "knowledge is commonly socially constructed, through collaborative efforts toward shared objectives…" (Pea, 1997). According to the theory, intelligence is not solely an attribute within individuals, but is generated collaboratively in community. Bringing multiple experts into a learning environment distributes expertise among learners. Students seek different forms of support from instructors, their peers, colleagues, and other community members (mentoring, coaching, modeling, mediation) (Fosnot, 1996). Tools in the physical environment serve as mediating structures that shape and direct human activity; and human activity emerges from human need. Resources that shape and enable activity are distributed in configuration across people, environments, and situations so that "intelligence is accomplished rather than possessed" (Pea, 1997).

The fundamental premise in Spiro's cognitive flexibility theory (Spiro, Feltovich, & Coulson, 2004). is that multiple perspectives must be available to learners in a knowledge domain so that learners can flexibly build understanding. Well designed instruction provides conditions that facilitate cognition that is flexible enough to transfer to circumstances other than those the student encounters during instruction. Spiro has shown that a well-designed hypertext environment can facilitate such cognitive flexibility. First, the theory emphasizes the importance of embedding multimodal representations of to-be-learned content in complex, case-based scenarios. Second, it recommends that learning activities provide multiple representations of content in order to support learners as they build mental models. Third, the theory describes ways that hypertext instructional environments avoid oversimplification of content and support context-dependent knowledge. Fourth, cognitive flexibility theory suggests that knowledge sources be highly interconnected rather than compartmentalized.

Cybersecurity content is presented in the VNEL in the format of case-based learning as suggested by cognitive flexibility theory (Spiro, Fletovich, Jacobson, Coulson, 1991; Jonassen, 1997). Case-based learning is widely used in professional education to engage learners with real world situations in order to give to them the expertise required to be successful in the workforce. We chose case-based learning as the instructional approach because novices need to learn how to gain and refine their expertise at solving real-world cybersecurity problems. When cybersecurity students build experience through authentic cases they learn to think like network engineers. In effective learning environments, experience is scaffolded with expert case knowledge. A case serves as a representation of real-world phenomena and is a safe, yet meaningful context in which students can develop understanding of the complexity of network engineering. Jonassen and Hernandez-Serrano (2002) describe the case-based reasoning cycle as the presentation of a new problem-case to solve. Given a case, learners apply previous experiences and general knowledge to solve the case, suggest solutions, test the solutions, revise their suggestions, and confirm solutions. During the cycle, learners retrieve, reuse, revise, and retain understanding until expertise is gained from the problem-case. Expertise is derived from expert scaffolding and experience in the case's content domain; in cybersecurity, such scaffolding and experience are both hard to come by and are impractical for novices.

Based upon the two theories described above, the VNEL system was designed to provide novices with opportunities to gain expertise and cognitive flexibility in cybersecurity from multiple experts through multimodal experience in the context of real-world problems. Such real-world problems are presented to students in sequences of simple scenarios and increasingly complex cybersecurity cases to be solved. Through these scenarios and cases students build mental models that they can draw upon for future problem solving. The VNEL provides for both distributed expertise and hands-on experience with real-world cybersecurity problems making it an ideal environment for testing distributed cognitions and cognitive flexibility theories.

Virtual Network Engineering Laboratory

The technical architecture for the environment is represented in figure 1. The learner can experience the environment autonomously or with the help of an instructor.
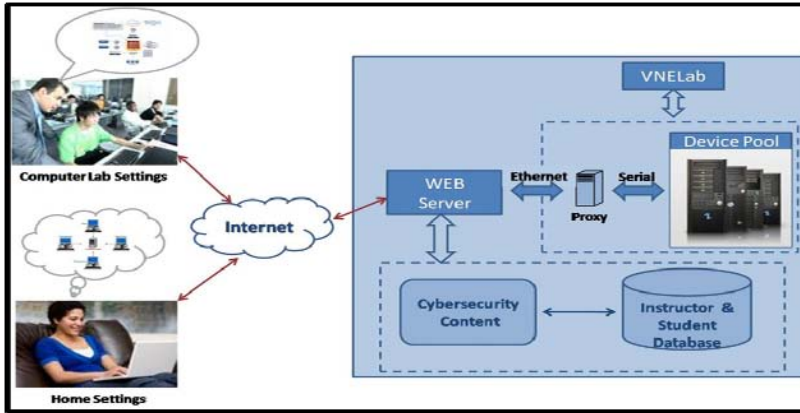
Figure 1. The VNEL environment.

We provide for continuous improvement of VNEL instruction through implementation cycles of development research, evaluation, and revision. Our design and development system for constructing the case-based learning environment involves a cycle of rapid prototyping processes that undergo continuous evaluation by the design and development team and a sample of users. Priorities for topics to be taught in units of instruction are set by the expert faculty in community colleges around the United States. Cognitive task analyses provide the foundation for the scope and sequence of each unit (Jonassen, Tessmer, & Hannum, 1999). Based upon the content described in a given task analysis, cases are developed that include ability to perform all tasks for that topic. To scaffold the ability to solve each cybersecurity case, instruction within each topic is modularized and scenarios that compose the tasks for the larger case are developed for each module. Then exercises including assessments are developed for each scenario.
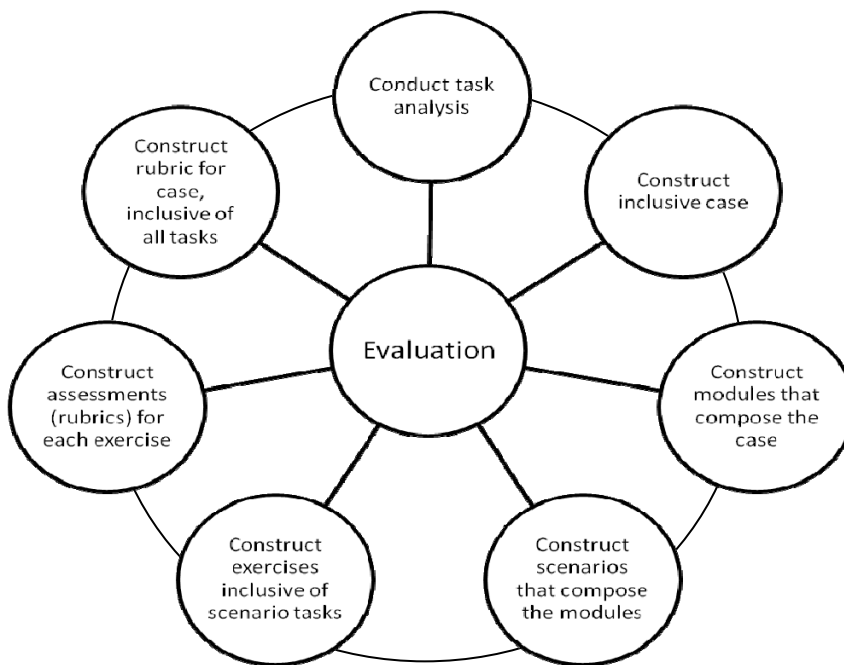
Figure 1. Rapid prototyping process for the solution.

Ability to solve cases for each topic involves a network technician's problem-solving skill within that topic. Each case presents sufficient detail to make the case motivating without causing students to focus on extraneous information. Cases include a main character, events and reactions by the main character, problems to solve in a real-

world context, a description of how to demonstrate that an acceptable resolution to the problem has been achieved, and a call to solve the problem.

In the VNEL, students are initially presented with a unit's case and are told that upon conclusion of the unit they will have the necessary skills to solve it. Each case presents sufficient detail to motivate students without causing them to focus on extraneous information. Cases include a main character, events and the main character's reactions to them, problems to solve in a real-world context, a description of how to demonstrate that an acceptable resolution to the problem has been achieved, and a call to solve the problem. Students then work through a carefully sequenced series of modules. Each module contains multiple scenarios and exercises. Within each exercise are problem statements, described prerequisites, foundational content, supporting documentation to complete exercises, activities, and an assessment. In the current design, activities include performance objectives, directions, the opportunity to submit work, and feedback. Ability to apply the skills taught in each exercise is assessed. Assessment consists of supporting documentation, objectives, directions, student performance in the form of completed templates, questions answered, or command line interface logs. Once students have successfully completed each of the exercises in a unit, they are able to apply the skills learned in order to successfully address the well-structured, complex problem in the initial case. Solving the case is the terminal activity in the unit and currently serves as the students' authentic assessment. Such an assessment is limited to providing evidence of students' abilities to solve a well-structured problem as students have had prior exposure to the case and have been systematically guided to solve that specific problem. However, the current instruction does not prepare students to solve ill-structured cybersecurity problems as those they will encounter in the workforce. By adding an automated ITS to the current VNEL as illustrated below, we hope to prepare students to approach ill-structured problems from a stance of cognitive flexibility and test whether the cyberlearning environment indeed prepares students for ill-structured problem solving. That is, we will ask, do students learn the *process* of solving ill-structured cybersecurity problems in the learning environment by learning how to solve a series of similar structured problems?
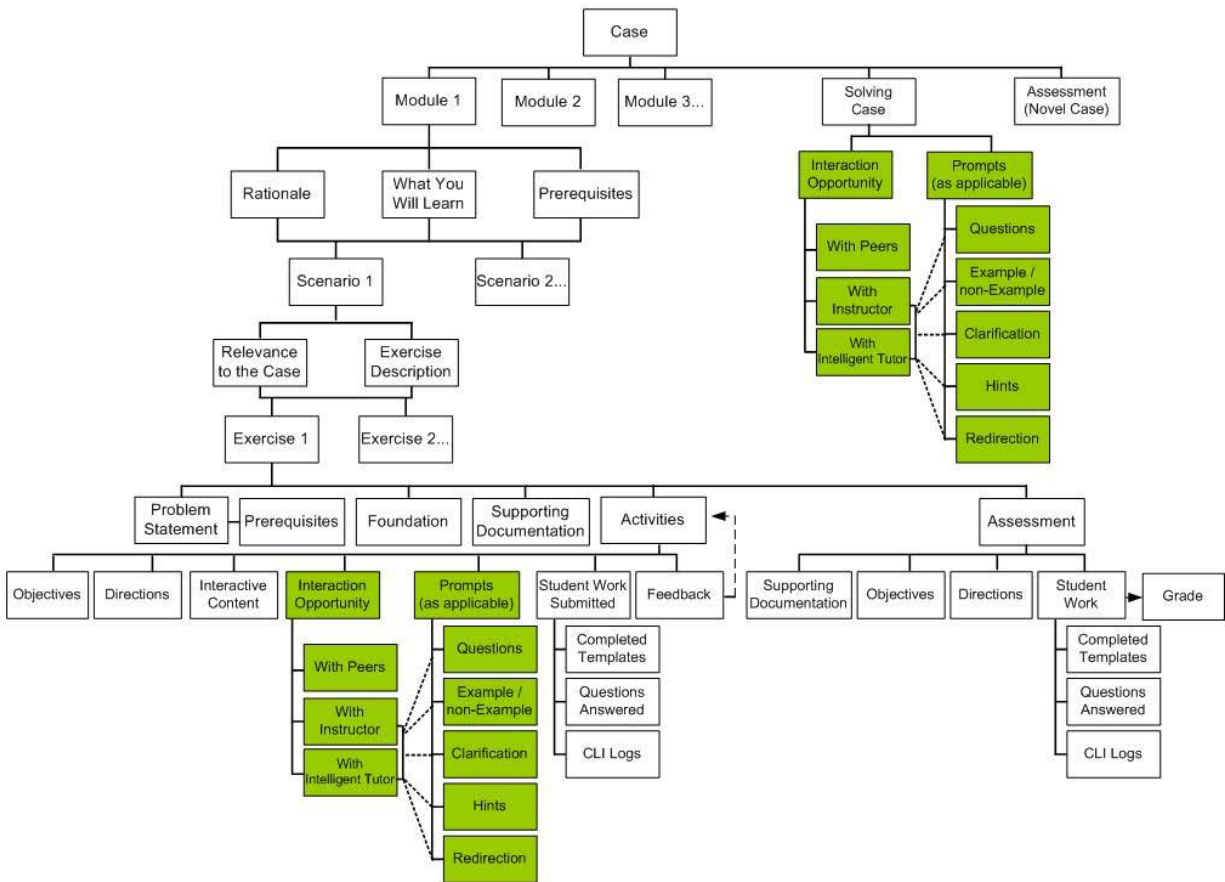
Figure3. Structure and scaffolding in the case-based learning environment with intelligent tutoring system functions highlighted.

The unit on Firewalls serves as an example. In order to address cybersecurity issues with firewalls, network engineers need to be able to align a topology with network policy requirements, restrict access, and configure networks through logging, encryption, and VPN's. The full range of skills required for addressing the complex case are described in Figure 4. Once students have mastered each of the skills, they should be able to address the case.
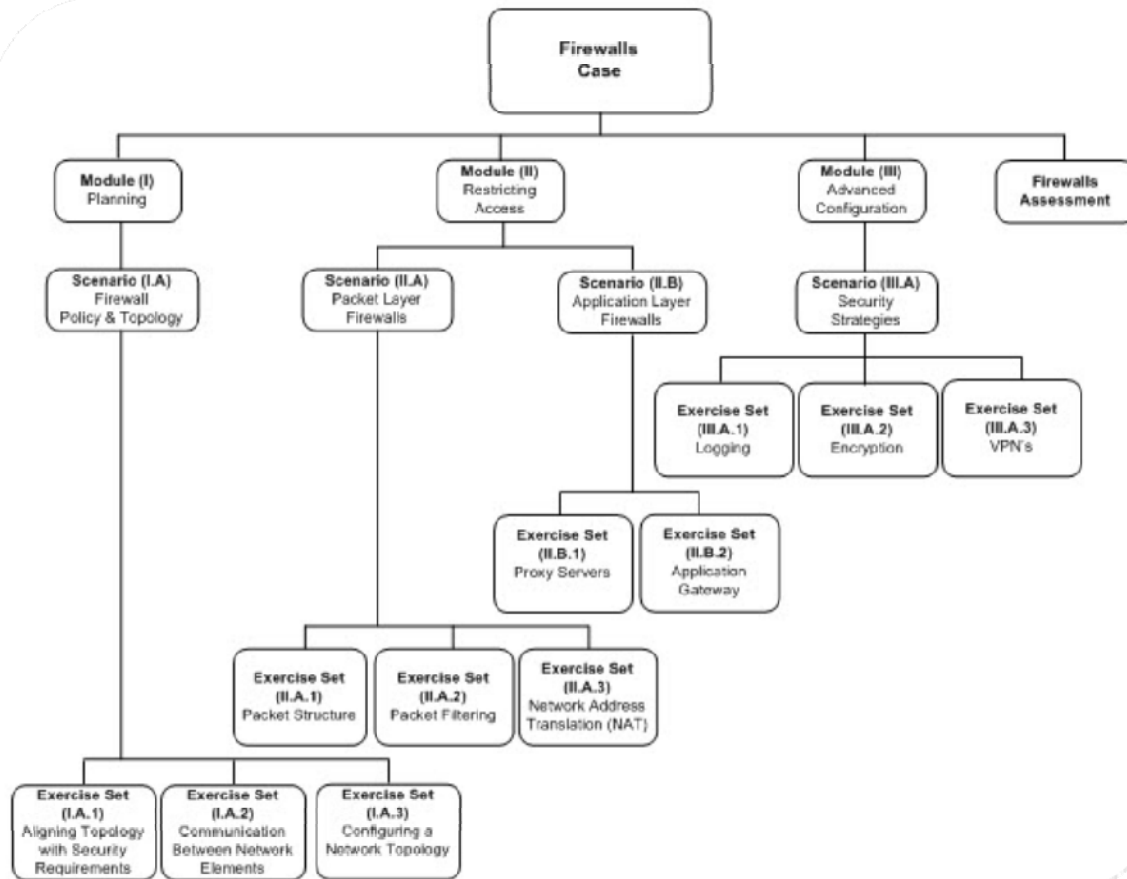
Figure 4. Firewalls unit map.

Evaluation and Testing

The researchers use formative evaluation as the research method, continuously investigating the VNEL in pursuit of establishing design and development theory grounded in experience (Orrill, Hannifin, and Glazer, 2003; Wang & Hannafin, 2005). In design-based research such as this, researchers hybridize instructional design methods with research methods as they investigate their own processes. Each case, module, scenario, and exercise was constructed through a process involving eight iterations with the design team and periodic one-on-one and small group evaluation with the target audience. Field testing is scheduled for Winter of 2010.

Participants

The team of developers includes instructional designers, network engineers, computer scientists, and network engineering instructors who meet and correspond weekly to inform design decisions. One-on-one and small group evaluations were conducted with 11 students at Del Mar Community College in Corpus Christi, Texas. Two of the students were female and nine were male. Two students were White and nine were Hispanic. Field evaluations are scheduled for the upcoming semester.

Data Collection, Documentation, and Analysis

The researchers collected and will continue to collect data from design documentation, pretest and posttest comparisons, usability and attitude surveys, and faculty and student focus groups. We ask questions such as- Is the activity authentic? Is the activity something a network engineer would really encounter on the job? Does the terminology used reflect everyday terminology used by instructors and practitioners alike? Does the activity reflect a competency necessary for understanding and mastering the content? Does the module combine enough or too much information into one exercise? Design documentation involves continuous records of tasks to be done, task due dates, responsible party, and task status. In addition, the lead designers keep journals that include lessons learned during the process. Documentation is constructed weekly. Questions about content, design, technical quality, and attitudes toward the instruction are delivered in multiple usability surveys, and focus groups. The hundreds of inputs from data continuously inform revision of the VNEL.

Results

Preliminary findings indicate that the case-based learning environment provides students with a meaningful learning experience that uniquely prepares them for the workforce. The majority of students were able to describe the problem that was to be solved in the case and in the scenarios. Ninety percent felt that the scenario and case were applicable to something they might encounter in an on-the-job situation. Users were able to pinpoint unclear language for revision and where in the environment they needed more instruction. An important input from users was the need for clear connections between the contents of modules and the ultimate case. Student's responses to a Likert scale survey instrument indicated that most agreed that their experience using the VNEL system was interesting, navigation through the interface was easy to understand and easy to do, and the case-> module->scenario->exercise configuration was easy to follow. Pretests scores reveal the need for instruction that facilitates problem solving rather than learning of discrete skills.

Both instructors and students appreciate the flexibility regarding sequence and participation provided in the environment. Input from instructors indicated the need for an instructors' manual. Instructors also indicated that they may need scaffolding beyond what is currently provided in the environment in order to support students of various abilities. Some students find too much guidance in the environment while others express the need for more. Interdisciplinary team meetings result in strategic improvement of the environment and provide graduate students in both Computer Science and Instructional Design with rich professional experience.

Students reported that they hoped to get a job in network engineering in their futures. Most importantly, the target audience felt that they were provided with useful training to help them get a job in network engineering and that they were doing the real work of a network engineer technician while in the VNEL system.

Our experience suggests that small scenarios scaffold more complex cases, especially when coupled with tutoring strategies such as guiding questions, clarification, hints, examples/nonexamples, and redirection to support students' success and cognitive flexibility.

Educational Implications

The process used for developing the VNEL case-based learning environment illustrates how instructional designers can address societal problems through case-based learning environments. Over the years educational research has been criticized for having little practical relevance. Reeves (2000) calls for socially responsible design and development research that addresses relevant, real-world problems. Our study provides an elaborate illustration of the process for conducting such research in the field of educational technology and instructional design. The product under study, the VNEL, stands as a solution to substantial societal problems of lack of hands-on instruction for training the network engineering workforce.

The study examines implementation of a web-based technology in a real-life context, thereby testing distributed cognitions learning theory. "Research examining the concept of affordances [of technological tools] is critical if we are to build a science of distributed intelligence and a more flexible design orientation to the practices of education" (Pea, 1997, p. 51). Design of the VNEL environment was based on philosophical assumptions of social constructivism and on distributed cognitions theory with the intention of supporting collaborative knowledge

construction among members of a learning community. The qualitative methods used to investigate the overall impact of the website will extend the research on use of technologies to support constructivist learning.

Findings in this study will inform design and support grounded theory for design and development of case-based learning environments. Design-development guidelines generated will be evidence-based and generalizable to other design efforts because they will be based upon reflective process analysis rather than the summative effects of a contextualized intervention. They will be of practical use for developers and could not be generated through traditional experimental research approaches.

Acknowledgments

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A Case for Stealth Educational Games

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Abstract

The purpose of this paper is to make a case for using stealth educational games to increase science self-efficacy. To make the case, the authors describe a theoretical framework to support two common held views: 1) today's students are different from previous generations and 2) educational games are sometimes neither engaging nor educational. The theoretical framework is also used to explain why stealth educational games are a possible solution. The framework includes three theories and one empirical study: attention theory, flow theory, self-efficacy theory, and an implicit learning study.

The theories highlight the relationship between personal experience, attention, self-efficacy, and learning objectives. The theories affirm that recurring experiences influences the development of attention and self-efficacy. The empirical study suggests that experience is also impacted by explicit learning objectives. The relationship between the constructs in the theory suggests that for students with low self-efficacy, sharing objectives may negatively impact their experience. Using attention theory, flow theory, self-efficacy theory, and an implicit learning study, the researchers argue that a stealth educational game will support positive experience that can build science self-efficacy.

Although explicit learning objectives are thought to be core elements of effective instruction, the value of explicit learning objectives has not been supported by research (Morrison, Ross, & Kemp, 2004). Thus, implicit learning objectives may also be a core element of effective instruction. For over 3000 years cultures in the east have used implicit learning objectives to teach history and values while for the past 30 years instructional design practices in the United States have focused on making learning objectives explicit (Marzano, 1998). One of the oldest and most widely read books that utilizes implicit learning objectives, for example, is the Bible.

We advocate the use of implicit learning objectives rather than explicit learning objectives in science educational games to improve science self-efficacy. Traditionally, educational games use explicit learning objectives and focus on educating the player. In contrast, stealth educational games have implicit learning objectives and focus on entertaining the player.

Stealth educational games are defined based on four attributes:
1. Primarily focusing on entertaining the player,
2. Not informing players of learning objectives,
3. Hiding tasks that support the learning objectives in game play, and
4. Requiring players to apply rules in complex multivariate systems.

The first attribute contributes to engaging today's adolescents. The second and third attribute address engagement for unmotivated or struggling students by hiding the educational aspects of the game. The fourth and last attribute four adheres to one of the recommendations of the National Assessment of Educational Progress (NAEP). NAEP urges that science curriculum teach students about complex multivariate systems:

> "Students should be able to identify and define the system boundaries [i.e. know rules], identify the components [i.e. multiple variables], and their interrelationships [e.g. complex relationships], and note the inputs and outputs of the systems [i.e. know and apply rules] (O' Sullivan & Weiss, 1998, p 309)"

In today's era of accountability and standard-based assessment, explicit learning objectives have become commonplace in science curriculums (Scruggs & Mastropieri, 2007). Unfortunately, this approach has not had the anticipated impact (Lee & Wong, 2004). In an effort to improve the impact of explicit learning objectives, some educators began incorporating explicit learning objectives in games, including educational science games. Regrettably, educational games could not and did not tackle the problem. The reason for the mediocre impact has been explained by two common arguments:

1. "Today's students think and process information fundamentally differently from their predecessors (Prensky, 2001, p1)."
2. All too often, educational games are neither entertaining nor educational (Papert, 1998).

Since these two arguments have been firmly acknowledged by numerous experts in the field (e.g. Chen, 2007; Gee, 2003; Prensky, 2001, Van Eck, 2006, Tapscott, 1998), we focus on synthesizing three theories and one empirical study.

We support these two arguments using the selective attention construct from attention theory, flow theory, self-efficacy theory, and an implicit learning study conducted by Berry and Broadbent (1998) (see Figure 1). Selective attention construct describes the relationship between repeated practice and focused attention. Focused attention along with flow (e.g. engagement) and learning objectives influences personal experience. Personal experience, in turn, directly impacts the development of self-efficacy, including science self-efficacy. Results from the implicit learning study suggest that implicit learning objectives, rather than explicit learning objectives, in complex systems help performance.
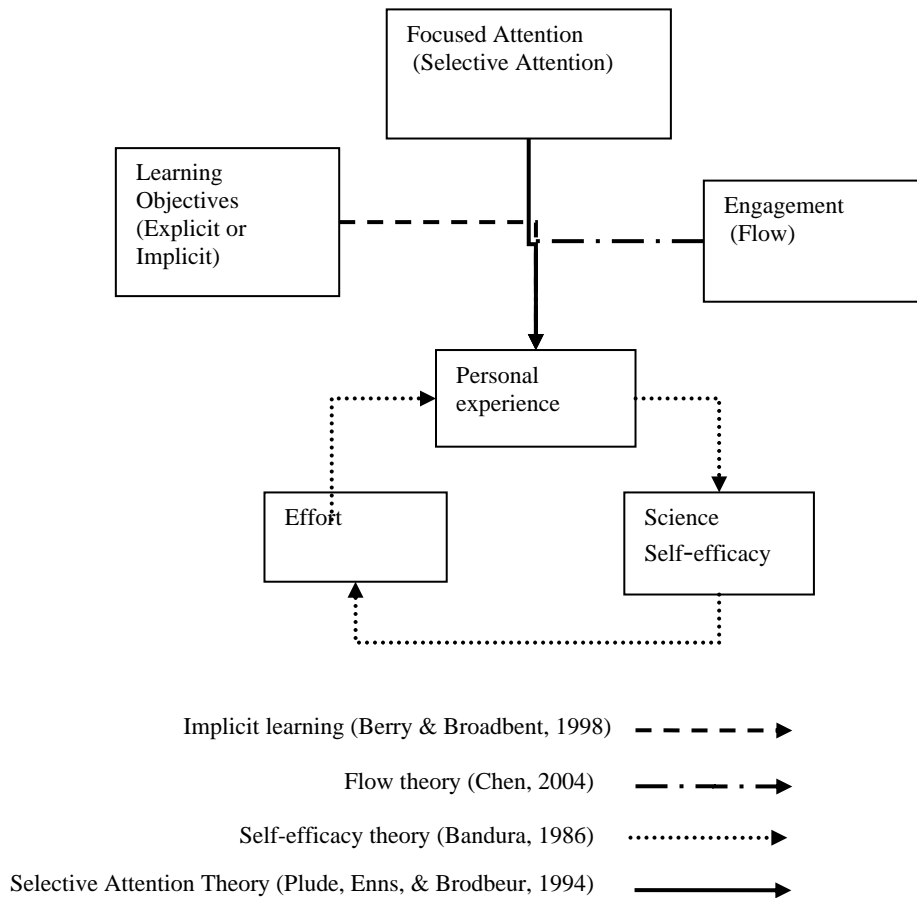
Figure 1. Theoretical Framework

Argument 1

The expectations and skills of this generation are very different from the baby boomers (Prensky, 2001; Tapscott, 1998). During their formative years, digital and interactive technology surrounded today's adolescents. According to A. C. Nielsen ratings in 2006, the average child watched 1,680 minutes of television a week.

"The typical 8-18 year old lives in a home with 3.6 CD or tape players, 3.5 TVs, 3.3 radios, 2.9 VCRs/DVDs players, 2.1 video game consoles, and 1.5 computers according to a 2005 study by the Kaiser Family Foundation. .The Kaiser study found that 64% of young people ages 8-18 have downloaded music from the internet; 66% use instant messaging; 39% have a cell phone; 32% have created a personal website or web page; 18% have an MP3 player; and 13% have a handheld device that connects to the Internet (Macarthur Foundation, 2005, p??)."

Adolescents' digital technology experiences include a significant amount of practice playing video games. In 2005 "about 83 percent of young people between the ages of 8 and 18 play[ed] video games regularly" (Macarthur Foundation, 2005, p. 9). In 2008, ninety-seven percent of adolescents between the ages of 12-17, self-reported that they played computer, web, portable, or console games regularly (Lenhart, et. al, 2008). It is safe to say that video games are a popular past time of adolescents.

Adolescents have repeated practice playing video games. According to attention theory, repeated practice impacts the development of selective attention (Plude, Enns, & Brodbeur, 1994). Selective attention is the process of focusing attention on relevant information and disregarding irrelevant information (Plude, Enns, & Brodeur, 1994). Thus, repeated practice in video games impacts process adolescents use to select relevant information.

Selective attention makes use of characteristics internal and external to the person. Internal characteristics include items such as priorities, values, and goals. External characteristics include items such as color and sound. When playing computer games repeatedly, a person's priorities, values, and goals (e.g. internal characteristics) become associated with the sights, color, and sound (e.g. external characteristics) in computer games. For example, a person who performs well in a computer game may associate confidence, excitement, and competence (e.g. internal characteristics) with vivid color and deafening sound (e.g. external characteristics). As a result, "today's students think and process information fundamentally differently from their predecessors (Prensky, 2001, p1)."

Argument 2

All too often, educational games are neither engaging nor educational (Papert, 1998). An educational game typically does not facilitate flow. Flow describes the situational attributes that lead to
- Feelings of immersion,
- A merging of awareness to current actions,
- A high degree of concentration,
- Self-confidence, and
- Feelings of control (Eccles &Wigfield, 2002).

These five situational attributes influence a player's degree of engagement during an activity, such as playing computer games. Entertainment computer games are purposely designed to facilitate flow. Since adolescents spend a considerably amount of time playing entertainment video games, they expect similar flow experiences when playing educational video games (Prensky, 2005).

Adolescents flow expectations are impacted by their selective attention. As mentioned previously, selective attention refers to the process of selecting relevant information and disregarding irrelevant information, which develops as a result of repeated experiences (Plude, Enns, & Brodbeur, 1994). Through repeated practice in entertainment games adolescents are programmed to automatically focus their attention on game elements that lead to flow (e.g. a feeling of immersion). Because the purpose of educational games is instruction and not facilitating flow, flow is often a secondary goal or a by-product. Educational games that superficially mimic the environment of entertainment games may not facilitate the flow experience adolescents are expecting. Not meeting these expectations leads to educational games that are not engaging to adolescents.

Educational games have not had the anticipated impact on learning (Van Eck, 2006). Educational games are designed by educators or instructional designers. Unfortunately, these professionals are often not familiar with the gaming environment; thus, they do not know how to best use the game elements (e.g. storyline, character development) to support learning (Papert, 1998; Van Eck, 2006). This limited experience is confounded when trying to create educational games to teach science. Science involves applying rules using multiple variables that are interrelated (O' Sullivan & Weiss, 1998). Performance in these complex multivariate systems may be impeded by explicit learning objectives, typically found in educational games (Berry & Broadbent, 1988).

For learners who struggle in science, explicit learning objectives in science may hinder performance. Berry and Broadbent (1988) report that explicit instructions hindered performance in a complex multivariate system. In their study, the complex multivariate system was defined by the relationship between the computer response and

participants; the computer response depended on participant's input in preceding trials. In this complex system of interrelated variables, participants performed better when the instructions and learning objectives were implicit rather than explicit. One explanation for their results can be attributed to the selective attention construct and self-efficacy theory.

Recall that selective attention becomes automatic through repeated practice (Plude, Enns, & Brodeur, 1994). During recurring negative experiences in science class, students may learn to selectively attend to goals, objects, or items not related to science. For example, if a student feels foolish during science class, he or she may focus on entertaining the class instead of the learning objectives. Through repeated practice the struggling student may learn to avoid science. Anything related to science may automatically cause a similar response. This lack of focus will impede performance.

Similarly to selective attention theory, recurring experience also impacts the development of self-efficacy. Self-efficacy is an individual's belief in their ability to accomplish a goal or task in a specific domain or context (e.g. science self-efficacy; Bandura, 1986). Since personal experience is a dominant source of self-efficacy, recurring negative personal experience can create low self-efficacy (Bandura, 1986). For example, students who struggle in science class may develop low science self-efficacy.

There is a circular relationship between personal experience, self-efficacy, and effort (Bandura, 1986; Pajares, 1996). Personal experience directly influences self-efficacy. In turn, self-efficacy is directly related to effort. Low science self-efficacy may create little effort in science activities. The circle is completed by the relationship between effort and personal experience; effort has a direct impact on personal experience. So, little effort may create a negative personal experience. For struggling or unmotivated learners, this circular relationship between personal experience, self-efficacy and effort may reinforce low self-efficacy. This leads one to question how then, can low self-efficacy be improved in struggling or unmotivated learners. The answer lies in the definition of self-efficacy.

According to the definition, self-efficacy is domain and context specific (Bandura, 1986). Domain and context are characterized by attributes of the environment and the activity. If the attributes of the environment or activity triggers low self-efficacy, the process of reinforcing low self-efficacy may began. One way to not trigger low self-efficacy is to put the person in an environment (e.g. video games) that triggers high self-efficacy. Since the goal is to improve low self-efficacy, the environment must also contain attributes that are related to the domain or context in which the person has low self-efficacy. In essence, the true purpose of the activity, for example, improving low science self-efficacy, is hidden from the person by the attributes of the environment. Stealth educational games fulfill this criterion because, similarly to entertainment games, their primary focus is entertaining the player and they also include implicit learning objectives.

Opponents' arguments

Opponents may base their argument on instructional design principles (Smith & Ragan, 2005) or the domain and context specificity of self-efficacy. Instructional design principles propose that making the learning objectives explicit is beneficial because explicit learning objectives prepare the learners to learn. Since self-efficacy is domain and context specificity, opponents may argue that building self-efficacy in a game will not transfer to activities outside the game.

Instructional design principles recommend that after gaining the learners attention, instruction should share the learning objectives (Gagne, 1977; Smith & Ragan, 2005). The argument follow that by sharing the learning objectives, the learner will recall related prior knowledge. Thus, knowing the goal will help structure their learning experience and knowledge (Morrison, Ross, Kemp, 2004). The benefits of explicit learning objectives are only available to motivated or prepared learners. As noted by the Reber (1993), explicit instructions or sharing the learning objectives could have a positive but also could have a negative impact on learners. Learners who are not interested or who struggle with the content may choose to avoid the learning activities or give less effort.

As for the dispute based on self-efficacy theory, most of the self-efficacy research focuses on one dimension of self-efficacy – strength (Cervone, 2000) but Bandura (1977) describes three dimensions of self-efficacy - magnitude, strength, and generality. Magnitude describes the difficulty level of the task. Strength reflects the certainty of the belief. Generality refers to the transferability to other context and tasks. Generalizations in self-efficacy depend on self-knowledge that comes to mind in various situations and settings (Cervone, 2000).

Through repeated practice and practice variability self-efficacy is generalized (Holladay & Quinones, 2003; Pugh & Bergin, 2006). In addition, self-efficacy is increased most significantly by personal experience (Bandura, 1986). By placing the personal experience in a stealth educational game, learners are more likely to play the game repeatedly. By definition stealth educational games include complex systems with interrelationships between

multiple variables, thus, repeatedly playing a stealth educational game provides practice variability. Through repeated practice and practice variability self-efficacy developed in the game should generalize.

Discussions and Implications

The two arguments presented in this paper are primarily learner-centered. A significant portion of today's adolescents developed cognitively in a digital environment. Thus, the way today's adolescents' process information as well as what motivates and engages them is different from previous generations. As a result of these characteristics, the instructional approaches typically used may be contributing to science achievement gap among various ethnicities and socio-economic levels.

For unmotivated and/or struggling students repeated negative experiences in the classroom may reinforce low academic self-efficacy. Self-efficacy is important because it affects goals, interests, and choices, which in turn impacts career paths and opportunities. Without an intervention inside and outside of school these students will have a difficult time changing their path.

Using a stealth educational game to impact academic self-efficacy gives us new avenues for helping unmotivated and/or struggling students. Since stealth educational games include a focus on entertainment, they may appeal to students outside of school. Thus, these games are not just limited to the classrooms; these games may be sold in stores, integrated into youth development programs, or made available on the Internet. They could become a part of adolescents' daily entertainment package. Thus, academic self-efficacy may be increased in a myriad of context.

Conclusions

Instructional design principles suggest that well-designed instruction shares learning objectives with the learners (Smith & Ragan, 2005). Counter to instructional design principles, implicit learning research suggests that explicit learning objectives can also negatively impact performance. Based on the arguments in this paper, the appropriateness of sharing learning objectives may not be clear-cut. Rather, the appropriateness may depend on learner and context analysis.

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When Text Should Be Seen and Not Heard: An Instance of the Reverse Modality Effect in Multimedia Learning

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Abstract

This study examined the extent to which the modality principle of multimedia learning extends to learning from a static diagram and associated hypertext. Participants were randomly assigned to 2 modality conditions (visual text vs. spoken text) and 2 information cueing conditions (cueing vs. no cueing). The results showed a main effect for modality, revealing a reverse modality effect. Participants studying visual text performed better than those studying spoken text on three separate dependant measures. These results provide insight into the boundaries that should be applied to the modality principle.

Theoretical Framework and Hypothesis

The modality principle in multimedia learning has received considerable research support over the last few decades (Ginns, 2005; Mayer, 2001; Sweller, van Merrienboer, & Paas, 1998). This principle states that learning from words and pictures is improved when written or on-screen text is replaced with spoken text. A theoretical rationale for this principle is provided by Baddeley's (1992) model of working memory. According to Baddeley, working memory contains two sub-systems, one for processing visual information and another for processing acoustic information. Presenting textual information visually (as on-screen text) is purported to overload the visual subsystem during multimedia learning due to the need to process both pictorial (e.g., animation) and textual information within the same memory subsystem. However, according to the modality principle, this unimodal presentation format can be improved by employing a bimodal format, wherein textual information is presented auditorily and pictorial information is presented visually. This presentation format is purported to reduce cognitive load by using the total capacity of working memory more efficiently (Tabbers, Martens, & van Merrienboer, 2004). The modality principle has been linked to reduced mental effort and study time during instruction and to improved performance on retention, transfer, and matching tests (Tabbers et al., 2004).

Notwithstanding the research support for the modality principle, recent research has shown that the principle may not apply to all multimedia learning situations. For example, Tabbers et al. (2004) found that a visual presentation of text was superior to a spoken presentation when learners were given control over the pacing of the instruction. In another study, Wouters, Paas, & van Merrienboer (2009) found that when learners were prompted to study visual text they performed better on a transfer test than when they received no prompts, suggesting that learner inattention to visual text may be an important factor in prior studies of the modality principle. There is also evidence that visual text may be superior to spoken text if the subject matter pertains to learning spatial relations (Penny, 1989).

In the current study we examined the generalizability of the modality principle to an instructional situation that prior research suggests may be conducive to a *reverse* modality effect. That is, where on-screen text is superior to spoken text. To create this situation the following elements were incorporated into the treatment materials: 1) learner control of instructional content, 2) a learning task with a significant spatial component, and 3) information cueing to draw attention to specific features within the learning materials. This is the first time these three elements have been explored together in the context of studying the modality principle. Our hypothesis was that learners studying on-screen text would outperform those studying spoken text due to the presence of learning conditions favorable to a reverse modality effect in multimedia learning.

This study investigated the effects of modality and information cueing on learning from a computer-based diagram and related text. Modality (visual text vs. spoken text) and information cueing (cueing vs. no cueing), see Figure 1, were examined between subjects to form a 2 X 2 factorial design. One hundred and fifty-two students from a large southwestern university were randomly assigned to one of the four experimental conditions. The dependant measures consisted of a matching test, a comprehension test, and a diagram reconstruction test. All dependant measures were delivered via computer. Students received credit toward their final course grade for participation.

		Modality	
		Visual text	Spoken text
Information cueing	Cueing		
	No cueing		

Figure 1. Four different instructional units in terms of modality and information cueing

The matching test consisted of a listing of the 12 places of articulation (e.g. Dental) and a corresponding listing of the sounds made at each place (e.g., "th" as in *thunder*), plus three distracters. The participants were required to match each place with its corresponding sound. The comprehension test was a 12-item instrument designed to measure student comprehension of the computer program. Finally, the reconstruction test presented each participant with a blank outline of the Places of Articulation diagram and a listing of the 12 places of articulation next to the diagram. Each participant was required to drag the name of each place to its correct location on the diagram.
The experimental materials consisted of a computer-presented diagram depicting 12 places of articulation in human speech with a corresponding 324 word expository text. The text contained 12 sentences with each sentence hyperlinked to a specific place of articulation on the diagram. The participants accessed the text by selecting a place of articulation on the diagram with a computer mouse. In the visual text condition each sentence was presented as on-screen text; in the spoken-text condition the text was presented as narration (i.e., spoken text). In the cueing condition an animated pointer directed the participants' attention to a selected place of articulation; In the no-cueing condition there was no pointer. The participants had complete control over the pace and sequence with which they selected the hyperlinked text.

Students participated in the experiment in a computer lab with 15 to 18 participants in each experimental session. They were instructed to study the diagram and the related text for 10 minutes. After 10 minutes of study and a one minute rest period, the participants were given the matching, comprehension, and reconstruction measures.

Results and Conclusions

ANOVA revealed main effects on the modality variable for matching $F(1,151) = 6.10$, $p < .05$, comprehension $F(1,151) = 6.63$, $p < .05$, and reconstruction test performance $F(1,151) = 7.30$, $p < .01$. The means for visual text were higher than the means for spoken text on all three dependant measures. No main effects were observed on the cueing variable, and there was no modality by cueing interaction effect. In summary, we observed a reverse modality effect for all dependant measures, as hypothesized.

The results of this study support the hypothesis that modality effects are not likely to occur with diagrams and text when learners have control over the pacing and sequence of their study and spatial learning is an important instructional outcome. In fact, we observed a reverse modality effect favoring on-screen text over spoken text. Since cueing was not a significant factor in this study we cannot attribute the reverse modality effect to increased attention to the written text (Wouters et al., 2009). Rather, the best explanation appears to be that user control and spatial learning are conditions favorable to learning from on-screen text. These results will guide practitioners during the design and development of multimedia materials and to theorists as they seek to clarify the boundaries of the modality effect in multimedia learning.

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To Friend or Not to Friend: Academic Interaction on Facebook

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The popularity of Online Social-Networking Websites (OSNW) such as *MySpace.com* and *Facebook.com* has grown considerably throughout recent years (Gosling, Gaddis & Vazire, 2007). The use of Internet-based medians such as blogs, personal websites, and virtual communities by college students have continued to increase in recent years and have impacted how these students communicate with each other in both online and offline contexts (Pempek, Yermolayeva and Calvert, 2009). Recent high school graduates spent a substantial time of their development in the digital age and have been labeled "digital natives" because of the ease in which they operate in these virtual worlds and formats (Prensky, 2001).

Sites such as *Facebook* and *MySpace* are accessible to most internet users and anyone with an email address. Users can provide information through creating a 'profile' with the intent of communication with others, meeting new friends and connecting with old friends. In addition to connecting to friends, dating use, career searches, feedback and blogging, users post self-descriptive information.

Facebook is merely four years old, but already boasts of "More than 68 million active users" and "An average of 250,000 new registrations per day since Jan. 2007", (*Facebook*.com website, 2008). We chose *Facebook* due to its organizational structure. Website users designate themselves with a university affiliation along with other personal information such as gender, musical tastes, courses taken, education background, etc. *Facebook* users can also post picture albums that can be shared with other users who are considered 'friends'.

This study examines *Facebook* usage and how students use *it* to engage in the academic realm, including student perceptions of faculty as friends. As OSNWs continue to thrive in today's environment, faculty are increasingly implementing them in the classroom. Some feel this is an invasion of the students' privacy, and have labeled this as a "creepy treehouse" practice (Abel, 2005; Stein, 2008). On the other hand, others feel that it is an intelligent use of current technologies in the classroom. Since classroom community has substantial impact on the overall collegiate experience, more needs to be learned about this virtual community that serves as an undercurrent communication channel that binds students and faculty. Coupled with student usage of *Facebook* (i.e. hours spend, number of friends, number of groups subscribed to, etc.), is there any relationship between faculty interaction and academic benchmarks such as cumulative GPA?

Literature Review

The popularity of OSNWs such as *MySpace* and *Facebook* has grown considerably in recent years (Gosling, Gaddis & Vazire, 2007). However, any social environment involves personal disclosure, leading to issues of privacy (Acquisti and Gross, 2005; Gemmill and Peterson, 2006; Gross, Acquisti & Heinz, 2005; Kolek & Saunders, 2008; Patil & Kosba, 2005; Tufekci, 2009). As the Pennsylvania State example illustrates, privacy issues persist on OSNWs. Patil and Kobsa (2005) studied the use of privacy controls within awareness systems, and establish that the use of privacy controls in technology is dependent on the knowledge of security features, and the technology itself. Users of *MySpace* were presented security concerns and chose not to enable more privacy settings.

But what do people disclose on ONSWs? Gross, Acquisti and Heinz (2005) examined 4,540 *Facebook* users for the type and amount of information disclosed and found that an overwhelming majority of profiles provide full access, associating the person with their first and last name, picture, birthday, and hometown. More than half provided their current residence. The majority of users provide fully identifiable information although the sites do not require disclosure. The study concluded that few users change the privacy settings and seem willing to provide personal information to the public. Kolek and Saunders (2008) also found that a great number of students in their quantitative study disclosed substantial information on their account profiles such as contact information, academic schedules and personal pictures of alcohol consumption. Given the low-privacy settings, high personal disclosure, and college-age participants show very little concern over privacy issues in ONSWs (Acquisti and Gross, 2005; Gemmill and Peterson, 2006; Gross, Acquisti & Heinz, 2005; Kolek & Saunders, 2008; Patil & Kosba, 2005; Tufekci, 2009).

Gemmill and Peterson (2006) surveyed student's technology use behavior and habits. Information was gathered regarding the use of email, instant message services, internet for academic and leisure, cell phone use and land-line phone use. The study found that college students obtain social support via cell phones and instant message and the use of technology is likely to increase with the advent of social networking technology. The study concluded that technology use surveyed was highest among freshman and lowest in seniors and in order to avoid academic side effects, users need to address the role of technology within their academic progress.

The world of ONSWs also may have ramifications on the student-teacher relationship both in and outside the classroom, given that ONSWs provides a virtual realm in addition to the pre-existing physical one (Li & Pitts, 2009). Previous research provides some insight into non-academic social exchanges between college teachers and students, finding that academic performance increases with informal interactions (Pascarella and Terenzini, 2005).

The amount of time that undergraduate students invest in OSNWs varies, but studies conclude that *Facebook* is fully integrated in the lives of most undergraduate students. Pempek, Yermolayeva and Calvert (2009) found that undergraduate students invest approximately 30 minutes daily (27.93 on weekdays, 28.44 minutes on weekend days) on *Facebook*, adding this task to their daily routine.

And the time that is invested may not be devoted to academic enhancement. In other words, medians like *Facebook* and other OSNWs are used more for socializing rather than academic usage (Madge, Meek, Wellens & Hooley, 2009). Madge, et al. (2009) surveyed British undergraduates and found that undergraduates were uneasy with academic utilitization of ONSWs.

> There were several activities that the majority of students did *not* use *Facebook* for, such as checking out the profile of a member of university staff (68% said they had never done this). *Facebook* is therefore currently used by students for communicating with other students, not with university staff…Moreover, when respondents were asked if there were any ways they thought *Facebook* could be utilised to enhance teaching and learning at the University, 43% responded negatively, explaining that *Facebook* was a SNS [Social Network Sites], not a tool for academic work (p. 149).

So what are the academic costs of spending a substantial amount of time on ONSWs? To date, research on the academic implementation of *Facebook* or other ONSWs has been limited.

With the seeming ubiquity of *Facebook* and other ONSWs, researchers are beginning to note the viability of their use in the academic arena. An article in *Educause* (2006) suggested, "Any technology that is able to captivate so many students for so much time not only carries implications for how those students view the world but also offers an opportunity for educators to understand the elements of social networking that students find so compelling and to incorporate those elements into teaching and learning." Along the same lines, Cloete, de Villiers, and Roodt (2009) found that most faculty members have not implemented an ONSW as an academic tool, but at the same time, most felt like one could be applied as a tool for academic learning.

One of the biggest concerns in implementing *Facebook* into the classroom is student privacy. Many of the studies about taking the faculty/student relationship online have focused on this specific student concern (Ellison, Steinfield, & Lampe, 2007; Hewitt & Forte, 2006; Mack, Behler, Roberts, & Rimland, 2007). Some students are worried that faculty might form opinions about them based on their online accounts (Abel, 2005). However, students, when presented with the option did find a beneficial reason to use *Facebook* with faculty. Mazer, Murphy, and Simonds (2007) found that if faculty members have *Facebook* accounts, students are likely to base decisions on whether or not to take a class from someone can be affected by the amount of information disclosed online by the faculty member.

Another area potentially affected by implementing faculty *Facebook* usage in the classroom is faculty/student communication. Sturgeon and Walker (2009) found that students seem to be more willing to communicate with their instructors if they already knew them through *Facebook*. Hewitt and Forte (2006) similarly found that students liked the potential to get to know their professors better, and that Facebook interaction had a positive impact on how they perceived their professors. Additionally, Haspels (2008) found that faculty *Facebook* usage also had a positive effect on the face-to-face faculty/student relationship.

But most importantly, does a faculty/student relationship in *Facebook* have an effect on student performance? Studies have found differing results. Yang and Tang (2003) found that those networks which "consist of relations through which individuals share resources such as information, assistance, and guidance" (p. 96) are "positively related to student performance" (p. 93) both in face to face and online settings. Sturgeon and Walker (2009) found what they termed an "indirect connection between faculty use of Facebook and academic performance" (p. 11). Their findings postulate that because of an increase in faculty/student familiarity, students feel more comfortable and therefore, are able to learn better. However, a preliminary study by Karpinski and Duberstein (2009) showed that students who self-reported spending more time on *Facebook* had lower GPAs than those who spent less time there.

Methods

We constructed a survey instrument to ascertain the behavior, attitudes about and *Facebook* usage as a mechanism to develop a sense of community. Regarding the voyeuristic nature of *Facebook*, we also included questions over account disclosure and privacy concerns. Our 45-question instrument covered a variety of issues such as privacy issues, faculty interaction on *Facebook* and social interaction tendencies (see Appendix A). In addition, a series of questions are included to assess demographics of the students, which also serve as independent variables.

We hypothesize that students with professors or instructors have a higher self-reported GPA than those who have none listed as friends. In other words, our hypothesis is:

$$\mu_{not\_friend} - \mu_{prof-friend} > 0$$

In addition to using descriptive statistics, we analyzed the collected data using T-tests to examine whether any differential between those students who had faculty as a *Facebook* friend and those who did not was statistically significant. In addition to collecting demographic information (i.e., age, gender, ethnic background, selected major, classification, etc.) and selected questions about *Facebook* usage and privacy issues, we asked the respondents how many faculty members they friended on *Facebook*. We coded those who had one or more faculty members as *Facebook* friends as "1" and those who had none as "0".

The institution used in this study is a research university in the central US that serves a student population over 20,000 at its flagship campus. The campus houses approximately 5,900 students: 4,400 of which reside in single student housing and the remaining 1,400 students live in family housing. Our sample is drawn from *Facebook* users residing in on-campus single student housing. A screening question regarding if the student has a *Facebook* account was used to screen out all students who do not have a *Facebook* account. These students were told to skip to the end of the survey and not answer any further questions.

Since this study examines online behavior and interaction, we used Microsoft SharePoint to disseminate the survey to residential life students on December 2008. Data collection continued for three weeks. In light of the recommendations of Dillman (2007), we contacted the participants three times throughout the data collection process. The first contact will occurred at the invitation to participate in the study, and reminder emails were

disseminated a week apart afterwards. There were no incentives given to participate in the study. We received a 13 percent response rate to our online survey that was disseminated in the Fall of 2008 to 5,013 residential life students.

Descriptive Statistics

Of the respondents, 49 percent self-reported themselves as freshman, 22 percent as sophomores, 15 percent were juniors, 9 percent as seniors and 8 percent were graduate students. Females constituted the majority of the respondents, 64 percent while 36 percent were males. When looking at ethic backgrounds, 77 percent of the participants were White, 7 percent were American Indians, 6 percent were Hispanic, 6 percent were Asian and 4 percent was were of African American descent.

In regards to community, first, we found that 72 percent of the respondents were active in some student organization while 28 percent reported no affiliation. Of the respondents, 86 students belonged to a Greek organization while 485 students did not. Within the organization community, students are using *Facebook* groups as a viable means of communication. Forty-two percent of respondents use *Facebook* groups to contact organization members, 41 percent by email while 11 percent use phone. The popularity of email among respondents also aligns with recent findings (Boase, et al., 2006, Boase & Wellman & Gulia, 2006; Haythornwaite, 2001; Stern & Dillman, 2006), but *Facebook* is at the very least on par with e-mail as a communication option among students.

As for social community participation, a sizeable majority of survey respondents, 84.4 percent, reported to have more than 100 *Facebook* friends while 66.4 percent disclosed that they have more than 200 *Facebook* friends. Clearly, *Facebook* is an avenue for social community development. At the same time, *Facebook* usage is not merely social. It is also being used to support an academic community.

Thirty percent of respondents reported having a faculty member as a friend on *Facebook*. We also asked about the effect of *Facebook* on professor selection. While 56 percent of respondents reported that they would be more apt to take a professor if they liked his/her profile, 53 percent reported that they would be more apt not to take a professor if they disliked his/her profile. Within the academic community, 88 percent of respondents used email as a primary means to contact their instructor and 12 percent use office hours as a secondary method. This is not surprising when considering email communication increases as one's social ties increase and email's asynchronous and convenient nature (Boase, et al., 2006). For the professor, his/her own social ties increase according to the number of students in a given class. When asked about the secondary method of contacting their instructor or professor, 78 percent of respondents preferred office hours, 14 percent listed email, 6 percent voicemail and 2 percent listed *Facebook* as a means of communication.

The survey instrument also inquired about issues of privacy and disclosure that painted a very interesting picture on *Facebook* usage. When asked whether their *Facebook* profile privacy, 74 percent of respondents disclosed that their profiles were private while 26 admitted that their profile was open. In addition, 70 percent reported that they post no residence information on their *Facebook* profile while 22 percent list their residence halls and 9 percent post both their residence hall information and room number. Respondents were less restrictive on access to their photos. Surprisingly, 55 percent of respondents disclosed that they make their photos available to their entire network while 45 percent did not. However, most of the respondents have taken action to restrict access to their profiles. When asked whether they have blocked anyone (i.e., blocked their profile access to a particular person or people) on *Facebook,* 47 percent responded affirmatively while 53 percent have not. Sixty percent of survey respondents reported that they have limited access to certain individuals to their profile (i.e., allowed general access, but limited access to photos, information, etc.) while 40 percent have not. And lastly and most disturbing, a large percentage of respondents (47 percent) have *friended* people on their *Facebook* profile who they do not know.

Analysis

When analyzing the data, we found that those students who had professors as *Facebook* friends had a higher self-reported GPA than those who did not. Those with professor or instructors as friends as a GPA of 3.42 as compared to those who did not with a GPA of 3.33.

Table 1: Descriptive Statistics

	N	Mean cumulative GPA	Standard deviation	Standard Error
Professor Not Friend	349	3.33	.58	.03
Professor as Friend	179	3.42	.51	.39

Although outside of the purview of this study, we additionally tested various variables to see whether there was a correlation with their online activities (i.e., number of self-reported hours spent on *Facebook,* number of self-reported *Facebook* friends and number of self-reported *Facebook* groups joined) and their self-reported GPA. However, after conducting T-tests, none of the relationships had any statistical significance. However, when testing our hypothesis, we found that the difference of self-reported GPA between those students who had *friended* an instructor (GPA = 3.42) compared to those who did not (GPA = 3.33) was statistically significant at the .05 level.

Table 2: T-test analysis for cumulative GPA between Two groups of students

Variance	T	Df	Significance
Unequal	1.965	387	.05

Therefore, our analysis reveals that those students who have friended one or more faculty members are more likely to have a higher self-reported GPA than those who have no faculty members listed as friends on *Facebook.* In the next section of our paper, we will discuss the significances of this finding and the results of our descriptive statistics.

Discussion

The discussion of our results is organized into three different sections that paints a rich picture of *Facebook* student usage, disclosure, privacy and faculty/staff interaction. First, we discuss the descriptive findings that involve privacy issues on *Facebook,* discussing some key issues. Second, the findings involving faculty interaction are also discussed through descriptive statistics and the ANOVA model of our student. Lastly, we provide policy implications and a conclusion at the end of this paper.

Facebook Usage and Privacy

Two observations stand out after examining the survey results, both having a relationship with *Facebook* usage and privacy concerns. First, in terms of privacy, there remain a large percentage of students who maintain their profile to be open to the public at 26 percent. Although some studies have lamented over the reasons for this disclosure needs, other studies have concluded that students simply do little to protect their own disclosures in ONSWs (Acquisti and Gross, 2005; Gemmill and Peterson, 2006; Gross, Acquisti & Heinz, 2005; Kolek & Saunders, 2008; Patil & Kosba, 2005; Tufekci, 2009).

However, the survey results may deviate from the literature. Selywn (2009) found that *Facebook* serves as a supplement to pre-existing relationships and student typically do not use it to make friends who they may not have met in person. However, the results of our survey are mixed. Nearly half of those surveyed conceded that they have *Facebook* friends who they have never met which conflicts with Selywn article and raises serious safety concerns. However, they generally do not use *Facebook* to make personal connections on a college campus before enrolling. However, when asked whether those surveyed sought *Facebook* friends at the university before they arrived on campus, only 34 percent admitted so. One explanation could be that students may accumulate unmeet *Facebook* friends through other friends, but not purposely to pre-establish a social network on campus prior to arriving.

Faculty/student interaction

With an OSNW that relies on college populations as consumers, it is not surprising that there is faculty and student interaction on *Facebook.* The connection between faculty and student interaction appears to have positive benefits. First, students could benefit from the interaction that comes with communication on *Facebook.* Research has shown that general interaction between faculty and students increase academic performance (Kuh, Cruce, Shoup, Kinzie & Gonyea, 2008; Carini, Kuh & Klein, 2006; Pascarella & Terenzini, 2005; Kuh, 2001). While most of the literature examines general faculty and student interaction (Carini, Kuh & Klein, 2006; Kuh, 2001), there is some evidence that suggests even informal student interaction provides students with some positive benefit whether it be higher student satisfaction (Kuh & Hu, 2001) or higher educational aspirations or even academic performance (Pascarella, 1980; Pascarella & Terenzini, 2005). Perhaps the same can be said about interaction on OSNWs. Second and more cynically, professors and instructors may be more apt to *friend* academically talented or students who perform better in their class as oppose to students who do poorly in class. On the other hand, higher performing students may feel more comfortable with friending a faculty member than low-performing students. To further investigate these ONSW interactions, future research can examine as to who extends friend invitations and why faculty *friend* some students and not others.

Implications

However, our findings do not suggest that faculty and staff should use *Facebook* as a mechanism for enhancing academic performance or student satisfaction. The literature and the descriptive statistics from this survey recommend otherwise. First, when contacting their instructors or professors, students opt to communicate through email then office hours. *Facebook* and voice mail are distant thirds and fourths. In addition, only a minority of 30 percent has a professor or instructor listed as a friend. The literature aligns with this finding and suggests that students see OSNWs more for socializing rather than for academic usage (Connell 2009; Madge, Meek, Wellens & Hooley, 2009). In examining whether *Facebook* would be proper median for outreach, Connell (2009) found that a good number of students were not favorable to be *friended* by the library, possibly seeing it as an intrusion into their realm.

> Some participants (63 or 17.2 percent) were very open to the idea and said that they would be proactive and invite the library to be their friends if they know about the account. The majority of respondents (211 or 57.5 percent) said that they would not be proactive about it, but if the library friended them, they would accept the friend invitation. Another group of 92 students (25.1 percent) said that they would not add the library as a friend. (p. 31).

This study only illustrates that a relationship does exist between self-reported GPA and *Facebook* friend status with a student. There is certainly no evidence to suggest that faculty should use their *Facebook* account for improved academic performance. Such a proactive approach would likely be met by disappointing results by encroaching on perceived social space. Instead, if faculty were inclined to open their *Facebook* account to students, promoting its availability as a median of communication may be a wiser choice rather than sending invitations to enroll. When examining library outreach efforts through *Facebook,* Connell (2009) warned:

> Therefore, perhaps indiscriminate friending is not a good idea. It is important not to annoy students but rather let them come to the library on their own terms (p. 34).

In all, we must be cognizant that *Facebook* is in fact the realm of the digital native, and students may view any unilateral outreach by faculty or staff as encroachment on their turf and instigate a 'creepy treehouse' effect.

Conclusion

Student usage of OSNWs is nothing short is prolific and information from the literature, as well as anecdotal evidence, shows that this trend will most certainly continue. Students will continue to utilize web-based social networking as an online communication forum, but mostly for informal, social interaction with other students. Those few students who have professors or instructors as friends have been found to have higher self-reported GPAs compared to those who don't. Although this relationship was found, much more can be learned about OSNWs, college life and the faculty-student relationship. By conducting this study, the authors sought to shed more light in how OSNWs intercross with the academic realm.

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Appendix A

1. Do you live on campus?
   a. Yes
   b. No

2. Estimate your family income:
   a. $20,000 or less
   b. $20,001 to $50,000
   c. $50,001 to $100,000
   d. $100,001 or more

3. What types of financial aid do you receive? (pick all that apply):
   a. Stafford
   b. Pell
   c. OHLAP
   d. Private loans
   e. Other state grant
   f. Etc.

4. What best describes your ethnic/racial background?
   a. American Indian or Alaska Native
   b. Asian
   c. Black or African American
   d. Native Hawaiian or Other Pacific Islander
   e. White
   f. Hispanic or Latino

5. Which of the following online social network websites do you use the most?
   a. Facebook
   b. MySpace
   c. Friendster
   d. Ball of Dirt
   e. Other

6. What is your gender?
   a. Male
   b. Female

7. What is your cumulative GPA in college on a 4.0 scale? ____

8. Are you a member of Greek organization?
   a. Yes
   b. No

9. Do you live in Greek housing?
   a. Yes
   b. No

10. Are you a member of a non-Greek student organization?
    a. Yes
    b. No

11. What is your age?
    a. 17-18
    b. 19-20
    c. 21-25
    d. 26 or older

12. What best describes your major?
    a. Education
    b. Humanities
    c. Engineering
    d. Social science
    e. Health/medical
    f. Other

13. What is your classification?
    a. Freshman
    b. Sophomore
    c. Junior
    d. Senior
    e. Graduate student

14. What best describes your political orientation
    a. Very conservative
    b. Conservative
    c. Moderate
    d. Liberal
    e. Very Liberal
    f. Apathetic

15. What is your primary method of contacting your instructor or professor?
    a. By email
    b. By voicemail
    c. By Facebook
    d. By office hours

16. What is your secondary method of contacting your instructor or professor?
    a. By email
    b. By voicemail
    c. By Facebook
    d. By office hours

17. How do you communicate with members of student organization to which you belong?
    a. By email
    b. By Facebook groups
    c. By phone
    d. By flyer
    e. By Other means

18. If you have a Facebook account, how many friends have you added on Facebook? _____

19. What is your primary method of contacting your resident assistant?
    a. By email
    b. By voicemail
    c. By Facebook
    d. By office hours
    e. By instant messaging
    f. By text messaging

20. What is your secondary method of contacting your resident assistant?
    a. By email
    b. By voicemail
    c. By Facebook
    d. By office hours
    e. By instant messaging
    f. By text messaging

Please answer the following questions if you have a Facebook account
21. What residence information do you post on Facebook?
    a. I post no information
    b. Residence hall
    c. Residence hall and room number

22. Do you make your photos public to everyone in your network?
    a. Yes
    b. No

23. How many professors or instructors do you have listed as a friend? _____

24. Do you have your resident assistant, community facilitator or community mentor listed as a friend?
    a. Yes
    b. No

25. Which of these do you feel comfortable posting on Facebook (if you have open access to your pictures)?
    a. Pictures of yourself
    b. Pictures of parties
    c. Pictures of family
    d. Pictures of friends
    e. Pictures of vacation
    f. No open access

26. Is your Facebook profile private?
    a. Yes
    b. No

27. Have you created a group?
    a. Yes
    b. No

28. How many Facebook groups are you a member of? _____

29. Mark as many as apply: how active are you in these groups on Facebook?
    a. Read messages only
    b. Read and post messages
    c. Look at pictures
    d. Post pictures
    e. An administrator of a group

30. Is your mini-feed public or private?
    a. Private
    b. Public

31. Have you blocked anybody?
    a. Yes
    b. No

32. Have you limited anybody's access of your profile on Facebook?
    a. Yes
    b. No

33. How much do you agree with the following statement: Students would be more academically engaged if their professors were on Facebook?
    a. Strongly agree
    b. Somewhat agree
    c. Somewhat disagree
    d. Strongly disagree

34. How many times do you log into Facebook per week on average? _____

35. How many hours do you spend on Facebook per week? _____

36. What best describes your motivation for participating on Facebook (check all that apply):
    a. Making and maintaining college friendships
    b. Maintaining high school friendships
    c. Dating
    d. Random

37. Do you have people listed as friends that you don't know?
    a. Yes
    b. No

38. Would you be more apt to take a professor if you saw their Facebook profile?
    a. Yes
    b. No

39. Would you be more apt not to take a professor if you disliked their Facebook profile?
    a. Yes
    b. No

40. Would you be more apt to take a professor if you liked their Facebook profile?
    a. Yes
    b. No

41. Do you agree or disagree with the following statement: It is appropriate for a staff member to use Facebook to check on the well-being of a student.
    a. Strongly agree
    b. Somewhat agree
    c. Somewhat disagree
    d. Strongly disagree

42. Do you agree or disagree with the following statement: It is appropriate for a staff member to use Facebook for university policy reinforcement.
    a. Strongly agree
    b. Somewhat agree
    c. Somewhat disagree
    d. Strongly disagree

43. Do you agree or disagree with the following statement: I feel connected to campus through Facebook.
    a. Strongly agree
    b. Somewhat agree
    c. Somewhat disagree
    d. Strongly disagree

44. Do you agree or disagree with the following statement: I feel that there is a genuine campus community on Facebook.
    a. Strongly agree
    b. Somewhat agree
    c. Somewhat disagree
    d. Strongly disagree

45. Did you seek Facebook friends at the university before you arrived on campus as a student?
    a. Yes
    b. No

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Integrative and Interdisciplinary Approach to Designing an Educational Technology Graduate Program

Authors: Michele Estes, Karen Kellison, Diane Wilcox

Introduction

Faculty at a Master degree granting institution in the Southern United States are in the process of creating systemic and collaborative change as they revise and expand an existing Educational Technology program that awards the Master of Education degree (M.Ed.). In addition to typical efforts required to generate change within the curricular system, the faculty have initiated intra-departmental collaboration to reduce curricular redundancies, better sequence courses, align key assessments, and appropriately respond to diverse student needs and institutional expectations for rigor. This paper will explain the background, impetus for change, the participants and processes involved in change including survey results, curricular outcomes in relation to course development and outreach, and conclusions.

Background

James Madison University was established in early 1908 as the State Normal and Industrial School for Women. A teacher's school, the institution has traditionally focused heavily on quality teaching and learning. It has been recognized annually as a top, Master degree granting institution in the South. Since its inception, the Education arm of JMU has been transformed through changes to name and organizational structure. In 2003, the School of Education became the College of Education and departments emerged from existing programs.

When first conceived, the Educational Technology program at James Madison University was much like those of other Colleges of Education. In the 1990's, 'technology' at the K12 level was an outgrowth of library programs. The publication of Information Power, 1st Ed, in 1998 (AALA) led the charge for 'libraries' to become 'media centers' and for those responsible for library programs to view their role in K12 as one that also includes the selection and utilization of technology in the instructional process. Flexible scheduling of the media center was promoted as a way to include authentic use of and provide instruction in the integration of media. Following suit, JMU's Educational Technology graduate program began with a Library/Media focus. It was a media program designed for those who would be teaching such media skills in the K12 environment, and in fact, was arranged around the requirements of the Virginia Department of Education licensure requirements for school media specialists.

Educational Technology is currently housed in the Learning, Technology and Leadership Education (LTLE) department, established in 2006. Other LTLE programs include a collaborative doctoral program in Strategic Leadership, and Masters programs in Educational Leadership, and Adult Education and Human Resource Development (AHRD). At the undergraduate level the department offers Foundations courses for the College, a minor in Educational Media, and a minor in Human Resource Development. The establishment of this department is a reflection of the changing and broadening focus of many Colleges of Education – that is to be inclusive of all contexts of educational needs, not only those in the K12 realm. Specifically, AHRD and Educational Technology recognize corporate, non-profit, and K12 education as potential contexts for the practice of instructional design, development, delivery, and management.

The JMU College of Education is still very young and opportunities to influence future direction abound. Each College of Education academic program must bring its strengths to bear on the institutional change process. The applied and diverse nature of the JMU Educational Technology Masters program (M. Ed.) is a strength that supports the goals and standards used by a range of programs in the College of Education. The program is distinguished in the College by its learners who hale from a number of academic disciplines and who bring with them diversity in professional experience and career goals.

Impetus for Change

Evolving Interests

While the Educational Technology program served the JMU College of Education well for many years, the early 21st century brought with it an increased demand for teacher competency with technology - skills and knowledge that were previously designated for the media specialist. Along with this changing K12 focus also came the recognition that the term 'education' applies to many contexts, not just that of early education. The target audience for enrollment was broadened to include anyone who had previously worked in K12. School-work connections are,

and continue to be, emphasized in the program. Learning is presently viewed as 'life-long' and, as such, the focus of education programs is no longer kindergarten through high school only. There is now a strong recognition that learning and development continue beyond the school years, into adulthood. It is only natural then, that the Adult Education and Human Resource Development program and the Educational Technology program came to model this expanded view of education.

Program Decline

Bowling (2001) offers a life-cycle model of declining programs that apply to this scenario. Characteristics of declining programs in the model include: (1) a declining number of program participants; (2) falling evaluation ratings; and (3) increasing interest in new subject material beyond the current program curriculum. Program enrollment followed a steady decline with time and there was little branding or marketing of the graduate program due to limited faculty resources and very specific admittance criteria. Students who lacked K12 experience were not admitted and instead tended to pursue a degree in Adult Education and Human Resource Development. In that way, students could develop instructional design and technology skills that were transferable to a corporate or non-profit setting. Students who graduated from the AHRD program often assumed roles as instructional designers, trainers and course developers.

In a 2007 internal review of the Educational Technology program, it was noted that more consistency was needed in the alignment of course objectives to assessments. Ultimately this practice would ensure the alignment to national standards. It is important that applied programs undergo relatively constant review and revision. This challenge to the field of Educational Technology tends to spur debates over the nature, mission, and role of educational technology in the education arena. To address program decline and help situate the program in the College of Education, a committee was formed of faculty who specialize in K12 and corporate Educational Technology, Adult Education and Human Resource Development, and general education. It is the goal of this newly formed educational technology committee to revise the program to be more holistic and reflective of lifelong learning in modern society. Each course is scrutinized for its relevance in the program of study. Intellectual content, objectives and assessments are being redesigned to ensure alignment with the Association for Educational Communications and Technology (AECT) standards.

Educational Technology is defined by the Association for Educational Communications and Technology (AECT) as, "the study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources" (p. 1). By definition the field can serve a number of disciplines. The program curriculum needed to grow to better serve this definition and to address expanding departmental interests.

Increasing Committment

Prior to 2008, the number and diversity of students enrolled in the Educational Technology program was limited. A small number of faculty managed to sustain the program while maintaining other job responsibilities. In 2008 the Learning, Technology and Leadership Education department hired two tenure-track faculty to enhance the program. One faculty specialized in K12 and the other in postsecondary and adult education. The hiring of the new faculty members enabled the department to broaden the program's focus to encompass learner interests across the lifespan. This change demonstrated a significant commitment to bolstering a program with much potential.

Curricular Redundancies

An initial comparison of intra-departmental programs revealed curricular consistencies between Educational Technology and Adult Education and Human Resource Development, where students pursue careers in training and organizational change - largely in response to innovation. Evidence of curricular overlap has been identified in the professional core, in the program core, in advanced areas of concentration, and in key assessments. The curricular overlap is due, in part, to the increased requirement for technology proficiency among training professionals in the corporate sector, and for the same competencies in technology educators. In other words, the courses in both programs have addressed the needs of the marketplace by adapting the program to include greater coverage of instructional design and technology use. As shown in Table 1, the two programs share four core courses and four key assessments. In addition, the faculty have proposed the addition of Educational Technology Management to the AHRD core to address the need for competence in strategic project and technology management among students preparing to lead training organizations.

Table 1. Overlapping Professional Core and Program Core Courses and Key Assessments

Educational Technology	Adult and Human Resource Development	Shared Key Assessments
Foundations of Educational Technology	Foundations of Adult Education and Human Resource Development	
Inquiry in Education	*Inquiry in Education*	
Curriculum Theory	Needs Assessment and Performance Analysis	
Instructional Design	*Instructional Design*	
Design and Development of Digital Media	*Design and Development of Digital Media*	Preliminary Portfolio Review
Learning Theories	*Learning Theories*	
Educational Technology Management (proposed also for AHRD students)	Leadership and Facilitation	
Developing and Critiquing Visual Literacy	Program Evaluation	Qualifying Exam
Advanced Coursework	Advanced Coursework	Advanced Coursework
		Applied research/inquiry project; final portfolio submitted at program conclusion

Overlaps in advanced coursework occurred because of evolving interest in eLearning and the specific challenges that such an approach brings to instructional designers and trainers. It is becoming increasingly difficult to discuss and practice instructional design removed from the context of rich technological learning environments, and in fact, may now be impossible.

Demps (2008) identified consistencies in Human Resource Development and Educational Technology programs and suggested that gaps in one field could be filled by the theories and practices of the other. Utilization is defined as the "act of using processes and resources for learning" (AECT p.141) and is directly related to training and development that is typically found within the HRD field. Likewise, human performance and development is of foundational interest to the HRD field and must use current technologies in order to exist. Educational technologists bring to the table the application of eLearning strategies, technologies and management to core HRD contexts. Collaboration between the programs supports a departmental move to expand the existing focus on K12 careers in Educational Technology to include learners with non-K12 career interests. The strengths of each program are used as a springboard for "renewal, growth, and transformation" (2009 AECT call for proposals).

An unintended outcome in the various collaborations was that the Learning, Technology, and Leadership Education (LTLE) department was taking on a branding and presence of its own within the College. College of Education programs relied on LTLE to provide foundational courses in diversity, technology, and educational leadership. The overlap of core courses in the AHRD and Educational Technology Master's programs prompted a departmental discussion about, and subsequent introduction of, the *LTLE* course prefix to validate the combined strength of these expanded educational programs with the foundational courses provided to the larger University.

<div align="center">Change Participants and Processes</div>

The basic core competencies involving theory, research, and design in College of Education M. Ed. programs are determined by the College and department, with national standards in mind. Change to the program core and advanced courses and certificates are influenced by national standards, the department, program, and input from the larger community. In addition, a systemic process for change requires looking at the process as a whole and not just

a series of parts. Change also consists of multiple dimensions that must be understood and appying a systems strategy to change is required in order to integrate the parts; select and coordinate types of changes; involve stakeholders and their needs; and ensure that the end result is viable within the context of its surrounding system (Ellsworth, 2000.)   Likewise, the people who will implement the innovation must have sufficient knowledge to do so. While JMU's Educational Technology faculty were certainly qualified in their field and able to determine broad program goals and needs, it was also important to survey the feelings and needs of those affected by the program and changes – more specifically those in K12 and corporate educational technology and related fields. Such a survey of the field would provide feedback about what happens when those trained in Educational Technology programs attempt to operationalize their knowledge and skills. An informal survey of those involved in educational technology in and out of K12 was designed by the JMU Educational Technology program faculty and distributed locally, nationally, and internationally to the ITFORUM listserv. (Appendix A)

Survey participants included the K12 positions of Director of Technology (3); Instructional Technology Resource Teacher (3); and Supervisor of Instructional Technology (1). Non-K12 respondents held the following positions: Learning Technology Manager; Instructional Designer (3); Independent eLearning Consultant; Director-Learning Resources and Instructional Technology Centers; Coordinator for Special Technology Projects; and Distance Learning Coordinator. Responses provided confirmation of the reorganization of JMU's Educational Technology program to be inclusive – that the skills and knowledge are not really context specific – but an effective educational technologist must have a certain core of knowledge and skills that can be applied to any educational context, in short, a generalist. The AECT standards provide such a guidepost for program and course development. Not surprisingly, the question regarding application programs used brought a gamut of responses – from free resources such as Google Apps to more expensive, specialized content creation applications such as Adobe Photoshop, Dreamweaver, Flash, and other high-end development programs. (Appendix B) Loud and resounding themes were the need for more educational technology management skills, project management, resource management, and evaluation skills. This input influenced the committee's thinking about advanced courses and certificates designed for the Educational Technology M. Ed. program.

These courses must meet the needs of a current and unpredictable future market demand. New technologies emerge every day and their influence on our daily lives and the way we view learning cannot be ignored. A large challenge of program review is to provide advanced courses that include appropriate and effective use of current technologies, and to create a dynamic program revision process that can adjust course offerings as new and more effective technologies and approaches become available.

<div align="center">Course Development and Outreach Outcomes</div>

Transformational processes take time and an intra-departmental approach may create questions and concerns on the part of others in the College. As a result, the program revision committee has taken care to present udpates at departmental meetings, to initiate meetings with administration and other stakeholders, and has responded to survey data beyond the University. Curricular changes involving collaborations have resulted in the development of academic coursework and flexible certificates that are planned for implementation Fall semester 2010.
Academic Coursework

Graduates of the Educational Technology M.Ed. program should be able to do the following: (1) demonstrate knowledge of characteristics and issues surrounding the integration of technology for learning; (2) apply the principles of learning to design, develop and implement effective instructional activities utilizing emerging technologies; (3) apply the instructional design process to design effective media elements and instructional sequences to meet the needs of diverse learners; (4) critically analyze current trends and research in educational technology; (5) demonstrate competence in oral and written professional communication; and (6) demonstrate integrity and ethical professional behavior when designing, developing and implementing educational technologies.

To complete a Master of Education degree with a concentration in Educational Technology, one must complete a minimum of 36 hours of course work to include a professional core, Educational Technology core, and specialty area of concentration. The professional core consists of twelve credit hours including the JMU College of Education requirements for M. Ed. programs. Courses are: Inquiry in Education, Curriculum Theory and Instructional Models, Learning Theories, and Principles of Instructional Design. First year students are exposed to workshops that help orient and prepare for the portfolio and qualifying exam key assessments. The Educational Technology

program core courses include Foundations of Educational Technology, Educational Technology Management, Design and Development of Digital Media, and Developing and Critiquing Visual Literacy. At the conclusion of core course work, students must successfully complete a qualifying examination and defend a learning and design portfolio. The Advanced Educational Technology program courses are: User Interface Design, Professional Development in Educational Technology, Advanced Video and Audio Production, Data Visualization, Games, Simulations and Virtual Worlds for Learning, and eLearning Applications. Students have a portfolio defense at the conclusion of the degree and an inquiry project involving applied research.

Flexible Certificates & Course Delivery Options

Another outcome of the curricular revisions is the design of certificate programs intended to support individuals who have an interest and/or need to further their expertise in Educational Technology, but choose not to pursue the 36 credit hour Masters degree. Certificate courses are offered online and completed hours may be applied toward the Masters degree. Three certificates are currently available. They are: Educational Technology, eLearning, and Educational Technology Leadership. Course delivery options are to be determined although online certificate programs can inform and change traditional practices in a graduate program while broadening and diversifying the student population. Distance learning is a relatively new consideration for both the university and the College of Education during the academic year. Programs that are moved substantially off campus or into alternative modes of delivery (online) must be re-submitted by the university to the accrediting body that is the Southern Association of Colleges and Schools, or SACS. It is the desire of the Educational Technology committee to provide an 'open' approach to learning, whereby the learner has equal options to meet face to face, online, or a combination of both. Given recent advances in real-time desktop sharing and conferencing, and the ability to use these tools in conjunction with more high-end applications of classroom video conferencing, the program hopes to take advantage of being able to provide students with opportunities for course delivery choice.

Conclusion

The JMU Educational Technology program is moving through a transition prompted by interdisciplinary similarities and the need to serve a more inclusive audience, including, but not limited to K12. Changes in organizational structure and culture of the College of Education created a ripe environment for collaborative efforts during this time of program review and revision. AECT provides the necessary framework of standards for the program. This, coupled with full-time expertise, is allowing the program to grow and to provide rich educational technology courses and programs, while also leveraging itself as a foundational resource to the College of Education at large.

Ultimately, decisions of curricular change are dependent upon national standards and institutional classification and expectation. Guiding standards for educational technology are those of AECT and ISTE. The International Society of Technology in Education (ISTE) has worked to establish technology proficiency standards for students, teachers, and administrators in PK-12 education. ISTE's National Educational Technology Standards (NETS) have "served as a roadmap since 1998 for improved teaching and learning by educators." ISTE standards are designed to help measure proficiency and set benchmarks for the knowledge, skills, and attitudes needed to succeed in the 21st century. The HRD program follows standards of the American Society for Training and Development (ASTD). There are many overlaps in skills and knowledge among these program standards and the continued systemic review of such standards and program course offerings in both educational technology and human resource development will strengthen both programs and provide the best of both worlds for students.

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Appendix A

1. Your current Ed Tech/IT-related position title
2. Number of years experience working in this position
3. Describe typical practices in your Ed Tech/IT workplace - what kinds of things are done on a regular basis?
4. In your opinion, what kind of academic/technical/other skills are necessary to be successful in your position?
5. List your college degrees, certificates, licensure, etc.
6. If you obtained a Bachelor's/Master's/Certificate in an area related to Educational Technology or Instructional Technology, in what ways did your program prepare you, and what was missing from the preparation you received?
7. If you were to return to graduate school for a Master's degree, or refer someone to a Master's program in the discipline, what kind of program would be desirable?
8. What would be a desired course delivery method (f2f, online, hybrid, synchronous, asynchronous, etc.) and mode of interaction with others in the program (cohort, non-cohort, etc.). Please explain.
9. What software and hardware do you use on a regular basis to accomplish your professional goals? (commercial, web-based, open-source, etc.)

Appendix B

Summary of informal survey results

Skills	Software	Delivery Methods
Project Management	MS Office	Must inlcude online
eLearning	Adobe	Not exclusively online
Communication	Open Source	Non-traditional
Design	Photoshop	Hands-on .. real clients/problems
Research	Blackboard	
Change Management	*many specific programs too	
Time Management	numerous to list	
Troubleshooting		

Transforming Pedagogy: Challenging High School Teachers to Integrate Effective Instructional Strategies

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Abstract

Nieto (2009) clearly frames a question that both teacher educators and teachers themselves ask: "How do teachers move from simply surviving to actively thriving in the profession?" (Educational Leadership, February 2009, p.8). Nearly 7,000 students drop out of school every day (Editorial Projects in Education, 2007). However, research clearly tells us what the qualities of an effective teacher are and which instructional strategies increase student achievement. In this case study, two research-based elements were combined to determine how implementing them would impact the pedagogy of teachers. The results indicated when teachers were provided with a self-assessment metric of effective teacher characteristics and learned new research-based instructional strategies in a collaborative, supportive setting, their classroom instruction changed from teacher-centered delivery of information to student-centered learning.

Keywords: research-based instructional strategies, effective teacher characteristics, student-centered learning

Introduction

Teachers learn just as their students do: by studying, doing, and reflecting; by collaborating with other teachers; by looking closely at students and their work; and by sharing what they see. This kind of learning cannot occur solely in college classrooms divorced from engagement in practice or solely in school classrooms divorced from knowledge about how to interpret practice. Good settings for teacher learning, in both colleges of education and schools, provide lots of opportunities for research and inquiry, for trying and testing, for talking about and evaluating the results of learning and teaching. (Darling-Hammond, 1997)

Darling-Hammond (1997) pointedly summarizes what classroom teachers need in order to be highly effective partners in the teaching and learning process. Teachers know this. Administrators know this. Professors know this. Yet, learning opportunities that truly integrate the elements of research, inquiry, trying, testing, and collaboration are sparse. The impact of this dearth of meaningful learning for classroom teachers is felt throughout our school systems.

The meaningful application of skills, knowledge, and dispositions is an essential process in order for teachers to internalize concepts and make them an integral part of their pedagogy. If the classroom teacher is thoughtful and productive with her/his own content and models it in the delivery of instruction, it follows that the students see meaningful teaching and learning in action.

Teachers report their classrooms are filled with apathetic, bored, and passive students. At the same time, teachers are pressured into superficially addressing content in order to cover the required state standards and prepare students for the end-of-year tests. "I don't have time to really teach or reach my students" is lamented throughout teacher lounges across the nation.

Overview

Coburn's research on teacher learning tells us that teachers respond to practices through a continuum of action ranging from total rejection to accommodation (Coburn, 2001). Teachers need to experience success and to see changes in their own students' learning. One of the keys in connecting to this kind of thinking is to create relevancy and results.

Utilizing current research-based content is essential in overcoming questioning attitudes toward learning. This article integrates the work of two powerful books: *Qualities of Effective Teachers (2002)* by James H. Stronge and *Classroom Instruction That Works (2001)* by Robert J. Marzano, Debra J. Pickering, and Jane E. Pollock. The concepts of teacher effectiveness and research-based instructional strategies combine to form a foundation that results in changes in teaching.

Study Participants

Two cohorts of teachers in a master's degree program studied the qualities of effective teachers and instructional strategies that work over a one-month intensive course. They met twice a week for 4.5 hours. During this time they participated and interacted in a number of learning activities. They were presented with the key concepts through the modeling of strategies. They reflected on their own teaching characteristics, developed a personal effective teacher plan, studied and discussed research findings, debated the differences between teacher-directed and student-directed learning, developed new lessons and units, implemented new strategies, documented their lessons, shared what worked and what didn't, and created portfolio binders filled with energizing learning activities that transformed their personal classroom instruction and learning.

Multiple elements combined to produce transformational learning. First and foremost was the trust they had in each other and their deeply felt desire to learn. The modeling of the effective research-based instructional strategies during class time, collaboration time to discuss and share ideas and implementation techniques, the application and practice of new skills, and self-reflections to improve practice also contributed to the process of not only gaining new knowledge and skills, but internalizing them.

Method

At the first session of the course, each teacher completed the Teacher Skills Self-Assessment Checklist adapted from the Stronge (2002) research (See Appendix). After a self-evaluation process where strengths and areas for improvement were identified, a Personal Teacher Effectiveness Plan (PTEP) was created. The baseline self-assessment and PTEP were used to determine personal growth and development each week.

During Session 1 several instructional strategies from *Classroom Instruction that Works* were modeled. Students applied: a.) identifying similarities and differences while discussing their educational philosophies and creating their effective teacher characteristics lists; b.) note taking when jotting down important concepts; c.) cooperative learning when working in small and whole group activities; and d.) setting objectives during the development of the Personal Effective Teacher Plans. This intentional use of strategies from *Classroom Instruction that Works* was implemented throughout the course. Students were able to experience the instructional strategies, internalize them, reflect on what worked (or didn't), and discuss how to adapt them to their own teaching. They were able to understand the relevancy of the content they themselves were learning and connect to it on multiple processing levels due to the student-centered learning environment that encouraged sharing, discussions, and the questioning of assumptions.

Connecting Effective Teacher Qualities to Instructional Strategies

The next step was to align the effective teacher characteristics with the research-based instructional strategies. This process provided the framework for the study of the strategies while consistently looping back to the PTEP. This alignment provided both a visual and cognitive reference point for reflection to determine if goals were met. The class accomplished the alignment through a cooperative learning assignment, which modeled one of the effective instructional strategies. The resulting chart (Table I) allowed the teachers to pinpoint which instructional strategies were most likely to increase their teacher effectiveness. For example, if a teacher identified the area of Monitoring Student Progress as an area of need, he/she would focus on the strategies presented in the chapters dealing with Setting Objectives and Providing Feedback as well as Homework and Practice.

Table I Alignment of Characteristics and Strategies

Effective Teacher Quality Category	Instructional Strategy
Organization for Instruction 　Time management 　Planning for instruction 　Communicating expectations for student achievement	Setting Objectives and Providing Feedback
Implementation of Instruction 　Using appropriate questioning techniques 　Supporting active learning 　Differentiating instruction	Nonlinguistic Representation Cue, Questions, and Advance Organizers Generating and Testing Hypotheses Identifying Similarities and Differences Summarizing and Note Taking
Management and Organizational Skills 　Creation of an effective learning environment	Cooperative Learning Collectivism vs. Individualism
Monitoring Student Progress 　Feedback 　Homework 　Student learning outcomes	Setting Objectives and Providing Feedback Homework and Practice
Teacher as a Person 　Nonacademic interactions 　Professional attitude 　Reflective practice	Reinforcing Effort and Providing Recognition

Collecting Data

A qualitative approach was used for this case study. Reflection papers were turned in at the end of each class session that focused on specific instructional strategies paired with lesson plans. A weekly journal entry revisited the PTEP and tracked their progress in becoming more effective teachers. The instructor kept a master journal that tracked changes in pedagogy and evidence of personal growth from the weekly reflections.

During the two sessions each week, one or more of the instructional strategies were presented followed by a lesson plan development activity. The lesson was implemented in the classroom the following day and the results were analyzed during the following class session. The teachers discussed in small and large groups what worked and what needed revised. They each then wrote a reflection paper and turned that in along with the initial lesson as well as the revised lesson attached. At the end of each week, the Reflective Journals were sent via e-mail to the instructor. They included personal progress towards the goals generated from the self-assessment task.

Evidence of Growth

The power of collaboration in education has been written about with great authority (Darling-Hammond, 1997). One of the ongoing frustrations of being a classroom teacher is the feeling of isolation that happens on a daily basis (Turley, 2005).

One of the many positive aspects of being a member of a cohort is the time for collaboration, sharing, and teacher talk. The teachers who participated in this study talked. They shared what worked and what didn't. They enthusiastically explained how their teaching was changing. They asked for new ideas from their colleagues. They designed and developed new learning activities. Their reflective papers and journals clearly showed evidence of growth and change in their pedagogy.

All thirty-one teachers reported that their teaching had improved by implementing the research-based instructional strategies. They reported feeling more confident in how they defined themselves as effective teachers and stated when implementing the new skills and knowledge their own students were more engaged in learning.

Conclusion

Sonia Nieta (2009) poses the question: How do teachers move from simply surviving to actively thriving in the profession? From the collaborative work done by the teachers in this study, the answer would appear to be, by

understanding the connection between effective teacher characteristics and research-based effective instructional strategies. The teachers first clearly identified their areas for improvement and then learned and applied specific strategies to improve their instruction together. The results included changes in attitudes and pedagogy. The teachers talked about a return to a love of and enthusiasm for teaching.

Suggestions for Future Research

Action research is a fertile avenue to provide meaningful information about what is taking place in the field of teaching today. This case study was conducted with two cohorts of teachers focusing on how the combination of two powerful concepts could merge to support a change in pedagogy. Each month, quarter, or semester we have the opportunity to study what strategies improve teaching instruction and in turn, what creates engaging learning environments. More research in this area will help us to become more effective teachers.

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Appendix

Teacher Skills Self-Assessment Checklist
The following checklist is adapted from Qualities of Effective Teachers, James H. Stronge.
Directions:
1. Use the following scale to score your qualities as a teacher.
2. Then, review the checklist and highlight the HE and AE qualities in blue.
3. Go on to highlight the E qualities in green.
4. And finally, highlight the ME and IE qualities in yellow.
5. Reflect on the ME and IE qualities. What skills and knowledge do you need to acquire to move these into the E rating or above? Identify those qualities you want to improve.
6. Create an Effective Teacher Improvement Plan. Indicate specific actions you will take to move the identified qualities into a higher rating. Place this plan in your portfolio. The expectation is that you will identify an action each week and work on improving your teacher effectiveness.

HE =   Highly Effective An HE rating indicates that the teacher is an expert and has mastered this quality.
AE =   Approaching Effective An AE rating indicates a teacher who exhibits this quality 90% of the time.
E =   Effective An E rating indicates a teacher who demonstrates this quality at least 75% of the time and gets effective results.
ME =   Marginally Effective A ME rating indicates a teacher who infrequently (70% or less of the time) demonstrates the quality and needs to gain additional skills in this area.
IE =   Ineffective An IE rating means the teacher does not possess the quality.
N/A =   The quality is not applicable to the subject matter.

Quality	Indicators	HE	AE	E	ME	IE	N/A
Teacher as a Person	Listens actively						
	Develops a personal relationship/interest in student while maintaining professional boundaries						
	Values student input						
	Exhibits love of teaching						
	Shows passion for content area						
	Enjoys teaching and learning						
	Seeks new knowledge and skills						
	Engages in reflective practice to improve teaching						
	Sets high expectations for personal classroom performance						
Organizing for Instruction	Carefully prepares meaningful lessons aligned to standards						
	Selects a variety of teacher-directed and student-directed strategies and techniques						
	Prepares all materials in advance						
	Organizes sequencing of lesson for effective presentation						
	Sets clear learning outcomes aligned to standards and explains the linkage to students						

	Sets a pace that maintains momentum throughout the class period						
Implementation of Instruction	Optimizes use of instructional time						
	Varies research-based instructional strategies, learning activities, and assignments to engage and motivate learners						
	Paces learning and is able to adapt as the situation demands						
	Uses appropriate questioning techniques to scaffold learning and increase critical thinking						
	Connects prior knowledge to new concepts						
	Frequently checks for understanding using a variety of techniques						
	Sets high expectations for learning which includes stressing student responsibility and accountability						
	Gives clear examples						
	Differentiates instruction						
	Changes plan as needed based on successes and challenges						
	Celebrates student learning in a positive, reinforcing manner						
Management and Organizational Skills	Prepares plans and materials in advance						
	Involves students in creating classroom expectations						
	Is fair and consistent in using discipline						
	Establishes a classroom routine that creates a safe, yet welcoming learning environment						
	Balances variety and challenge in selection of learning activities						
	Uses space to maximize learning and to encourage interaction						
	Maintains a highly effective learning environment that values student learning						

Monitoring Student Progress	Clearly explains the purpose for assignments and homework						
	Provides timely feedback based on clear grading rubrics to improve student performance						
	Provides opportunities for re-teaching concepts as needed						
	Knows the strengths and needs of each student based on ongoing continuous assessment						

A Review of Factors Impacting Online Healthcare Education: Guidelines for Enhancement

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This literature review investigates and classifies key content delivery methodologies and user characteristics that are believed to have high impact on the quality of online healthcare education. The purpose of this review is to identify significant user characteristics and methodologies such as information delivery technologies, health assessment tools and web-page interface element accommodations in the health information delivery. This information will inform the instructional and graphic design of learning systems for this population.

Online healthcare education has been a primary source of disseminating and receiving health information for both consumers and professionals for the past several years (Liu, 2007; Morrell, Mayhorn & Bennett, 2002). While the increase of online healthcare sites make it worthy of investigation and the potential of utilizing new web technologies to facilitate healthcare is just emerging (Morgan, 2002), much of the current information found online is informal and insufficient in scope. For this review, the web sites of ten of the "best" hospitals according to the honor roll in *U.S. News* 2009 were analyzed to better understand the type and scope of content being delivered to the public. The results show that many of these web sites are crowded with information but do not follow basic design guidelines for facilitating efficient health care information delivery (see appendix). Mead, Lamson & Roger (2002) extensively reviewed current health-oriented websites and pointed out: "many exiting web sites have characteristics that would make them virtually unusable by the average older adults and by many young adults as well" (Meadd, Lamson & Roger, 2002, P. 96). This review focuses on the quality of online health care information dissemination by investigating and classifying factors helping with quality improvement.

The quality of online health care education is profoundly impacted by content delivery methodologies such as information delivery technologies (Hollandsworth, 2007; Boulos, Maramba & Wheeler, 2006; Heinich, et al., 1993; Ma, Lee, Du & McCahill, 1998; Osheroff, 1994; Wei & Levkoff, 2000; Siau,K, 2003; Mehrabi, et al., 2000), health assessment tools (Kitchie, 2003; Shapiro, et al. 1996; Siau, 2003; Bensley, R., & Lewis, J, 2002), health information accommodations (Shepperd, Charnock, & Gann, 1999; Risk, & Dzenowagis, 2001, Eysenbach, et al, 2002), and user characteristics including the characteristics of patients, primary care providers/family members, and other healthcare professionals (Ewler & Sinnette, 1986; Mead, Lamson & Rogers, 2002; Wetle, 2002; Siau, 2003; Bastable, 2003; Dryfoos, 1990; Diclemente, Hansen, & Ponton, 1996; James, & Gabe, 1996; Kitchie, 2003; McCormick, & Gilson-Parkevich, 1979; Treweek, 1996; Cline & Haynes, 2001). This review focuses on each of these issues and is divided into two categories: 1) content delivery methodologies; and 2) user characteristics.

Content delivery methodologies

Information Delivery Technologies
1. Podcast

Since podcasts first appeared in 2004 (Hollandsworth, 2007) they have been widely adopted in entertainment and education sectors. A podcast is a digital media file (audio or video-vodcasts) distributed via the Internet for the audience to utilize whenever, wherever and however they want (Boulos, Maramba & Wheeler, 2006). Podcasts provide users with a flexible environment to listen to content through a number of delivery systems including their phone, computer, or portable MP3/MP4 players. Such audio media is desirable for many people because "the impact of the spoken word is frequently greater than that of print". (Heinich, et al., 1993, p163). Audio materials are cheap to produce and distribute, and easy to access. Some universities use podcasts within online education to deliver lectures and review assignments. Results indicated that podcasts minimized technological support demands and empowered learners to self manage. Learners found them easy to use and benefited from the flexibility in assimilating large amounts of information (Hollandsworth, 2007). Computer-based interactive programs using audio-based instructions have been found to be at least as effective as other forms of content delivery(Heinich, et al., 1993). Finally, podcasts are good alternatives for users suffering visual impairment (Heinich et al., 1993). A major challenge with podcasts are that audio and video files take a long time to download and require sufficient bandwidth (Boulos, Maramba & Wheeler, 2006).

2. Video clips

The application of video clips online has been very popular for global information distribution (Ma, Lee, Du & McCahill, 1998). The special attributes of video streams –manipulation of space and time enable learners to view phenomena in microcosm and macrocosm and experience the process of an event by compressing or expanding the time that it takes to occur. Researchers outlined the advantages of the application of video clips based on their attributes: a) motion of images; b) process of operation; c) safe observation; d) skill learning; e) dramatization; f) affective learning; g) problem solving; h) cultural understanding; i) establishing commonality. (Heinich, et al., 1993). Video clips are not only an attractive feature for web pages; their advantages make them a powerful tool to effectively disseminate information and education online.

3. Online Discussion Groups

Online discussion groups such as blogs and forums are attracting a large and dedicated readership as they encourage people in knowledge sharing, reflection, and debate (Boulos, Maramba & Wheeler, 2006). Osheroff (1994) stated that "online forums are an increasingly important source for both physicians and patients seeking education, guidance in clinical decision making and interpersonal connections" (Osheroff, 1994, para. 2). It is easier for either patients or care givers to find coping strategies and emotional support in a group with others who share the same situation (Wei & Levkoff, 2000, p314; Osheroff, 1994, para. 4; Siau,K, 2003). Online discussion forums provide such stages for health information users to "discuss daily challenges and stresses and exchange ideas for dealing with a wide variety of problems" (Levkoff, 2000, p314). Other main methods to conduct online discussions are blogs, list servers and newsgroups. Less-expensive Internet access, more useful information, more practical advice and more accessible emotional support make online discussions more and more popular. In another study, Culver & colleagues (1997) analyzed messages displayed on Internet bulletin board and found out that one challenge facing users was the accuracy of the health information (Culver, 1997). Since people from around the globe can share their advice and strategies in the online discussion platforms, the information calls for strict scrutiny.

4. Animations, graphics and slide shows

We are a visual society. Studies indicate that the interactive use of multi-media components such as graphics, animation, sound, and digital slide shows can theoretically facilitate the learning process(Mehrabi, et al., 2000). Moreover, moving images "have an obvious advantage over other visual media in portraying concepts"(p.220), such as a first aid demonstration. When used appropriately, animations and graphics will facilitate learning (Ackerman et al., 2006). Heinich et al. also pointed out that graphics and animations were not only helpful for young children but also for adult learners (Heinich et al., 1993).

Health Assessment Tools

Kitchie (2003) pointed out that assessment was essential to determine learning needs in any of the cognitive, affective or psychomotor domain and assessment of people's health status was vital to determine the amount of energy available as well as present comfort level, both of which profoundly impact the cognitive procedure of information assimilation (Kitchie, 2003). Health Assessments can help identify the signs of symptoms for many physical and mental health conditions, as well as social and behavior issues (Shapiro, et al. 1996). Currently most commonly used health assessment tools online are Health Calculators, Self-Assessment and Quizzes. Patient oriented calculators and assessment tools help answer common questions like "What are the symptoms?". They cover common symptoms of health conditions, addictions, and other behaviors. Studies believe that the more patients know, the more they can participate with their physician in planning their own health goals (Kitchie, 2003; Siau, 2003). Interactive quizzes and other tools will help patients pinpoint problem areas, assess their risks for certain diseases and conditions, and assist in improving health and well-being. Health assessment tools are not only helpful for patients; they assist practitioners in developing interventions to promote health (Bensley, R., & Lewis, J, 2002)

Health Information and Web-page Interface Accommodations

Issues concerning online health information have emerged (Shepperd, Charnock, & Gann, 1999; Risk, & Dzenowagis, 2001, Eysenbach, et al, 2002) with the proliferation of the Internet and the massive growth of online health information. The convenient access to myriad of health information is companied with potential dangers. Risk and Dzenowagis (2001) pointed out that numerous surveys and studies had painted a picture of dubious information quality, widespread practice of fraud and the risk of exposure of the public to harm (Risk, & Dzenowagis, 2001). Information with regard to a) symptoms and conditions, b) remedies and treatment, and c) professional reports and recommended books will be good resource for users to take advantage of.

A lot of time is spent modifying web page interface designs to facilitate the effective use of online information among a variety of users (Echt, 2002; Mead et al., 2002; Ackerman, 2006). User-centered web page design is considered to be the best approach. "It is not enough to design for our own effective use and aesthetic satisfaction" rather effective health information web sites should be designed to "maximize the likelihood that it can be effectively sensed, perceived, understood, and consequently learned and applied" (Echt, 2002, pp.201).

1. Visual adjustment

Research shows that it may be better for older users and users with visual impairment to use at least 14-point fonts, and user should be allowed to individualize text size (Echt, 2002, Mead et al., 2002). Also, familiar fonts such as sans serif font types that are at least 12-points should be used (Ackerman, 2006). High contrast text is recommended in web designs. Mead (2002) suggested that dark text on a light background was ideal to improve reading performance (p98). Studies showed that patterned backgrounds would slow users reading speed by 32 percent (Ackerman, 2006). Since "most learners prefer colored visuals" (Heinich et al., 1993, p 68), color used on web pages is an attention-attracting feature. However, they should be used appropriately, or they will potentially annoy users. Web design guidelines suggests that color-coding should be used when the coding scheme can be easily understood, that bold for headers and key words to emphasize importance and that the same way or color should be used to highlight the same information (Ackerman, 2006; Echt, 2002).

Heinich et al. (1993) stated that young users prefer simple visuals, whereas older prefer more complex visuals. Appropriately used graphics and animations enhance information assimilation. Web users are helped by instruction that are combined by text and text-relevant illustrations (Echt, 2002). However, they are supposed to be used in a meaningful way, which means "use graphic and animations only when they help to convey, or are supportive of, the Web site's message or other content" (Archer man, 2006). Meaningless graphics and animations or abusing graphics can only frustrated users and slow the web page download times. Research suggested reducing unnecessary graphics and animations and providing high contrast and high resolution ones for older users(Mead et al., 2002). .

2. Audio/video streaming

Multimedia such as audio and video can easily capture users' attention so it is effective methods to disseminate important information. However, they are distracting elements if there are no clear and useful reasons of using them (Archerman, 2006). A myriad of Web users including older people are not technology guys, Mead (2002) revealed that some adjustment on audio/video incorporation in Web pages would have salient effect on the web users. The modifications concerning audio/video streaming are listed as follows:

- Avoid unnecessary use of audio/video streaming;
- Avoid complex streaming software;
- Use the same kind of software for all the audio/video streaming;
- Do not require users to download or install plug-ins;
- Limit the download time and improve the video/audio quality.

3. Disability accommodations.

In another study, Gonzalez etc (2003) revealed that people with disabilities, especially people with visual disabilities, found it difficult to retrieve information from the net due to the fact that most web pages placed their emphasis on aesthetics and attractiveness rather than functionality and simplicity. During the study, Gonzalez and colleagues explored the project KAI (Kit for the Accessibility to the Internet), introducing an accessibility measurement module to assess the accessibilities of existing web pages and provide guidelines for web designers. The study indicated that web designers should take into account the accessibility of the web content and the

utilization of some tools such as WebTouch, which would make online information more accessible for a larger range of users. According to American Disabilities Act, information provided via Web must be accessible to people with a wide range of sensory and physical disabilities. Echt (2002) also pointed out that such assistive technologies as screen magnification programs, screen readers, and refreshable Braille displays made it possible for most people with disabilities to surf the Internet.

<center>User Characteristics</center>

There are various users of online healthcare information ranging from patients to care givers and professional. Thus the point for effective information design is to have users clearly in mind. Ewler & Sinnette (1986) stated: "To plan effective health education, the first step is to identify the user and their characteristics" (Ewler & Sinnette, 1986). A lot of other authors also mentioned the important role that intended user characteristics play in the success of healthcare education (Mead, Lamson & Rogers, 2002;). Tailoring information and web interface to fit with users' age, existing knowledge and experiences is essential. Based on the reports from APHA (American Public Health Association, 2009) and American Heart Association (2008), diabetes and heart diseases are top killers threaten American's life. Thus, the user characteristic description focuses on these two patient populations: patients with heart disease and those with juvenile diabetes.

Patient
Wetle (2002) revealed in his study that both older and younger persons had powerful motivators to seek information of maintaining good health and preventing disease (Wetle, 2002, p. 5). Issues regarding diseases are the big issues in most people's life. The Internet allows patients to gain up-to-date information and benefit from online support groups sharing the same diseases (Siau, 2003).This review examines characteristics for two typical patient populations: heart disease and juvenile diabetes.

1. Age
Juvenile Diabetes also is known as type I diabetes or insulin-dependent diabetes mellitus (IDDM). Although juvenile diabetes can occur at any age (Medical Encyclopedia, 2008), it is more common for patient at the age 19 and younger. Patients with Juvenile Diabetes have to walk through their daily life including obtaining health care information with the physical and emotional changes.

While IDDM mostly attacks juveniles aged under 19, heart diseases of various kinds are the number one killer in American, especially for older people over 65 (American Heart Association). According to the American Heart Association, almost 150,00 Americans killed by heart disease each year are around the age of 65, and one out of every 20 people below the age of 40 has heart disease. Patients with heart diseases are threatened by death while facing the ongoing physical and psychological changes (Bastable, 2003).

2. Physical and psychological conditions
Adolescence are known to be among the nation's most at-risk populations (Dryfoos, 1990), and an understanding of their characteristics is crucial for patient education to be effective (Bastable, 2003). Bastable (2003) and Dantzer, et al.(2003) revealed the physical and psychological characteristics influencing adolescence juvenile patients:
- Experiencing biological and psychological alternations
- Maturation of cognitive development
- Psychological development resulting in conflict, toleration and alternation between adolescents and authority such as parents, doctors.
- Easier exposure to psychological disorders, especially anxiety disorders and eating disorders.
- Showing signs of depression, lack of will and learned helplessness.

The maturation of adolescent patients' cognitive development enables them to understand the concepts of health and illness, the multiple causes of diabetes, the impact of variables on disease control and the ideas of health promotion, while their psychological conditions such as anxiety and fear negatively interfere with their ability to obtain information (James, & Gabe, 1996).

<center>125</center>

In addition to the threats from heart diseases, the patients, aged 35 to 60 or older, are undergoing the physical and psychological changes, which have a great impact on the efficiency of obtaining health related information. Bastable (2003) pointed out that these patients were faced with a lot of physical changes, such as metabolism slowing down, endurance and energy level lessening, hearing and visual acuity diminishing, which greatly influence their learning capacity. On the other hand, the psychological alternations associated with aging, such as developing concerns for their children, recognizing the psychological changes in themselves, dealing with the new roles of being a grandparent, affect their organ functioning, ultimately reducing their energy level (Bastable, 2003).

Thus, more online information should focus on assisting the patients in coping with stress and maintaining optimal health status (Bastable, 2003). Another studies stated that patients tended to focus their energy on information related to treatment, test and minimizing pain or other discomfort and so they did not have energy for learning of product introduction, life style (Kitchie, 2003).

Family members as health care providers

Care providers/ support group are a great part of health care information seekers. Care providers/support group mainly consist of family members, volunteers, healthcare workers and friends (Ewler & Simnett, 1986). For the heart failure group, the age is probably like 65-85 so the most likely care providers would be their children who would be about 40-55. Juvenile diabetes patients are more apt to care themselves, but their parents or aunts/uncles may also provide support, seeking health care information. Thus the age range will be 35-55 for parents and others (Bastable, 2003).

1. Experience and knowledge

Health care experience and knowledge have a great impact on selecting and acquiring information. Generally speaking, most family members or friends as health care providers / support group have less expertise compared to professionals. However, many family members as health care providers mybe unaware of the knowledge they lack or may be reluctant to admit their deficits (McCormick, & Gilson-Parkevich, 1979). a lot of information is needed to raise health consciousness, help to make decision, facilitate attitude change (Ewler & Simnett, 1986)

2. Emotional attitude and motivation

Treweek (1996) pointed out that understanding the world as an emotional space had been a central concern in health care work (Treweek, 1996). Gagne pointed out that attitudes were "mental states that predispose the individual towards some choice of personal action" (p.143). Users' emotional attitudes are vital in selecting and accepting information.
Studies (Ewler & Simnett, 1986; Bastable, 2003) revealed the special emotional attitude care providers/ support group encountered:

- Feelings of overburdened, underappreciated and hopelessly inadequate
- Pressures of caring for children and parents are overwhelming
- Feelings of depression, stress and fatigue
- Expressing a form of grief, at the thought of losing loved ones

Such emotion as anxiety and grief negatively influenced their attitude to acquire information (Kitchie, 2003), and thus the effectiveness of health care information may be enhanced by introducing some information on diminishing their anxiety and grief, enhancing.
However, some degree of anxiety is a motivator to learn (Gagne, 1991). Their love for their parents or children is strength for information acquiring and they believe that " doing so is a gift that they will always cherish"(Ewler & Simnett, 1986).

Healthcare Professionals

Cline and Haynes (2001) pointed out that not only patients and caregivers, but also professionals increasingly engaged in interactive online health communications (Cline & Haynes, 2001). The Internet is potential platform for health care professionals to obtain, exchange and advertise their expertise. Healthcare professionals find the Internet more convenient to provide patients with good and instant service.
The Internet allows physicians' access to immediate information without having to shift through piles of files; it

enhances quick and seamless interaction between physicians and patients(Siau, 2003); it is more convenient tool for prescribing, scheduling appointment, sending reports, reminding and alerting patients about their health status; it makes professionals capable of responding to patients inquiries more conveniently because of the asynchronous nature; it is even potential space for e-commerce, extending professionals capacity to profit from selling various commodities (Kassirer, 2000).

Conclusion

The conclusion drawn from these reviewed studies implies that both content delivery methodologies like information delivery technologies, health assessment tools , health information accommodations and web page interface accommodations (Hollandsworth, 2007; Boulos, Maramba & Wheeler, 2006; Heinich, et al., 1993; Ma, Lee, Du & McCahill, 1998; Osheroff, 1994; Wei & Levkoff, 2000; Siau,K, 2003; Culver, 1997; Mehrabi, et al., 2000) and user characteristics including the characteristics of Patient, Care provider/Family member and Healthcare professionals; Ewler & Sinnette, 1986; Mead, Lamson & Rogers, 2002; Wetle, 2002; Siau, 2003; Bastable, 2003; Dryfoos, 1990; Diclemente, Hansen, & Ponton, 1996; James, & Gabe, 1996; Kitchie, 2003; McCormick, & Gilson-Parkevich, 1979; Treweek, 1996; Cline & Haynes, 2001) have a great influence on the quality of online heath care education. The researchers' understanding of these factors and the existing research are crucial for web designers in designing future effective and qualified healthcare related web sites. In order to improve the quality of online health information dissemination, a variety of content delivery technologies can be manipulated with consideration to user characteristics. The users' awareness of these factors is also significant in assisting themselves in health promotion and disease prevention.

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Appendix Summary of Healthcare Information deliverables of top 10 Hospital Websites

Hospitals	Info delivery — Technologies							Health tools				Professionals	User accommodations		
	Content	Podcast	Video Clips	Slide Shows	Dis/Gr	Ani/Gra	others	Calculators	Self-Assessment	Quizzes	Others		Visual	Audio	Disability
Johns Hopkins Hospital, Baltimore	x				x	x	special reports						x		
Mayo Clinic, Rochester, Minn.	x	x	x	x	x	x		x	x	x				x	
UCLA Medical Center, Los Angeles	x	x	x		x	x			x	x			x		
Cleveland Clinic	x						news letter								
Massachusetts General Hospital, Boston	x														
New York-Presbyterian Univ. Hosp. of Columbia and Cornell	x	x	x	x		x	3D Models	x	x	x		x		x	
Duke University Medical Center, Durham, N.C.	x	x	x	x		x	news letter	x	x		in-depth reports	x		x	
University of California, San Francisco Medical Center	x					x						x			
Barnes-Jewish Hospital/Washington University, St. Louis	x								x						
Brigham and Women's Hospital, Boston	x	x	x			x		x	x	x		x	x	x	

Set Your Conversations Free: Skype as a Teaching and Active Learning Tool

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Abstract

This paper introduces you're Skype – free videoconferencing software to enhance collaborative learning. Imagine your class is working on a multicultural project with another a class in Spain. You want to set up videoconferencing for the students to learn – first-hand – about aspects of culture and language from each other. Without expensive equipment, how can you make this a reality? We want to introduce you to Skype – an easy-to-use tool that will allow you to accomplish this and many other learning activities.

Background Information

As teachers trying to broaden your students' world, a number of teaching strategies can be embedded to the curriculum. For example, you can invite a guest speaker from a multicultural background to talk about their culture, or show a video on a topic relevant to the unit you are teaching. But what if you want to work on a science project with a partner class a hundred miles away?

Creative teachers are always finding ways to integrate new teaching strategies to help their students gain knowledge, but there always seem to be stumbling blocks. They can be as minor as a guest speaker's availability not aligning with your class schedule, or as major as not having the budget to fund a file trip or other activity.

What could be better to explore Spanish cultural practices than taking your students to Spain? Impossible you say? We would like to introduce you to Skype – a technology available today, that would allow you to overcome these obstacles and bring resources to your students in real time that you never thought possible.

What is Skype?

Skype is a freeware communication tool that was launched in Estonia in 2003, and was purchased by eBay in 2005 for $2.6 billion dollars. Skype is an effective no-cost tool that allows you to remotely talk with and see others via the Internet from anywhere in the world. Once you download Skype to your computers it allows you to communicate with people all over the world for FREE, with an Internet connection.

With only a PC, Internet connection, microphone, speakers and Skype you can talk or make video calls (with a webcam), send instant messages and files, across the street or across the globe without costing a penny. You can also save Skype on your flash drive and take it everywhere you go. It's just that convenient!

What Can Skype Do?

- Voice Calls
    - Skype-to-Skype voice calls (Voice over IP) – free
    - Computer to cell phones and landlines – for a small fee
- File Transfer – instantly send/receive those large, hard-to-send files safely
- Instant Messaging – chat with any other Skype user(s)
- Video Conferencing – requires a webcam
- Call Logs – keep track of both calls and chats
- Mobility – log into Skype from anywhere in the world
- Skype Universal Translator – up to 28 different languages
- Global User Directory – a phonebook of Skype users world-wide

What Do You Need to Use Skype?

Skype is available for practically all platforms including Windows, Mac OS X, and Linux. There are very few system requirements:

- Computer and Internet connection
- Microphone and speakers (or a headset) – for calling
- Webcam – for video conferencing
- With all three, you can use Skype to its fullest potential!
- You need to make sure that your firewall is not blocking any of the Skype functions.

Learning with Skype

Skype presents a great opportunity for your students to engage in active learning via conference calls or video conferences with:

- other students anywhere in the world
- you and/or another teacher(s)
- guest speaker(s) remotely presenting new and interesting topics

In the Virtual Classroom

1. This is a great communication network for children whom are sitting out because of a sick day, snow day, physical disability, or discipline problem.
2. Skype can be used in the classroom to contact another classroom anywhere in the world to communicate with pen pals, learn about new cultures, learn a new language, and/or share teaching materials with other teachers.

Teachers and Students: Using Skype Together

There are many great ways you can use Skype in your classroom:

- Conduct research with students in another part of the country or world
- Practice communication skills in another language or culture
- Ask questions of experts or community resource people e.g., learn about Earth Day from an instant message chat room
- Conduct parent conferences remotely
- Provide mentoring or homework help
- Read, present, or perform to a remote audience
- Collaborate with other teachers
- Participate in Professional Development

Security Features

It is important to protect your students when they are using Skype. Students must be aware they should never give out personal contact information. In school settings extra safety and privacy considerations are recommended. There is a lot of information on the Skype website about staying safe while using Skype.

What Does the Research Say?

Skype enhances the interactions between teachers and students. Rexius (2007) says "The potential impact that Skype technology may have on teaching and learning is significant. It opens up numerous options to teacher and student interactions. Features that Skype offers can potentially revolutionize the teaching and learning process" (p.12).

VanDrimmelen (2006) stated "Skypecasts have the potential to revolutionize the academic community. They not only open up many options to teacher and student interactions, but level the playing field in a way that equalizes every participant's voice. They also create thousands of new and exciting possibilities for real-time learning that were never possible before" (¶ 1).

Beside the convenience of real-time learning, Skype also provides a state-of-the-art technology for language learning. Cunningham (2004) stated "Education depends on cutting edge technology, and with proper application of this new Skype technology a school can turn a computer into language lab" (¶ 1).

In Conclusion

Skype is a fun and easy way for people to communicate around the world. Teachers and students benefit from the advanced technology, convenience, and reasonable cost. This technology has allowed teachers to implement more self-paced and learner-centered curriculums. With Skype you can take the "distance" out of distance learning. Communicating with anyone in the world, at little or no cost, is now a reality. Using Skype expands the active learning experience. It introduces students to new information and people that they would normally never be able meet. Skype also makes learning accessible to students who cannot attend class because of illness, travel, or family emergencies. Experience Skype for yourself and at the same time learn how to broaden the horizons of your students – all for free.

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Alternative Research Methods:
MAPSAT Your Data to Prevent Aggregation Aggravation

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Overview

In traditional quantitative research methods that are based on algebraic linear models, we typically obtain *separate measures of variables*, and then we statistically analyze relations among measures (e.g., linear, curvilinear or logistic regression analysis). That is, we *relate measures*. This approach, which assumes linear and additive models, can result in aggregation aggravation—i.e., obfuscation of important relationships due to assumptions in the approach.

In traditional measurement we aggregate units when we obtain a value for a variable. For example, we aggregate (count) the number of inches when we measure a person's height, or we count the number of years when we measure someone's age. We repeat this process of *independent* aggregations for more persons' heights and ages. Then we attempt to do a statistical analysis of these sets of independent measures, such as correlation or linear regression. This kind of thinking stems from algebra—e.g., $y = Bx + C$, where variable y is measured separately from variable $x,$ and a *functional relationship is assumed* to exist between x and y, where B is the slope and C is a constant.

Alternatively, we could *measure relations* directly. This is not a play on words, but a significant paradigm change in conceptualizing educational research problems and how we collect and analyze data: *map relations* instead of *measuring variables*, and then *analyze relation maps* instead of *statistically associating variables*. We call this alternative approach MAPSAT: Map & Analyze Patterns & Structures Across Time. MAPSAT is a *logical* analysis of relations, not a statistical analysis of separate measures. In MAPSAT, there are two approaches that can be taken. In the *Analysis of Patterns in Time* (APT) approach, we map temporal relations. In the *Analysis of Patterns in Configuration* (APC) approach, we construct a map of *affect-relations* in a system.

MAPSAT is a form of network measurement and analysis. More specifically, Dynamic Bayesian Network Analysis (DBNA) and Social Network Analysis (SNA) are similar to MAPSAT in that they are types of network analysis and are grounded in mathematical digraph theory (Thompson, 2008; Jensen & Nielsen, 2007; Brandes & Erlebach, 2005). These three approaches to network analysis are more closely related, compared with extant methods of measurement and regression analysis described above. While MAPSAT APC methods and SNA do have common aims, the advantages of MAPSAT are its theory basis (ATIS: Thompson, 2006b; 2008) and ability to measure structural properties of hypergraphs of multiple sets of affect-relations. Moreover, MAPSAT APT methods differ from DBNA in that Bayes Theorem is not assumed nor used in computing conditional probabilities in APT; rather relative frequencies of temporal sequences determine APT conditional probabilities.

Examples of APT

Frick (1990) invented a procedure called Analysis of Patterns in Time (APT) in order to map temporal relations. Phenomena are observed and coded with categories in classifications. The resulting temporal maps are then queried for temporal sequences of events. For example, Frick (1990) created temporal maps of student engagement and interactive instruction and found that, when interactive instruction was occurring, the temporal likelihood of student engagement was very high (0.97). However, when non-interactive instruction was occurring, then the probability of student engagement was much less (0.57). Regression analysis of the same data (when engagement and interactive instruction were aggregated separately) was only able to predict 32 percent of the variance in student engagement—i.e. aggregation aggravation.

Frick, Chadha, Watson and Zlatkovska (2008) used APT in a study of teaching and learning quality in postsecondary education. Based on student course evaluations ($n = 464$ in 12 different courses), they found that when students agreed that First Principles of Instruction occurred in their courses (Merrill, 2002) *and* they also agreed that Academic Learning Time occurred (ALT: Berliner, 1990; Rangel & Berliner, 2007), students were about 5 times more likely to be rated at a High Mastery Level by their course instructors than they were when they did not agree that First Principles and ALT occurred. Even more significant, students were about 26 times more likely to be rated at a Low Mastery Level by their instructors when students did *not* agree vs. agree that both First Principles and

ALT occurred. When linear regression analysis of separate measures of these variables was attempted, there was no clear or strong linear relationship between First Principles, ALT and student Mastery. Less than 10 percent of the variance in student Mastery was predictable—i.e. aggregation aggravation. On the other hand, the triadic patterns were clear in the APT analysis.

An example of APC

Thompson (2006a, 2006b; 2008) has developed Axiomatic Theories of Intentional Systems (ATIS). ATIS Graph Theory provides a way to measure 17 structural properties of systems that include strongness, flexibility, interdependence, wholeness and vulnerability. This approach is called Analysis of Patterns in Configurations (APC).

A study of a Montessori classroom indicated that some structural properties were markedly different in two different types of learning settings: head problems and morning work period. In the latter, for example, there was much more *interdependence* with respect to affect-relation sets for *choice of learning activities* and *guidance of learning* (Koh & Frick, 2007).

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Further studies that utilize MAPSAT methods

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We describe below three new studies that employ MAPSAT APT methods. The first is a study of patterns of feedback when students are anonymous or not when critiquing each other's work during an asynchronous discussion in an undergraduate course for preservice teachers. The second is a study of the relationships between comments students receive from other students during asynchronous discussion, and the quality of the work they offer up for discussion. The third study shows how MAPSAT was used to analyze sequences of game player moves in the online Diffusion Simulation Game. These studies further illustrate the value of using MAPSAT methods to prevent 'aggregation aggravation'.

Study 1: Anonymity to Promote Peer Feedback

Problem. Present-day tools such as Learning Management Systems (LMS) provide teachers with options to make learner-learner communication anonymous (Dreher & Maurer, 2006; Lin, Liu, & Yuan, 2001; Zhang & Zhao, 2008; Zhao, 1998). By eliminating social influence, group pressure, status and power differentials, computer-mediated communication (CMC) has been credited with bridging social boundaries (Rheingold, 2000; Walther, 1996; Warschauer, 2004). However, the nature of CMC introduces possible negative consequences of using these affordances as educational tools. Anonymity in CMC poses the risk of learners acting less like individuals, and more like an uninhibited, unfriendly, and curt group—the social identity de-individuation effect, SIDE (Postmes, Spears, & Lea, 1998; Postmes, Spears, Sakhel, & de Groot, 2001). By combining MAPSAT analysis with computer-mediated discourse codes (Herring, 2004) research questions surrounding the pedagogical decision on whether or not to include anonymity, specifically psuedonymity or type 5 anonymity (Flinn & Maurer, 1995; Pfitzmann & Köhntopp, 2001) in peer feedback activities asked (1) to what extent does anonymity promote or deter students from providing constructive feedback, (2) how students' comments change when anonymous, and (3) what prescriptions can be made for teachers who use wikis and anonymous configurations in education via CMC?

Method. The learners were university education majors at Indiana University in Bloomington. The LMS was an instantiation of SAKAI. Fifty minute feedback sessions were held where the asynchronous feedback platform, a wiki, could be used simultaneously by an entire class. The study used the second of two critiques held in a course. Students posted a link to their website within their own wiki, and class members viewed and posted comments about the website design directly onto the target students' wiki. No directions about the substance of comments were given. Seventy-nine of 85 students agreed to have their work included in this study. Thirty-seven (class sizes 22 and 15) students made up the two anonymous classes where 35 of these students agreed to participate. Forty-eight students (9, 20 and 19) made up the classes where both interlocutors' names were visible. In this group, 37 agreed to participate.

Learners' online comments were broken into utterances of semantic meaning into four categories to identify the substance of utterances. The mutually exclusive codes were *constructive*, *reactionary*, *clarifying a standard* and *other*. The utterances were also coded for tone—*positive, negative* or *neutral*. Each utterance received then two codes, creating joint occurrences of the two categories. In order to get a more holistic descriptive statistic of the students' participation in the critique, without discriminating for style, a *critical feedback* measure of both implicit and explicit suggestions aggregated negative reactions with constructive utterances. An inter-rater

agreement test was performed which met the requirements set forth in Fraenkel and Wallen (2006). Learner behavior *in sequence* was investigated to determine which group, the anonymous or the known identity, had the highest frequency of patterns resulting in critical feedback.

Results. Between the anonymous and known identity groups, the mean number of comments was not significantly different, but the mean number of words and utterances written was significantly different. Anonymous participants wrote significantly more words ($p < .05$) and utterances ($p < .01$). On average per student, 71 more words and 9.5 more utterances were written over the course of the task under conditions of anonymity. Not all participants in the anonymous group wrote more than those in the known identity group. In fact, anonymous participants whose number of words written was one standard deviation below the mean wrote less than half as many words as known identity participants whose number of words written was one standard deviation above the mean. However, the patterns of the utterance types were more revealing of the differences between the conditions.

We limited our analysis of patterns to sequences of utterances leading to critical feedback, the heart of the pedagogical intervention—namely *negative reactions followed by a design alternative or suggestion*, or *positive reactions followed by critical feedback*. Some critical feedback fit neither pattern—for example, critical feedback beginning a comment. Keeping in mind that the anonymous groups had a higher percentage of critical feedback overall, means of frequencies per comment of both patterns showed significant differences between the two conditions (see table 1). The frequency of the positive reactions followed by critical feedback pattern was significantly higher ($p < .05$) in the anonymous group as was the pattern of a negative reaction followed by a design alternative or suggestion ($p < .01$). Anonymous commenters produced 10% more occurrences of the *positive reaction then critical feedback* pattern, and more than four times as many *negative reactions followed by a design alternative or suggestion* patterns than the known identity group. Thus, in the anonymous condition in these critiques, students were between 4 and 5 times more likely to provide reasons or at least negative reactions before their constructive criticism, and more likely to couch their critical feedback when they did not precede it with a reason for change.

Table 1. *Comment pattern rates per student per comment by group*

Comment Pattern (Relative frequency perer Student per Comment)	Anonymous Group ($n = 35$)		Known Identity Group ($n = 37$)		Equality of Means (2-tailed *t*-test)	
	M	*SD*	*M*	*SD*	*t*	*df*
Positive Reactions *then* Critical Feedback	.444	.215	.339	.221	2.049*	70
Negative Reaction *then* Constructive Utterance	.10	.10	.02	.05	3.79**	49

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

Discussion. This APT study suggests that not only does anonymity promote, rather than deter students from providing constructive feedback, but it also increases the meaningful part of the intervention, suggesting changes based on reasons. Meaningful engagement, including meaningful online interactions, are key elements for young designers to enter communities of practice (Schwier, Campbell, & Kenny, 2004).The SIDE theory's prediction that anonymous interlocutors would be less inhibited seems to be evident, while a negative consequence, curt utterances, were only found in an extreme outlier. Students' comments became less inhibited, however not unjustified or random. As a pedagogical prescription, we can see a basis for suggesting type 5 anonymous, pseudonymous, critiques as an introduction to basic feedback skills, keeping in mind that the condition of anonymity ignores differences between learners which might warrant unique feedback for individuals. The lower number of purely positive reactions in the anonymous groups suggests they needed to spend less time on typing out compliments and spent more time on giving suggestions. A greater amount of time exploring design alternatives and a lesser amount of time devoted to simple politeness may be a more efficient use of time spent on feedback, for both the giver and the receiver. An anonymous introduction to online feedback may provide a less stressful route to developing feedback skills in novice learners.

Study 2: Validity of Computer-mediated Formative Peer Assessment: Pre-service Teacher's Comments in Asynchronous CMC

Purpose. The purpose of this study was to compare the patterns of pre-service teachers' online comments about peer websites with instructor ratings of the same websites. Computer-mediated formative assessment by peers has specific pedagogical benefits in the context of pre-service teacher technology education. Experience with formative assessment by peers prepares pre-service teachers to be digital-age instructors, generates more feedback quickly and provides for more socio-culturally enriched contexts.

Theoretical framework. Our understanding of peer assessment is based on Topping's definition that peer assessment is "an arrangement in which individuals consider the amount, level, value, worth, quality, or success of the products or outcomes of learning of peers of similar status" and it promotes "cognition and metacognition, affect, social and transferable skills, and systemic benefits" (1998, p. 197). Peer assessment can have a qualitative/formative orientation (as in this study), quantitative/summative orientation, or both. The systemic benefits that Topping refers to include reducing the assessment burden that instructors face.

Research questions. We also needed to be aware of our understanding of the task being assessed by the learners. Learners were conducting formative assessment on assignments that attempt to address a complex and multi-dimensional problem: designing a website for learning. The challenge of designing an instructional website is one example of the complex (Reigeluth, 2009) or even wicked (Mishra & Koehler, 2006) problem of enhancing learning experiences with technology. Thus we conceptualized the study as an investigation of how formative assessment by peers does or does not align with summative expert ratings, and how learners choose to structure their discourse with peers.

Method. Five intact sections (*n*=71) of a pre-service teachers' educational technology course in 2008 at the Indiana University Bloomington School of Education produced two types of data for this study: (a) rudimentary instructional websites, and (b) comments about those websites given by peers. These data came from the same online activity described earlier in the anonymity study. Differences in number of participants in the present study were due to use of further data on the quality of student websites according to instructor ratings. Several student website assignments could no longer be accessed during data analysis phase of this study and the associated students subsequently had to be dropped from the current study.

Researchers created a rubric based on the assignment guidelines and summatively rated student websites as poor, fair, or excellent. Researchers individually rated each student's website, compared ratings, and then achieved consensus on the rating. Analysis done in the anonymity study described earlier generated data about student online comments about peer websites. Recall that in the anonymity study each online comment had been broken into utterances of semantic meaning using computer-mediated discourse analysis guidelines and quantified in terms of substance, tone, and number of words (Herring, 2001, 2004). The utterance data was then analyzed to find the frequency of specific utterance patterns associated with specific website ratings through the application of MAPSAT pattern analysis methods (Frick, 1990).

Results. The following focuses on one portion of the results associated with the MAPSAT analysis. Pearson correlations were calculated between researcher website ratings and the frequencies of two specific utterance patterns: (1) positive reaction utterance followed by a constructive utterance; (2) negative reaction utterance followed by a constructive utterance. Unlike utterance pattern one, the frequency of the utterance pattern two had a significant negative correlation with the instructor website rating, r=-0.409, n=71, p<0.0005.

Discussion. The results of MAPSAT analysis suggest a possible issue with the use of formative peer assessment that would be difficult to detect with other methods. Pattern one begins with a positive reaction that may lessen the negative emotional impact of the constructive utterance. Pattern two makes no attempt to soften the possible negative emotional impact of the constructive utterance. Pattern two is harsher than pattern one since it starts with a negative reaction instead of a positive reaction. The results show that the lower the website rating the higher the frequency of the harsher pattern two. The affective or emotional impacts of receiving overly negative or harsh feedback from peers on learning are not well understood (Picard et al., 2004) but teacher feedback patterns, such as the "feedback sandwich" (Eckstein et al., 2002), exist to reduce the negative emotional impact of providing too much critical feedback. Those with poor quality websites did not receive significantly more critical feedback that was couched with a positive reaction than did those with higher quality websites. This finding suggests that the preservice teachers in this study were harsh since they did not encourage poorer performing learners as an experienced teacher might.

Conclusions. MAPSAT analysis enabled the researchers to analyze the structure of student comments in a way that accounts for the temporal dimension. In the context of formative peer assessment, *what is written when*

matters. This study found significant correlations between specific patterns of pre-service teachers' online comments about peer websites and instructor ratings of the same websites.

This study has important implications for both teacher educators and educational technology researchers. Most Schools of Education devote at least one course to the topic of educational technology (Moursund, 1999) and consequently there is a need to provide pre-service teachers with sufficient formative feedback on the digital artifacts that they create during these classes. Distributing the task of providing feedback to students may enable technology-savvy peers to provide feedback that instructors may not be able to give due to time constraints-. In addition, lack of sufficient and timely feedback in online classes may contribute to the disconnected feeling that many students experience in online classes (Ko & Rossen, 2001). Peer assessment could help to mitigate feelings of disconnection by providing increased opportunities for both receiving timely feedback and for engaging with classmates.

Future research could focus on what patterns of feedback align with guidelines regarding what type of feedback has the most impact on learning (Shute, 2008) or on the relationship between the feedback that a student creates and the quality of the products they create.

Study 3: An Analysis of Patterns of Gameplay Data in the Diffusion Simulation Game

This study describes how the MAPSAT method Analysis of Patterns in Time (APT) was used to analyze gameplay data from the online Diffusion Simulation Game (DSG). The DSG was originally developed as a board game by Dr. Michael Molenda and Patricia Young in 1976 to help Instructional Systems Technology graduate students at Indiana University learn the theory of *diffusion of innovations*. An online version of the DSG was developed in 2002 for use in the department's growing distance education program. The use of APT to analyze the data led to interesting findings that would not have been revealed using traditional statistical methods. These findings include differences between the strategies used by expert and non-expert players as indicated by the most common sequences of activities selected, as well as the most common joint occurrences of individual staff members selected to engage in particular activities.

Statement of the problem. Fidelity is the degree to which a simulation is faithful to that which it simulates. While high fidelity may seem desirable, several researchers have found that it is not always necessary and may in fact deter learning (Alessi & Trollip, 2000; Feinstein & Cannon, 2002; Winn, 2002). Reigeluth and Schwartz (1989) theorized that the most fundamental aspects of a simulation should have high fidelity, while lower fidelity is appropriate for the more superficial aspects that may otherwise lead to cognitive overload and impede learning and transfer.

In the DSG, the strategies used are the most fundamental concepts needed for learners to understand how to take on the role of a change agent effectively. However, the strategies that have been successful in the game have never been assessed in terms of their fidelity to the strategies predicted to be effective by the theory of the diffusion of innovations.

The theory of diffusion of innovations attempts to explain how innovations are adopted by a group of people (Rogers, 2003). The theory offers strategies that a can be used by a change agent—a person or group that wishes to promote the adoption of an innovation—in order to increase the probability that the innovation will be adopted as well as to speed up the adoption process. The purpose of this study was to examine the fidelity of the DSG to the theory of innovations by determining whether the strategies that are successful in the DSG are congruent with the strategies that the theory would predict to be effective.

What is the Diffusion Simulation Game (DSG)? The DSG is a simulation game in which a player takes on the role of a change agent in a junior high school. The main learning goal of the game is the comprehension of the theory of the diffusion of innovations first proposed by Rogers in 1962. The player's objective in the game is to persuade as many of the 22 staff members as possible to adopt an innovation–peer tutoring. To be effective, players must learn appropriate application and sequencing of the available diffusion strategies.

The primary game mechanic of the DSG is the selection of diffusion activities that the player, as the change agent, can choose in order to persuade staff members to become adopters of the innovation. The diffusion activities (Talk to, Ask Help, Pilot Test, Site Visit, Print, Presentation, Demonstration, Self-administered Workshop, Professional Workshop, Workshop to Develop Materials, Local Mass Media, Compulsion, and Confrontation) each cost the change agent a different number of weeks to complete and have varying impact on staff at different times in the game. With only a two-year calendar for the change agent to complete the diffusion process, selecting the most efficient diffusion activities at the appropriate points in the game is crucial to winning the game.

Players also have access to information on individual staff members and diagrams of the interpersonal communication channels that exist (lunch mates, committees, and social networks). This information can be used to

determine which staff members to include in the selected diffusion activities. While some staff members are well connected and influential, others are not. Therefore, the selection of staff for the activities is as important in the strategy of the game as the selection of activity.
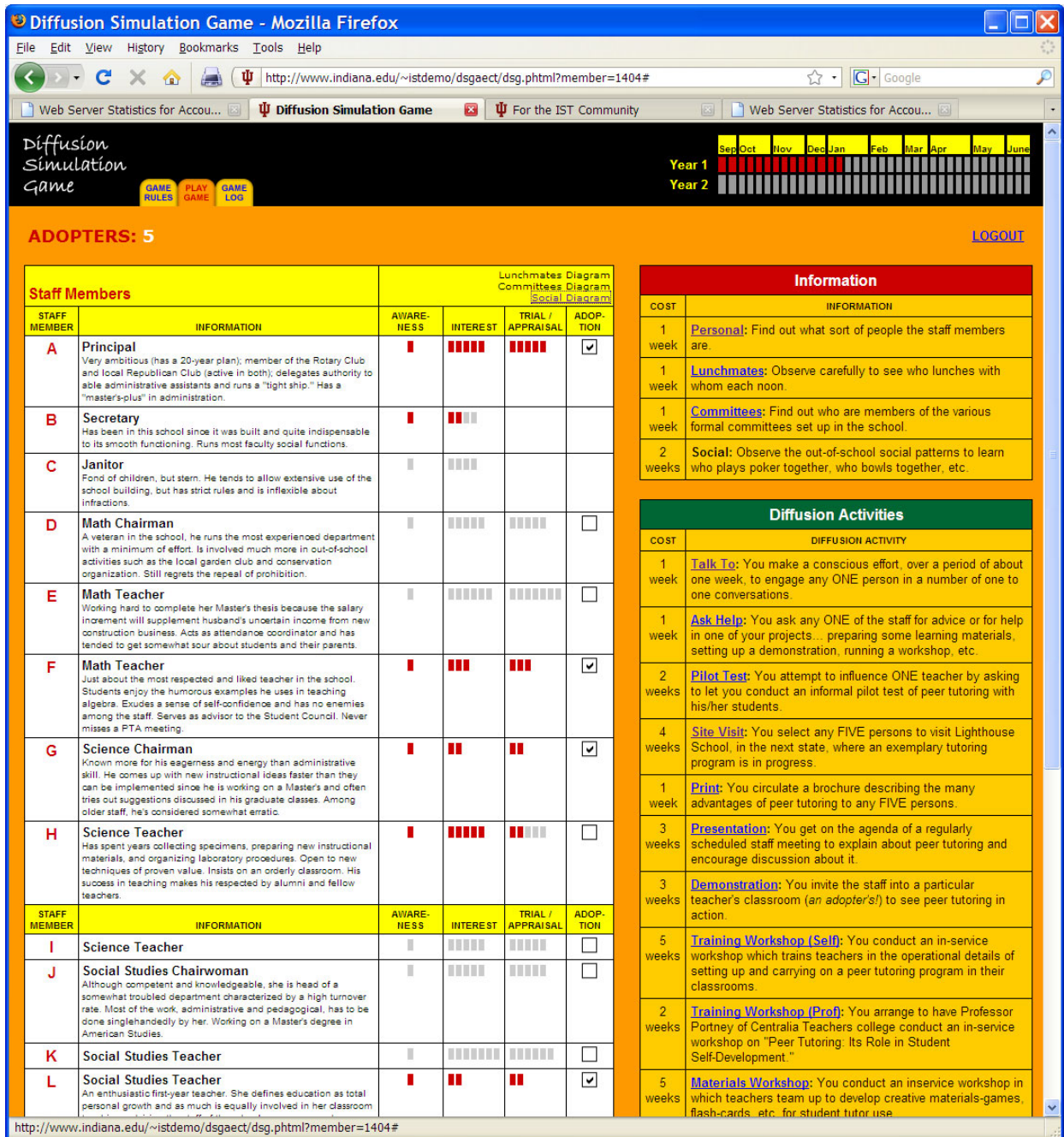
Figure 1. Screen capture of the Diffusion Simulation Game (v1) in progress.

To get staff members to become adopters, the player must progress the staff members through the adoption phases of *awareness*, *interest*, and *trial*. For each staff member, a variable number of boxes exist for each of these phases that represent how far along the staff member is in the innovation decision process. All staff members have one box that must first be filled in the awareness phase, two to seven boxes in the interest phase, and two to seven boxes in the trial phase. The number of boxes can give players insight as to what *adopter type* each staff member is: *innovator, early adopter, early majority, late majority, or laggard.*

Research questions. As previously stated, the purpose of this study was to examine the fidelity of the DSG to the theory of the diffusion of innovations by determining whether the strategies that are successful in the DSG are congruent with the strategies that the theory would predict to be effective. Specifically, the researchers attempted to answer the following questions:

1. What strategies were successful in the game sessions being studied?
2. Are the strategies that are successful within the game aligned with strategies that would be predicted by the theory of the diffusion of innovations?
3. Do other successful game strategies exist that do not relate to the theory of the diffusion of innovations?

Data collection. Due to a growing interest in the game outside of Indiana University, a free, limited version was developed in 2006 which required no university login. The data from this study was generated from the first 10,000 game sessions of the free version occurring between Oct. 7, 2006 and April 4, 2009. Of the 10,000 game sessions, almost half (4,489 games) ended with the player never selecting a diffusion strategy. The player simply did not attempt to play the game. The data set was further narrowed down to the game sessions that would give enough information about what strategies, if any, were being used throughout the *entire* game. Therefore the final data set used for the study consisted of 2,361 *finished games*—all game play sessions in which players completed all 72 weeks or won the game by convincing all 22 staff members to adopt the innovation. The sample of players was unknown as anybody with Internet access may have played the game. However—given how knowledge of the game was spread, communication from those using the game, and IP address/login information— it is likely that many players were students outside of Indiana University who were learning about the diffusion of innovations in an educational setting.

Data analysis and results. The data set was divided into three categories to be used as a means of comparing strategies used in the game. *Successful strategies* represented the 341 game sessions in which the player got 100% of the 22 staff members to adopt the innovation. Though all of these strategies led to triumph, the efficiency of how quickly players won the game varied greatly. While some players needed all 72 weeks of the game to win, others needed fewer than 40. The next category consisted of the 488 games in which 16 to 21 adopters were gained. Due to an element of randomness designed into the DSG, these strategies may have been successful or unsuccessful. *Unsuccessful strategies* represented the remaining 1,532 games in which fewer than 16 staff members became adopters.

Not only was there summative information on each of the 2,361 finished games, information for each of the 107,294 turns taken within games was available. Descriptive and inferential statistics were used to understand the data using each game session as the unit of analysis. Space precludes a detailed discussion of the results. Therefore, it must suffice to say that for the eight strategies examined, which were inferred from the diffusion of innovations theory, *t*-tests found statistically significant differences between games with successful strategies and games with unsuccessful strategies for seven of the identified strategies. This is not surprising given the large sample size (Enfield, Myers, & Lara, 2009). However, to answer the research questions of the study, analysis of the strategies within each game was needed. APT provided methods for analyzing both the sequences of activities selected and the joint occurrences of individual staff members and activities selected within games.

To understand which sequences of activities were used within games, a frequency count for every sequence of activities occurring in the data for combinations of 2, 3, and 4 turns was calculated. The analysis of sequences led to the discovery of strategies that could not have been found using inferential statistics. For instance, the most common sequence of four activities in games with successful strategies was the use of the *print* activity four times in a row, while in games with poor strategies it was the use of the *talk to* activity four times in a row. Furthermore, APT also provided methods for looking at the joint occurrences of the activities selected and the staff members selected for each activity. In games with successful strategies, the *print* activity was 3.8 times more likely to be used with the principal, 3.3 times more likely to be used with opinion leaders, and 3.5 times more likely to be used with highly connected staff members (those with connections to 10 or more other staff members) than in games with poor strategies; these targeting strategies are predicted by Rogers' theory to be successful. In examining these joint occurrences it becomes clear that successful strategies utilize communication channels (the *print* and *local mass media* activities) with influential stakeholders (the principal, opinion leaders, and staff members with large social networks).

Summary

These three empirical studies have illustrated the value of a MAPSAT approach to analysis of relations. Relations were viewed as temporal patterns in these studies. Instead of aggregating values for each unit of analysis separately and then using a linear model to study the relationships among variables, patterns *within* each unit of analysis were identified and counted. Thus, the "measure" of a variable was derived by counting instances of a pattern or relation itself within each case (unit of analysis).

For example, in Study 1, a pattern was identified: an utterance which was a negative reaction to a peer's website, *followed by* an utterance that was a constructive comment (e.g., Yuk! Hard to read. [negative reaction] You need greater contrast between text and the background to improve legibility [constructive comment]). For each student (the unit of analysis), this pattern was aggregated so that a rate of occurrences of such an utterance pattern per comment made by that student could be calculated. Thus, the pattern rate was the measure which became the value of the variable (negative reaction *then* constructive utterance). The variable was conceived as a pattern within the conceptual framework of the research. Then these variable values were averaged across students within each group (anonymous vs. known identity) and a standard parametric statistical procedure was used to compare groups (a *t*-test here).

What is important to note, however, is that if these utterance types were aggregated separately, where one variable is 'negative reaction utterance' and the other variable is 'constructive comment utterance', then we would have *two* variables not one. The only way to look at the relation between those two variables, when aggregated separately, is some kind of statistical correlation or covariance analysis. This can obfuscate the actual temporal relation. In fact, it is mathematically impossible to determine joint or sequential frequencies when only marginal distributions are known, except when relations are deterministic (cf. Frick, 1990). This is what is meant by "aggregation aggravation." If data are collected such that the patterns are preserved, then temporal or structural mapping can subsequently be done as "measures" of the values of variables. If not, then MAPSAT cannot be done at all, or can only be done in a limited fashion as in Frick, Chada, Watson and Zlatkovska (2008). Like Humpty Dumpty who fell off the wall and broke into pieces, the relationships among the pieces when Humpty Dumpty was whole are lost. Thus, advance planning of studies so that MAPSAT methods can be used is paramount.

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Meeting the Challenges of Traditional Learners in a 3D Virtual Environment: Preservice Teachers Learn to use the Prism of Avatars for Instruction.

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Abstract

This study is a Category 2: Work in Progress Report which delineates the progress of a study currently underway. Participants of this study included 54 preservice teachers in their senior year of an elementary teacher education licensure program at a Southwestern United States university. Initial findings reveal mixed response to integration of *Quest Atlantis* into a university reading methods class. Responses varied primarily along age group and familiarity with technology. Data revealed a connection between the number of participant logins and positive participant attitudes about playing in a virtual space. This study revealed the need to build a substantive background and link between theory and practice for preservice teachers.

Introduction

It is our theory that, in an attempt to prepare teachers for classrooms of tomorrow to create dynamic literacy environments, teacher preparation programs should be moving technology instruction beyond word processing, spreadsheets and use of the internet. In this presentation we will explore the theoretical link between the use of *Avatars* (i.e. alternate identities found in 3D virtual environments and video games) to move students toward specific state mandated learning goals. This paper applies, through the use of interdisciplinary studies, a new paradigm of what it means to teach and learn. The use of *Avitars* to support classroom instruction must first begin with introducing the theoretical framework of virtual literacy practices to both in-service and preservice teachers in order to allow educators to understand, through actual play, the cognitive and pedagogical connections between what is learned in a virtual game and traditional classrooms. We will first review long standing theories on the use of play as a cognitive tool for learning, then explore the connection play and cognition.

Related Literature

Make Believe as an Instructional Tool. For over a century, educational theorists (Goldman, 1998; Mead, 1934/2002; Piaget, 1962; Spodek, 1973) emphasized the importance of play as a cognitive tool for learning. Mead (1934/2002) noted that, in relation to building a socially situated identity, there is a strong need for children to play with peers to develop the idea of self in relationship to others. Additionally, Vygotsky (1978) noted the social significance of play as a way to rehearse adult behavior. Goldman, (1998) found that, for young children, social play provides an important and unique context within which cognitive and social skills may be acquired and practiced.

As a component of effective learning, little has been written of the educational potential of video games and simulations as a form of play for all age groups through the use of opportunities for social and educational play activities. As Piaget (1978) notes, "symbolic play, then, is only one form of thought, liked to all of the others by its

mechanism, but having as its sole aim, satisfaction of the ego, i.e. individual truth as opposed to collective and impersonal truth, but we are still faced by the question in make believe" (p. 167). Make believe then may lead to a sense of personal choice.

Psychological Nature of Personal choice. Across many domains of inquiry, psychologists have discussed the significance of choice as a beneficial factor for increasing an individual's sense of personal control (Rotter, 1966; Taylor, 1989) as well as intrinsic motivation as a method through which humans engage with the world (deCharms, 1968; Deci, 1981). While personal choice is a highly motivating factor, within a highly structured environment, choice may be limited. Having the ability to play with one's identity then becomes the means through which mediated learning may occur.

Pedagogical aspects of role play. According to Yellin, Jones, and Devries (2008), dramatic play provides for opportunities for cooperative learning, social skills and verbal abilities. Role playing and theatre arts have been used to support learning and "transmediation" in the Social Studies (Wallace, 2003) and Language Arts. High quality inquiry and play rich environments support increased memory, support language acquisition, and literacy (Berghoff, Egawa, Harste, Hoonan, 2000). Within video games and simulations, using first person perspective allows learners to align with an affinity group, practice skills and engage with problem solving in a relatively risk free environment while engaging in meaningful learning (Gee, 2008; Zieehezarjeribi, Graves, Gentry, 2010).

Psychological nature of Avatars. In research, specifically targeted to the psychological impact of *Avatars* in video games, Lim and Reeves (2005) found that, through the use of Avatars, "players become emotionally and psychologically involved in the game" and children learn to negotiate fictional world through symbolic representation. This symbolic representation mediates language, cultural, age, race and gender difference. Additionally, Bonk (2009) discusses the advantages of using virtual worlds as part of blended learning at the university level when he makes a formative claim that "the synchronous or real time interactions in Second Life provide a sense of a personal touch or presence that is not felt with online discussion forums and blogs. Synchronous technologies encourage immediate interaction, collaboration, and information on demand that connects students more deeply to a course" (p. 280).

Due to the psychological nature of the learning which occurs through anonymity we sought to determine first, how and why teachers would choose to incorporate virtual spaces in their own classrooms. The first step in the process of creating dynamic learning environments for elementary students had to first begin with determining what future teachers thought of virtual spaces.

Methods

Background and Setting. First year participants of this study included 54 preservice teachers in their senior year of an elementary teacher education licensure program at a Southwestern United States university. The population was homogeneous and consisted primarily of young White females. The three males in the population were all White, two of the female participants self-identified as "African-American" and "Hispanic." The course description included "methods of assessment and instruction for strategy building, comprehension, vocabulary, word identification. . .addressing reading differences including diverse learner reading processes and development of literacy in English or ELL." As a routine component of the course, participants were asked to complete at least 5 missions (Table 1) found inside a virtual game entitled Quest Atlantis (Barab, et.al, 2005). Students were given points for each mission completed. Mission completion ranged from 6 to 45 "logins" depending on the participant.

Table 1. Required Quest Atlantis Missions

Mission	Content
PD1-Intro Mission	Introduces players to the QA context. Players learn how to navigate through the virtual space
Statistics: Which Brand of Bike?	Mayor Enoch solicits help from players as consultants in his upcoming election. Players must learn to collect and interpret statistical data and create a report for the mayor.
Spacenik: NASA Needs You	Players attend a NASA conference and collect information about an asteroid named Atlas which is on a trajectory for Earth. Players must have two different scientific perspectives, report back to Mr. Newman, correct misunderstandings about a scientific concept, and travels in a rocket.
Taiga (Pre-Mission): Abby's Aquarium	Players are introduced to eutrophication, using water quality analysis, by helping to maintain Abby's fish tanks and talking to Ranger Bartle. Players must learn to balance the water quality in a fish tank, read Ranger Bartle's email, and discuss the mission in class.
Cinder Creek: Biological Indicators	Players learn to measure "biological indicators of water quality." by using a microscope to identify "macroinvertebrates" in a water sample, analyze data, and create a report on the player's findings.
Mesa Verde OLD: Welcome to Mesa Verde	Players help a friend who is having bad dreams about a missing puzzle piece in a stone image. Players are asked to correct misconceptions about the "discovery" of America. Players see Mesa Verde through the lens of an archeologist by collecting surveys measurements, talking to park rangers and tourists.

At the end of the semester, students had the option of submitting answers to an informal online interview. These digital responses became the foundation for Discourse Analysis regarding positive or negative experiences with the virtual experience.

Quest Atlantis (QA). In order to support comprehension, participants were first introduced to the back story of the virtual world. Participants first viewed the QA legacy video and were provided with login numbers which became their virtual identity. After completing several tasks, participants were allowed to modify their *Avatars* (Fig 1.).

Figure 1. Participant in "Math World"

While the *Avatar* options were limited, many of the participants were excited to have the ability to modify their attire as their mood changed. As participants received feedback or after "missions" were successfully completed, participants were addressed using only their number, "Fantastic data analysis on the Speedy Spokes, Thirty-One. The council appreciates the knowledge you are providing . . . . " In QA, *Avatars* then provide anonymity while participants learn to learn inside a virtual space.

Data Collection and Analysis. Data consisted of written responses to classroom instruction and classroom discussions found on an asynchronous discussion board (BlackBoard) woven into normal classroom instruction. These responses were analyzed using Critical Discourse Analysis (Fairclough, 2003; Rogers, 2003). Participants were required to follow a discussion board rubric which included a minimum of 500 words for full credit. Due to the asynchronous nature of the discussion board, individual participant's comments were available for viewing and feedback from all class members.

Data Analysis

Initial data analysis reveals a mixed response to learning to play in a "third space" environment. A significant difference resided between generations of students. For instance, preservice teachers within the age range of 35-40 struggled to learn the virtual world but found respite in the "virtual homework" assignments required for the course, while students within the age range of 19-35 were quick to adapt their limited experience with video games to their comfort with the use of technology.

In some cases, the pre-service teacher players remained focused how they were represented through their *Avatar* in the virtual world than accuracy of their statistical reports and analysis of eutrophication in a fish pond. Several participants gendered themselves differently than they did in the "real" world (2 older females dressed their Avatars as young males). As one of the generally self-marginalized male participants stated, "I like playing with other (university students) in the game (Figure 2). I stand at the entrance to the world and tell them, welcome to my world."

Figure 2. Avatar Welcoming Participants into Quest Atlantis
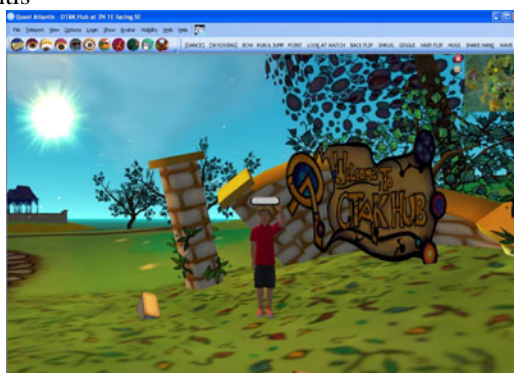
The ability to take on a new expressive identity underscores the potential impact of the use of virtual worlds for building social skills in a low risk environment. Within the virtual space, *Avitars* do not hesitate to ask for help and are more apt to advocate for themselves. Several students explained that, "to ask for help in (the game) is no big deal but when we are in class we don't want to sound stupid."

Virtual vs face-to-face participation. Expressing their feelings about the traditional classroom activities, some students made the point that the anonymity of an *Avatar* allows a certain amount of freedom of expression (i.e. identity formation). While most of the students found learning within a virtual space compelling, there were the few students who found the environment intimidating and could not learn to use the technological functions found within the game. The initial technophobia expressed by several preservice teachers, was finally alleviated through a discussion board and partnering with classmates. As such, even in the 3D virtual environment, players needed the social support for learning as typically found in a face-to-face environment (classroom).

Connection to learning. After building a background for the preservice teachers by reading literature which extolled the virtues of digital learning and new literacies, many of the preservice teachers simply did not see the connection between playing in the virtual space and fifth-grade learning. The lack of connection to learning which occurs in the elementary classroom may be due to the fact that people still see games and simulations as leisure activities and use them as rewards for completing more traditional assignments such as essays or reading

assignments. For most of the preservice teachers, vesting student time in a 3D environment simply did not fit the paradigm for traditional learning. Perhaps the failure to shift paradigms was due to the fact that most university classrooms still modeled effective instruction through the use of traditional literature such as novel studies and paper and pencil activities. Transitioning to classroom settings which include advanced technology such as simulations must also come with a shift in theories behind basic learning. Teachers must first be able to understand the notion of constructivist learning as opposed to behaviorist activities.

This reticence with the use of virtual worlds to enhance learning is expressed through three sentient comments from our participants,

"Linking technology with literacy often heightens fears for teachers who are not technologically educated."

"Many teachers do not want to take that (Quest Atlantis) route because they (teachers) are not competent in their computers skills. For fear of being so far behind in the world today, veteran teachers prefer to stick with the paper and pencil approach because it has worked just fine years before."

"I am really worried that these new programs are going to replace me (the teacher) in the classroom."

"I was never able to successfully overcome the challenges I faced while playing QA."

Reticence with technology seems to be balanced with those participants, who enjoyed the diversion of using QA as homework for their university course. As one of the successful participants stated,

"I believe happy successful students will be a far more persuasive argument for integrating technology than anything I could say."

Connection between practice and attitudes about QA. In an attempt to determine if there was a correlation between familiarity with QA and the positive comments from participants, we sorted data according to number of logins/attempts and positive, negative, neutral, and no response. The data revealed (Table 2) that the optimum login of 10-20 elicited the highest number of positive comments (15),

Table 2. Correlation Between Comments and Virtual Activity

Log Ins	Positive Comments	Negative Comments	Neutral Comments	No Response
<10	8	6	2	6
10-20	15	7	2	6
20-30	3	0	2	0
30-40	0	0	0	1

therefore, during the second year of this project we have added a minimum of 15 logins/hours of play for course requirements. Remembering that the original intention of this project was to simply familiarize teachers with the use of video games to support literacy instruction in general education classrooms, we learned that the term "to become familiar" had to be quantified in order to support pedagogical understanding for preservice teachers. In other words, teachers must be prepared to invest time to learn the intricacies of a particular game or a virtual environment before one is able to determine if that particular media meets of a particular classroom.

Play connected to "real" literacy. Many participants expressed a direct connection between "playing" in Quest Atlantis and literacy instruction. Participants noted that QA forced them to read and understand written instructions (Figure 3) as well as post detailed statistical reports to support a choice they had made within the virtual environment. The embedded nature of literacy within the normal function of the virtual experience seemed to create conditions where students were compelled to think about academic content in a dynamic environment. As one of our older female participants stated,

As each new generation makes its way into adulthood, they must possess the skills of the times. It is essential as educators to continually look ahead and as best as we can predict the skills the future generations will need. There is little doubt the 21st century generation needs technology skills to navigate the world in which they live. As responsible and responsive educators, teaching with and through technology will help ensure the future success of our students.

This study simply seeks to determine how to shift the teaching paradigm of learning through the use of technology as opposed to teaching with technology. The critical component of asking teachers to make this important paradigm shift is that there is a difference between teaching the simple use of technology and understand the potential technology holds for learning. Perhaps embedded learning is the secret to real instruction for younger students when content is naturally embedded in the virtual space, literacy practice occurs as a leisure activity.

Figure 3. Virtual Newspaper in Quest Atlantis

Most telling for this research was the fact that several of the participants, who expressed a sincere dislike for the virtual space during the data collection phase (they routinely left the computer lab in tears), later sought out our research team to report on their new found passion for "farming" (Facebook, 2009) with their friends. One participant stated, "I finally get what you were trying to tell us. You can learn and relax at the same time. This (gaming) is really addicting." Not surprising, for the participant feedback reflects what Turkle (2005) found when she stated,

> There is nothing mindless about mastering a video game. The games demand skills that are complex and differentiated. Some of them begin to constitute a socialization into the computer culture; you interact with a program, you learn how to learn what it can do, you get used to assimilating large amount of information about structure and strategy by interacting with a dynamic screen display" (p. 67).

Perhaps recognizing a direct correlation between dynamic literacy instruction and virtual spaces is as difficult as recognizing the importance of literacy instruction itself; one does not comprehend the importance of a skill until one does not possess that ability. We believe dynamic play environments may hold the key to closing the academic gap between groups of students in American public schools. Virtual spaces offer an alternative to traditional static instruction. The shift to more dynamic learning environments simply has to begin at the teacher level. Educators therefore need to be able to see how educational standards connect to the learning which occurs within virtual spaces. Some of our students are more familiar and learn best through computer software as opposed to learning situations where printed text is the sole source of instruction. We believe that virtual programs can

enhance not replace traditional face-to-face instruction. As Smagorinsky (2009) states, educators must move away from thinking about reading and literacy instruction as "one dimensional." Hull and Nelson ((2005) note

> There are great challenges that accompany the incorporation of digital multimodality into classrooms, challenges that are at once technological, economic, and pedagogic. . . . one last benefit that has to do with multimodality as a democratizing force, an opening up of what counts as valued communication, and a welcoming of varied channels of expression (p. 253).

There is a difference between learning to turn on an overhead projector to display a static image and learning to engage a student with a dynamic media such as a 3D virtual environment. We contend that technology instruction in schools of education must move beyond familiarity and into deep understanding of the powerful nature of well designed curriculums which incorporate the real potential of microcomputer applications. The use of media and technology can no longer be limited to word processing and PowerPoint presentations. There is a substitutive amount of advanced software already available in the commercial market already in the hands of the very individuals our teachers are learning to instruct.

<center>Conclusion</center>

While some teachers welcomed the diversion of playing in a virtual world, years two and three data still needs to be collected and analyzed to determine common threads of play and variations on the use of *Avatars* for instructional purposes. We believe that the inclusion of more participants (n=200) will either serve to substantiate or more clearly define participation for the preservice teacher players. Additionally, the change in requirement to a minimum log in of 15 times may shift the engagement of the participants.

Because virtual spaces are in a vestigial stage, it is too early to draw any definitive conclusions on the effects of virtual learning on preservice teachers. The response from our participants was mixed. During the second year of this project, the manner in which the professor introduces (1 hour introduction in the computer lab) and prepares the preservice teachers to engage with QA has dramatically shifted student attitudes. Participants are now expected to read several articles which build a more comprehensive background and pedagogical foundation for use of virtual spaces. We predict skeptics will always be present in our sample of participants regardless of the type of foundation or schema. A small component of our classes will always remain ambivalent about the increase use of technology in the classroom although electronic tools have impacted many other aspects of their lives. From interviews and classroom discussions, the participants report the routine use of technology in the banking system (paying bills online), shopping on the Internet, supermarket self-service checkout stations, and Global Positioning Satellite (GPS) systems. From professors on the campus, there are widespread complaints about the extensive use of texting during class. The most prevalent and universally accepted electronic tool for this group is *Facebook,* perhaps because it is one of the most popular social networks available free of charge. When asked what the difference is, many students pointed out how adding education or obvious instruction to the equation takes away the "fun" from any activity.

We are reminded again of Turkle (2005), who emphasized the tenacious nature of attitudes about electronic and cyber tools, when she stated "parents want their children to have every advantage, but this new expertise estranges them. It (technology) seems to threaten a new kind of generation gap that feels deep and difficult to bridge" (p. 66). Our initial findings reflect a similar "generation gap" which is somewhat difficult to overcome despite the course requirement of completing at least 5 missions. While many students liked playing Quest Atlantis for "homework" many students were still reticent to use alternative forms of technology (software) in their classrooms; while at the same time talking or texting with a cell phone. Virtual spaces are still seen as a form of leisure and not a context to support learning in the classroom. We predict, as paradigms on learning spaces shift, virtual learning will no longer be a foreign concept.

<center>150</center>

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Shifting the Story from Private to Public:
Resistance to Narrative Voice in Digital Storytelling

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Abstract

This qualitative case-based study investigates digital storytelling as a strategy to increase narrative voice, the relationship between the narrator and the narrative act which is captured when the narrator is a character in the story; and encourage reflexivity, the ability to relate to oneself externally. The nature of digital storytelling shifts narrative from private to public. Researchers use postmodern philosophy and narrative theory to consider narrative representation as it relates to self-construction and resistance to reveal self; the relationship between conferencing and disclosure; resistance to narrative presence; as well as ethical issues related to self-revealing in the learning environment.

Introduction

Digital storytelling is an expressive and culturally authentic form of representation that integrates personal narrative writing with digital technology. Pre-service teachers develop planning skills, learn to understand the relationship between words and images to convey meaning, and come to value digital technologies as tools for planning, writing, and sharing ideas as they construct digital stories. Digital storytelling is an adaptation of oral storytelling that utilizes multimedia and telecommunication tools to engage participants in authentic learning experiences that provide real world relevance to the learner within a situated context (Bruner 1996; Brown, Collins, & Duguid, 1989; Kearney & Schuck, 2006; Emihovich & Lima, 1995; Lambert, 2006). Designing a digital story requires participants to write a story script, record a voiceover and then select images, video, and music to elaborate the text. Unlike oral stories that are subject to varying interpretations and emphasis, digital stories become permanent artifacts, a finished product that captures a specific moment in time (Lathem, Reyes, & Qi, 2006). The digital artifact represents one telling of an experience. "A digital story becomes an object that stands alone, making it accessible for personal reflection and critique" (Davis, 2004).

Pre-service teachers in training today will in the near future be responsible for teaching in our public schools where superior writing instruction in desperately needed (Street, 2003). Learning how to write is a complex activity. The belief that writing is a learnable skill as opposed to a fixed ability is particularly important for pre-service teachers since their own beliefs have the potential to affect the learning of future students (Hammann, 2005). "As national and state standards require teachers to incorporate technology into teaching, methods courses in English language arts as well as all content areas of teacher education must be redesigned to infuse technology into all aspects of lesson design, instruction, and assessment" (Bowman, 2000, p. 98), so that pre-service teachers come to regard digital technology as an effective tool for the construction of knowledge (Jonassen, Carr & Yueh, 1998).

The digital storytelling process encourages the development of narrative voice and reflexivity. However, some participants express resistance to the public nature of digital storytelling, either through a resistance to narrative presence, self-revelation, or sharing with others. Conferencing with participants and peer feedback facilitate disclosure. In situations when participants continue to express resistance, ethical issues must be considered.

Theoretical framework

Digital storytelling promotes the development of narrative voice (Hofer and Swan, 2006). The Northwest Regional Education Lab (2001) defines narrative voice as, "…the writer coming through the words, the sense that a real person is speaking to us and cares about the message. It is at the heart and soul of writing, the magic, the wit, the feeling, the life and breath. When the writer is engaged personally with the topic, he/she imparts a personal tone and flavor to the piece that is unmistakably his/hers alone. And it is that individual something, different from the mark of all other writers, that we call voice" (as cited in Barrett, 2005). Vygotsky (1986) states that language is the primary way in which human beings create meaning. Language mediates both communication, which enables thinking with others, and also the inner speech through which individual thinking is brought under conscious control (Vygotsky, 1986, Wells, 2007). The development of higher order thinking in human beings occurs through the internalization of symbolic tools such as language, signs and images which serve as abstract tools in changing the nature of mental functioning (Vygotsky, 1986).

Bruner (1991) contends that human beings organize their experience and memory of human happening in the form of narrative which can take the form of stories, excuses, myths or reasons for doing things (Bruner, 1991). Stories serve as an organizing principle for human action and a focus for constructing meaning from experience (Bruner, 1986, 1996). Narratives serve as a set of interpretive procedures for considering departures from norms that are meaningful in terms of established patterns of beliefs. According to Bruner (1991), our stories are versions of reality; they are culturally situated, and depend on the human ability to process knowledge in an interpretive way. Stories are how individuals recount their histories. What an individual emphasizes and leaves out of a life story as well as the stance he/she takes as a victim or a liberated individual establishes the teller's identity (Rosenwald & Ochberg, 1992 as quoted in Riessman, 1993).

The storytelling process also encourages reflexivity (Linde, 1993). Storytelling serves to reinforce and magnify a student's ability to reflect on experience and personal growth (Lathem, Reyes, and Qi, 2006). Reflective writing, or reflexivity, includes self-assessment and pushes the writer to deeper self-knowledge (Davis & Waggert, 2006).

The digital storytelling process shifts narrative from the personal to the public: digital stories are created with the intention of sharing them. This is in sharp contrast to traditional writing activities, which most often remain a private communiqué between teacher and student. Telling a personal story becomes a social process for making lived experience understandable and meaningful. By making the details of one's life accessible to others in public discourse, personal narratives bridge the dominions of public and private life (Ellis & Bochner, 1992). Benmayor (2002) indicates that the digital medium allows students to tell identity stories and theorize them at the same time; thus becoming a gateway for constructing self and also for contributing a new generational perspective on identity, community, belonging and selfhood (Weis, Benmayor, O'Leary & Eynon (2002).

Lassonde (2006) states that writers use "positional writing practices" to frame their perception of self, society, and relationship to others. This, by nature, is a personal activity. In contrast, the public dimension of the digital storytelling medium enhances discomfort, or even pain, for some participants as they realize that their work has an audience (Gere, 2001). Bleich's (1995) "pedagogy of disclosure" emphasizes the need for a community that welcomes the diversity and individuality of storytellers.

Pre-service teachers become more willing to share stories when conferencing is emphasized during the writing process (Tompkins, 2007). When a facilitator conferences with a student, serving as a guide or mirror to aid reflection, students become more comfortable telling stories about their own lived experiences. Peer modeling

informs, motivates and provides information about what actions lead to success (Pajares, 2003; Schunk, 2003). Group share is a crucial part of the writing process model (Calkins, 1986; Tompkins, 2007).

Methodology

Participants

The researchers facilitated a digital storytelling project with six groups of undergraduate pre-service teachers in a reading education course over three semesters. Case studies were selected from this population. The course is one-semester introductory children's literature course designed to prepare pre-service teachers in Early Childhood Education to teach critical reading, language arts, and children's literature. The course is project-based and emphasizes both competent writing skills and effective methods to teach writing to early childhood - 4th grade students. The digital storytelling project is the culminating project of the semester. The project draws on knowledge from prior projects: picture story books and oral storytelling methods, literary elements and narrative structure, and the reading/writing workshop process. The digital storytelling project shifts the application of this prior content knowledge into the digital writing environment and engages pre-service teachers in the development of a meaningful project that integrates digital technology with narrative writing and demonstrates how digital technology can be effectively utilized in the classroom.

Design and procedure

The directed inquiry task requires pre-service teachers to respond to a focused writing prompt: Write a 200-500 word personal narrative that represents a "well-remembered event" in your life (Carter, 1993). This personal narrative becomes the basis for a digital story. The narrative must be written in the present tense using active voice. The personal narrative is recorded in the student's own voice; then combined with images, video, and music to create a digital story. We define a digital story as a short, reflective, multimedia narrative edited on a computer, using still images, voice, video, music, and sound to communicate with an audience (Lambert, 2005, Paull, 2002).

Voluntary interviews with study participants used a semi-structured script. Specific areas of interest included the planning process, story content, and the role of the author in the positional writing process (Lassonde, 2006; Merriam, 1998). The constant-comparative method of data analysis was used to code and categorize the interview data. For the purpose of this paper, pseudonyms have been used to protect the privacy of participants. Direct quotations and writing samples from participants are presented in italics.

Instructional strategies

Virtual storytelling circle: The story telling circle is an integral part of the digital storytelling process to allow participants to share initial stories and receive feedback from others (Lambert, 2006). Due to time constraints, the researchers utilized a "virtual storytelling circle." Students posted their stories on the class website. Using peer review techniques, each pre-service teacher gave constructive feedback to two postings providing suggestions and comments as a guide to the author.

Interventionist conferencing model: Researchers adopted Atwell's (1998) interventionist approach to conferencing to help students narrow story scripts and bring focus to story themes. The interventionist model emphasizes expert demonstration, an apprenticeship approach. Atwell (1998) advocates intervening directly in students' writing by telling writers what works and what doesn't.

Results

In facilitating the digital storytelling process, the researchers recognize certain elements of resistance in participants' writing. Pre-service teachers frequently exhibit reticence during story selection and resist playing an active role in the story, often because these stories will be shared publicly. Other manifestations of resistance are the use of past tense, passive voice, and third person in writing. Some participants also resist the public nature of digital storytelling: sharing their digital stories.

Story selection

Social positioning in stories is used by people to distance themselves from situations they find difficult to talk about (Harre & van Langenhov, 1999). Rogers (1992) suggests that what cannot be said overtly in subject clauses often gets revealed more covertly and implicitly in object clauses. She explains, "What is unsayable lies just beneath the surface of conscious knowing" (Rogers, as quoted in Josselson & Hieblich, 1999).

Nan is a 21 year old Hispanic pre-service teacher. Nan was initially reluctant to tell a story about her first job as an assistant dance instructor at a summer camp for disabled children. *I'm not very open with people. I love people, but people judge, and I feel like…..What are they going to say about my story? It is just a little intimidating to share. I felt like they were going to think it was cheesy or something.* Nan did not post her story on the virtual circle to be read by classmates; instead she e-mailed it to the teacher/researcher for comments. *I e-mailed Ms. Burnett and told her that I was having trouble. She read the story and said she loved it. She said don't switch. You need to focus on how you were feeling. Start with…as the curtain opened. Her telling me that motivated me to not switch again.* "Narrators select and assemble experiences and events so they contribute collectively to the intended point of the story…why is it being told, in just this way, in just this setting" (Mishler, 2000, pg 8). How a narrator tells a story conveys a great deal about the presentation of self (Goffman, 1969). In spite of Nan's initial hesitation about telling her digital story, *Not Your Typical Dance Recital*, she reveals that the reflective writing process lead her to greater self understanding. *Sharing my experience as a dance teacher for disabled kids tells a lot about who I am and my personality. I wrote about the dance recital that I lead with Makayla because she taught me so much about the world, despite her disability. It was through this experience that I found out how much I love working with children.* Nan comments on what it meant to reflect on this experience, *I have definitely grown as a person. I was a role model for these kids, especially for Makayla. She wanted to be exactly like me, and she did everything I did. Maybe that part of me because of this experience has made me grow into a role model teacher. It has made me grow and want to work with kids.* Her statement indicates how she has learned from experience and how her past experience serves to guide her actions in the present (Bloom, 1998, 2000)."Man is characterized above all by his going beyond a situation, and by what he succeeds in making of what he has been made" (Satre, 1960, 1963 as quoted in Bloom, 2000).

Resistance to narrative presence

Lana is a 20 year old Caucasian pre-service teacher. Like Nan, she experienced difficulty with social positioning. The story she posted on the virtual story circle begins….*Once every year Mother Nature gives Texas a beautiful gift unlike any other: the gift of the Bluebonnet. As if planted by angels overnight, these succulent blossoms appear everywhere – on the highways, in empty fields, and in backyards.* The Bluebonnet description is followed by a quote…the voice of Lana's mother. "Okay, Lana and Chris, we're going to take pictures in the Bluebonnets after church today." Lana does not enter her story until the third paragraph. *I hate having my picture taken. I have hated it from the time when I was young.* In the final paragraph, she describes her mother's annual photo ritual. *My brother and were put into position like dolls, while my parents took pictures…..What I really hated was the fact that I was being placed in a situation where who I was as a person was being pictured in one instant. I am more than a picture, and I resent not being seen as such.* In a tone of passive acceptance, Lana concludes, *But this is the way the world turns…..I did learn to accept that they (photos) would come with the sweetness of springtime and the Bluebonnets.* Peer feedback, provided through the virtual storytelling circle, indicates that the Bluebonnet description is picturesque, but the story needs to be more direct and concise. One student comments…. "Since your story is actually about your dislike of pictures, your first paragraph feels like it doesn't really connect or add to the rest of the story. In conferencing with Lana, the researcher asks why she is telling the story and encourages her to focus on her dislike for picture taking. Though her final version begins with the sound of her mother's voice, "Lana, we're going to be late," Lana quickly enters the story and reveals her inner conflict. *Can I do this? Today I will take my senior pictures……I hate taking pictures. I am afraid of what people will think of the image, what they will think of me. I don't want to be seen as the perfect China doll. I just want to be seen as myself.*

Trapped in the moment, Lana reflects, *Here is my chance to show the world….* Transformation occurs as she self-assesses and asserts herself. *This is my moment to shine, a moment that will last forever, even when the image of youth falls far away.…I am no longer afraid.*

Lana explains her initial reluctance to take an active role in the story. *Telling this story made me feel vulnerable. I am a very personal person. I don't like to talk about myself in personal ways. Talking about my dislike of pictures made me feel almost lacking in a certain area of myself, and I found that difficult.* She indicates that the reflective writing process leads her to reevaluate…..*I have come to realize that it isn't a "lack" of anything. I found*

that by opening myself up to others, I learn more about others, and can see that we all have those stories we hold within us. By sharing this story, I feel that I have been able to better connect with others around me, laughing off those moments that make us feel uncomfortable. It feels good to laugh these off because they are what make us more reflective individuals and more confident in ourselves.

Use of third person

Hay and White (2005) explain that the use of first person in storytelling is "as an entry point to the explorations of…identity" (pg. 1). Katie, a 25 year old Caucasian pre-service teacher, exhibits a resistance to use of first person in her writing. She begins the first draft of her digital story, *Floppy Laces*; *There was once this sad little girl. She was in kindergarten and was super smart for her age. She could already write her name and was even beginning to read and write sentences all her own. There was only one thing wrong. She couldn't tie her shoe!* Katie's use of the third person places her outside the story as an observer. In the interview, she explains that writing in first person is "too personal" and "the most difficult aspect" of the digital storytelling process for her, *I don't write about myself really. It's not something I'm not accustomed to…I'm not good at expressing myself…It was hard for me to put my thoughts like they were my thoughts. [Instead], I put it in third person; like I was writing about someone else…It was less emotional.* Conferencing with the researcher/teacher helped Katie to embrace the voice of the first person in her writing. She commented, *At the end, I did like it better, but it was just making myself do it [writing in first person]. I really liked it at the end when I saw it all together.*

Use of past tense

During multiple iterations of the digital storytelling process, the researchers observed that the most common exhibition of resistance is a resistance to the use of present tense in personal narrative; many participants have expressed discomfort to telling the story in the first person-present tense. Katie expressed this resistance in early drafts of her digital story. Katie describes one last attempt to tie her shoe, *With anger in her voice and tightly closed eyes she said, 'Under, over, around the tree, through the knothole, pull and see.' When she opened her eyes and looked down she couldn't believe it. Finally she had done it! She had tied her shoe all by herself.* Delconte (2007) explains that "simultaneous present tense narration [eliminates] the time between experiencing and telling; it also eliminates the (potential) distinction between the location of acting and the location of telling" (pg. 430). The researchers theorize that resistance to the use of present tense is intended to distance the participant from their own story.

Public nature of digital storytelling

Padma, a 20 year old Asian female, is an undergraduate pre-service teacher. Padma's digital story, *Different*, documents her experience following an incident of bullying, when she realizes that she is different from her peers. Her digital story concludes, *Today, I realized that I am different. My skin is much darker and no one has hair as dark as mine, the food I eat is different, and at home I don't speak English. How did I not see this before? How did I get to third grade without noticing that I don't fit in? I thought they were my friends. Today, I learned that I am different.* Padma did not have difficulty writing her story, but the researchers observed her obvious discomfort when her digital story was shown in class. Following that experience, Padma initially exempted herself from the interview process. Her e-mail said, *I do not feel comfortable talking about my experience. My story is very personal and even writing it was difficult for me. I had a very troubling time sitting in class watching it with everyone. Please forgive me…I hope you understand.* Although Padma and other participants knew from the onset of the project that sharing was an integral part of digital storytelling, it was the public nature of the process that proved daunting. Towards the end of the next semester, Padma indicated to the researchers that she was willing to discuss her digital story. In the interview, she stated, *This story is something that I kind of have tried to shut out of my mind because it's not something I like.* The researcher asked Padma, "What about this media (digital storytelling), what about this class made you feel like that was the story to tell?" She replied, *I felt that my story fit into the class since we had talked so much about multicultural issues and diversity.* Commenting on the digital story, the researcher tells Padma, "To me what is very powerful about your story is its credibility and honesty and your vulnerability. You could tell the story, and it would be powerful, but the fact that you created a digital artifact gives you story resonance….It is dense, it's rich with message…..so how do you feel about other people seeing your digital story?" *At first, I didn't want anyone to see it, it is so personal, but I think that I have grown from the experience.* Padma reveals that she showed the video to peers at the school where she is student teaching. *I think a*

lot of people don't understand that stuff like this still happens. I hope teachers watch it. I want people to see it and really understand that whether they physically see it in the world around them that it does happen, and there are so many kids who are hurt the way that I was. The researcher asked Padma what it meant to her to tell her story. *I wasn't really hiding from it (being different) any more. I was telling people about who I am and where I come from. I was opening up a side of me that most of them haven't seen.* Explaining her discomfort in class when the video was shown, Padma acknowledges that her story is important for others to hear, but avers that she does not enjoy discussing her personal differences or desire to be a focus of attention. *I don't always like being the one that's different. I like being able to tell them my experiences so that children, their students, will benefit from it, but at the same time, I'm not very keen to hear what they (other pre-service teachers) are going to say after that.*

Educational Importance of Study

Hofer & Swan (2006) indicate that iterative formative evaluations help to improve the implementation of an instructional approach such as digital storytelling and lead to the development of a theory of teaching and learning. The educational importance of this study resides in its attempt to analyze multiple implementations of digital storytelling and barriers to successful writing. The most significant findings of the research is the perceived benefit of digital storytelling as a pedagogy to engage students in a writing process that leads to the production of a meaningful artifact that can be reflected on by the author and shared with others and to increase their valuing of digital technology as method to teach writing in the classroom.

Two areas of interest stand out in the interview data. Students indicated that the virtual storytelling circle supported learning. Not only did students read two stories to provide feedback; most said they read most all the stories on the class site. Reading other student's stories helped students make decisions about their own work. The virtual story telling circle served as an active learning environment. Students reported that feedback from peer mentors was useful, but the greatest benefit came from being able to read many stories.

Students also talked about how helpful conferencing with the researchers was. Adoption of the Atwell's (1998) interventionist approach to conferencing helped students to refine story scripts. Interventionist conferencing took place in the classroom; however, much additional conferencing took place in e-mail messages and postings to the virtual story circle. Students indicated that receiving direct input about how their writing could be improved was extremely helpful. The positive relationship between the researchers and students, collaborating together, seemed to increase students' confidence in their own writing abilities.

Researchers also became more aware of the relationship between the guiding role of the facilitator, who serves as a mirror to aid reflection through conferencing and students' comfort level in telling stories about their own lived experiences. Teachers and professors that decide to integrate digital storytelling into their classrooms must consider the ethical implications of the process (Haney, 2004). This is particularly important when students are attempting to discuss emotional or distressing accounts (Gere, 2001). Students resistant or pained, after repeated conferences, should be encouraged to consider other topics for their digital stories (Haney, 2004).

Writing visually produces a new form of social text (Ulmer, 1989, p 3). "The 'truths' of narrative accounts lie not in their faithful representation of a past world, but in the shifting connection they forge between past, present, and future"(Riessman, 2001, p 342). In interviews, participants revealed that they felt empowered by the process of constructing a digital story and sharing the videos with peers. Pre-service teachers indicated that that they would use digital storytelling in the future with students. Most importantly, they came to understand that the stories we tell allow us "to know ourselves and others and the positions from which we speak" (Ellis & Flaherty, 1992).

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Using the Power of Facebook as Interactive Recruitment Tool

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Abstract

The purposes of the project were: (1) to create a social networking forum that would promote the Instructional Design and Technology Department (IDT) undergraduate program to high school students, community college students, transfer students, and the parents of prospective students, and (2) to provide graduate students an opportunity to work with "a real" client (a faculty member) on an actual project management scenario that involved the use of instructional project management principles and skills. During their project management course, two graduate students used a systematic approach to this project (ADDIE/IPECC) starting with the assessment of the departments' need and prospective students' needs and ending with presenting the product to the client and documenting it. The Facebook page provided information about the program including links to enrollment, campus life and environment, and multimedia examples of past students' work. This project provided the graduate students an opportunity to discuss general issues in instructional project management as well as to practice mentoring behavior with the graduate student peers in order to gain experience in management roles. Findings of the Facebook project and implications for increased interactive recruitment through social networking for higher education institutions will be detailed.

Project background

Graduate students enrolled in a project management course to experience how to implement a project management activity in a real world. The course that allowed the students to go through a project management simulation is critical in order to give the students knowledge and skills needed by real fields of work. The Instructional Design and Technology Department (IDT) provided the students an opportunity to work with the department to promote the department undergraduate program online through a social networking tool. Working with a real client in this case an IDT faculty member supported students' activities and outcomes.

Prior to the project, the IDT Department had promoted their department the university's website and through printed materials. The department chair and faculty member wanted to promote the undergraduate program through social networking means as well.

Today, there are many sites on the internet that are visited by many people globally to get information and to connect with others. One of the most popular sites currently used by both younger and older generations is Facebook.com. This trendy networking tool provides various options for connection with old and new friends, self promotion, distribution of information to the masses, and even specific forums creation. The use of social networking tools is increasing among students, with a whopping 85% of college students using Facebook according to Social Media University's Lee Aase (Ward 2008). In 2008, the Next-Student Student Loan Blog described an increasing number of higher education admission offices who are using Facebook to recruit and interact with prospective students. Social networking sites are where many incoming students are going to for social interaction, information, and informal learning ("Networking Sites."-2007). Based on the popularity of Facebook, the IDT Department proposed the promotion of the IDT program through a Facebook group and link it to create links to the department's website.

Project goals and objectives

The main goal of this project was to create a social networking forum that would promote the IDT departments' undergraduate program to high school students, community college students, transfer students, and parents of prospective students. The other goal of this project was to provide graduate students an opportunity to work with a "real" client (a faculty member) on an actual project management scenario that involves the use of instructional project management principles and skills.

Specifically, this project has the following objectives:

1. Organizational objectives: a) increase communication between the department and students, and b) promote the IDT Department widely through Facebook; and

2. Instructional objectives: a) apply the project management theories into real word situations, b) gain experience in working with a real client, and c) turn client's needs into project outcomes.

Project management and project development

Wysocky (2007) defined project management as "a method and set of techniques based on the accepted principles of management used for planning, estimating, and controlling work activities to reach a desired end result on time-within budget and according to specification" (p. 34). In order to plan, estimate, and control the project activities, a method and techniques based on principles of management are needed to reach the project goals. To develop a project, one must not only apply the project development activities but also apply the project management activities as a framework of project development activities.

According to Russell (2002), project management consists of activities to manage a project, including planning, organizing, and controlling work. Project development consists of activities to develop a project and it involves the analysis of skills or a knowledge gap, design of the solution, building and testing the solution. Lynch and Roecker (2007) stated that good instructional design and good project management are different. They are not interchangeable although they may go hand in hand.

Lynch and Roecker (2007) described the relationship between the project development procedure called the ADDIE model (Analysis, Design, Develop, Implement, and Evaluate) and the project management model called the IPECC model (Initiating, Planning, Executing, Closing, Controlling) in managing and developing a project. The relationship between the two models can be seen in each phase of ADDIE and IPECC models. In the first phase or initiating phase of IPECC model, the project goal is established and the project objectives are determined. The second phase or planning phase of IPECC model is related to the analysis stage of the ADDIE model. The third and the fourth phase of IPECC model which are executing and controlling phase are connected to the design and develop stages of the ADDIE model. The fifth phase or closing phase of IPECC model is related to the implementation stage of the ADDIE model. The last stage of the ADDIE model that is the evaluation consists of the project evaluation report and project documentation activities.

For this project, the graduate students used a systematic approach that is integrated ADDIE-IPECC approach. They used a combination of the ADDIE model (Analysis, Design, Develop, Implement, and Evaluate) and the IPECC model (Initiating, Planning, Executing, Controlling, and Closing).

Initiating

In the initiating phase of the ADDIE-IPECC model, the graduate students conducted five tasks, involving stating the opportunity, establishing the project goal, determining the project objectives, establishing the client's need, and creating a request for proposal (RFP) that shows a clear statement of need and to have external input for the project.

Planning (analysis)

In the planning phase, another student team reviewed the RFP for the Facebook page, identified the project activities, estimated the activities duration (timeline) (as seen in Figure 1), determined resource requirements (analysis the Facebook page and the materials needed for the page), created communication plan, created a risk management plan, created budget worksheet, created the criteria for level of acceptance, created a proposal, and presented the proposal to the client. After the proposal was approved by the client, the students who created the RFP also created the contract and gave it to the client to be reviewed and signed.

Executing and controlling (design and development)

In the executing phase, the graduate students used the other team's proposal to design and develop the Facebook page. In addition, the graduate students modeled the department's Facebook after the university existing Facebook page. The University's Facebook page had been named the"College and University: Facebook Page of the Month" for January 2009 ("College Admission Offices Using Facebook, 2008; "Universities of the Month," 2009). The university's Facebook page can be seen in Figure 2. Facebook commended the University for its Facebook page organization and "personality" of the page. The AECT WIU student chapter also already had presence which featured the events of the students' organization and information about the national AECT organization as seen in Figure 3.
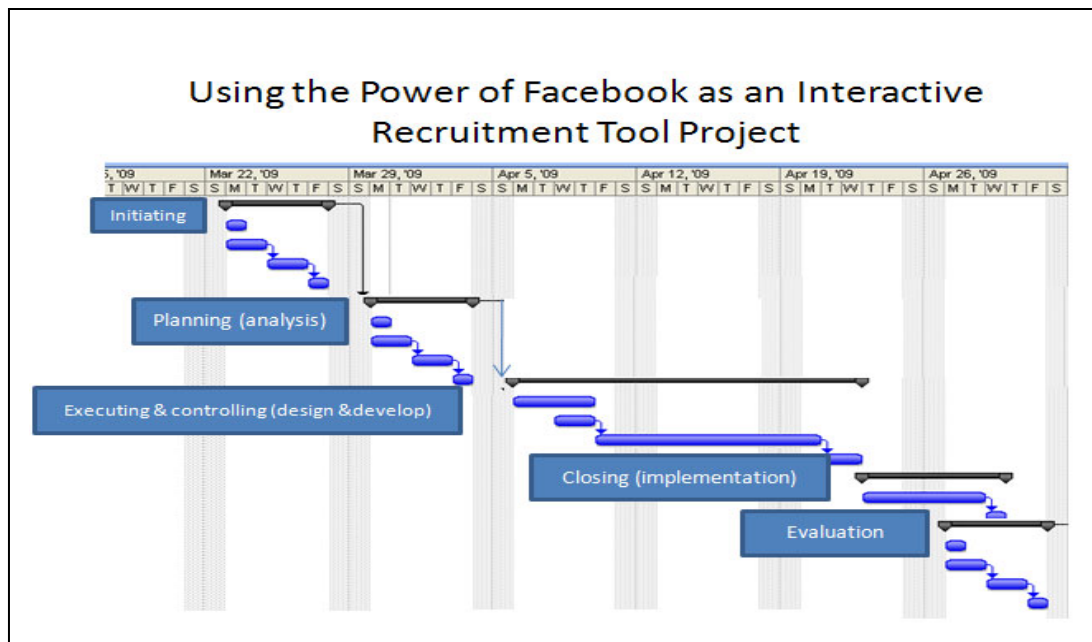
Figure 1. Project timeline.
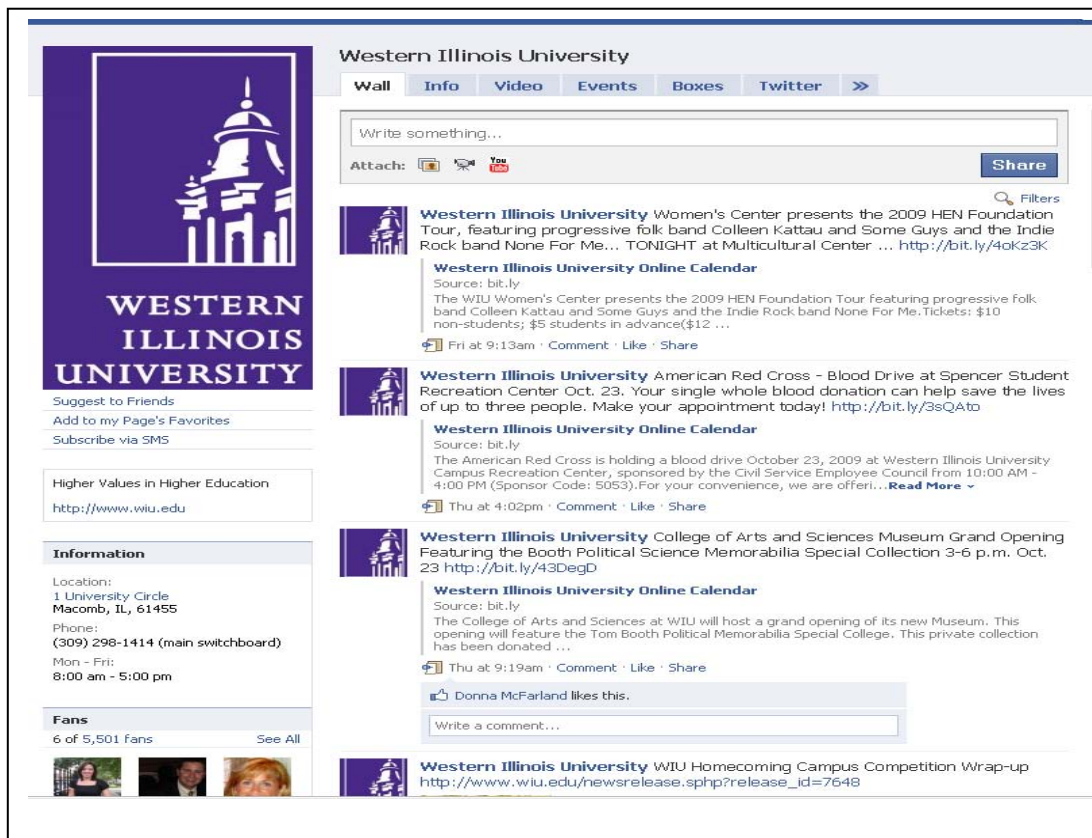
Figure 2. University's Facebook page.

Figure 3. WIU AECT Chapter Facebook page.

For the IDT Department undergraduate program Facebook page design, we chose the Facebook layout (Facebook Page) and created a storyboard as a guideline to develop the page. Based on the storyboard, the prototype was produced and materials were collected. Controlling was done during the design and development processes and we conducted three tasks: establishing the progress reporting system, monitoring project progress versus lesson plan, and revising the project plan when necessary.

Closing (implementation and evaluation)

After we created the prototype and collected the materials, we incorporated the materials on the Facebook page and we also created an account for the client on Facebook as seen in Figures 4 and 5.

The last phase of integrated ADDIE-IPECC model is evaluation. In this phase, we conducted the following tasks: evaluating the product, reporting the product evaluation, signing the acceptance product document, completing project documentation, and celebrating the ending of the project.

Findings

Several findings emerged from this project. First, the Facebook page for the IDT Department was created and met with the client's needs and expectations. The client accepted the product and signed the acceptance product document. The client was optimistic that Facebook page would be beneficial for the IDT undergraduate program to invite and attract prospective students' to consider and finally enroll in the IDT undergraduate program. The Facebook page was created by considering its usability (easy to use, easy to learn, easy to navigate), its interactivity (two-way feedback), and dissemination of information.

The combination of the two procedures helped the graduate student authors to obtain an understanding of project management and its associated activities. As a project manager in instructional technology projects, the graduate students had gained the hands-on experience of developing an entire project using project management skills. The responsibility to the project management plans, control of the project progression, and reports/evaluation of the project were main activities that the students went through to develop their managerial skills. In addition, they also learned to work cooperatively and take responsibility as a team. This form of learning allowed them to not only work together but also to develop their social and collaborative abilities.

Third, using the integrated ADDIE and IPECC model, the students learned how the project management activities and the project development activities work at the same time in a-real world application. The students experienced how complex it was to develop and manage a project. Furthermore, the opportunity to work with a real client trained their skills of managing and developing a real project, including improving responsibilities, maintaining an open communication with the client, and being flexible on the tasks, while staying focused on the goals and objectives.

Figure 4. WIU IDT undergraduate program Facebook wall page.
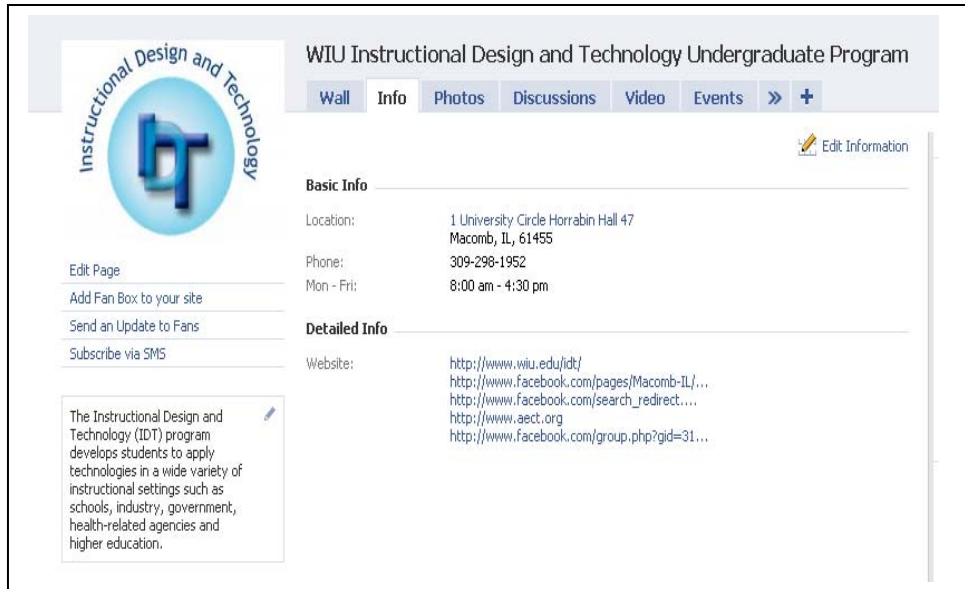
Figure 5. WIU IDT undergraduate program Facebook links to other sites page.

Conclusion

Based on the findings, the following conclusions were made:

1. The IDT Department now has social networking tool to promote its undergraduate program. Using Facebook as an interactive recruitment tool for an education institution would be beneficial for the institution itself and the prospective students in term of usability, its interactivity, and dissemination of information.

2. Developing a project for a real client involved two major activities, project management activities and project development activities. The integration of IPECC and ADDIE models to develop a Facebook project combined two systematic procedures that allowed the students to work cooperatively on a team to meet the client's expectations.

3. The project management course is the framework and basis of the project development activities. It is suggested that this course be a core course for the graduate students in the IDT Department.

Practical Implications

The following are some lessons learned throughout the project that would benefit the students to manage and develop future projects of instructional technology"

1. Developing a social networking project to promote organizations or institutions in a real-world context can be done by integrating the two procedures, the project management procedures (IPECC) and the project development procedures (ADDIE).

2. Applying a systematic procedure to manage and develop a project is crucial

3. It is essential to have an opportunity to work with a real client to train the senses of managing and developing a real-world project that would prepare the students to be more knowledgeable and ready to enter a real field of work.

4. In terms of working with a real client, clearly stating the client's needs and expectations, being flexible, and creating open communication, are initial methods and strategies to direct the project on the right track.

5. In order to give the students a comprehensive and complete understanding of the entire process in project management of instructional technology, the project management of Instructional Technology course should provides all graduate students with hands-on experiences in project management and development activities.

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Designing for Affect: The Potential of Social Networking for Teacher Education

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Emerging Web 2.0 tools are increasing the capability of designing online learning that provides rich affective environments that positively impact learning communities. Many advocates promote the use of social networking for community building, but some critics have suggested that the links between computer-mediated communication (CMC) and deep learning or engagement are not well documented, proposing that such advocacy is more a potential than reality (Godwin, Thorpe, & Richardson, 2008; Rourke & Kanuka, 2009; San Millan Maurino, 2007).

In this mixed methods case study, the author examined the impact of implementing a social networking tool in an online course to determine whether there was evidence to support positive impact on student outcomes, particularly in relation to the affective domain of learning. Does social networking improve student's sense of belonging to a community? Does community building impact student evaluation of the course? Does social networking increase engagement and motivation? Most important, does such interaction through social networking have an impact on student learning?

To examine these questions, a social networking tool, Ning (http://www.ning.com), was implemented in an asynchronous distance education college course to supplement the tools in the institution's online course management system. Ning has become a hot tool in educational settings over the past two years. The site ranking service, alexa.com, shows Ning as the 63rd most popular Web site in the U.S. in the second quarter of 2009. The social networking site has almost 7,000 Ning networks tagged with "education" via a search in September 2009. Its "Classroom 2.0" site boasts 30,500 members and 7,000 members in "Ning in Education," suggesting the reach of this tool in both K-12 and higher education.

The following is a report on the impact of using Ning in a summer online course within the context of learning theory and technology affordances in course design. The case study included 51 students enrolled in four sections of an undergraduate summer 2008 class, "Computers in Education." The online course was fully asynchronous with bi-weekly modules. Students used multiple online collaborative and local productivity tools, although the main content for the educational technology course is structured within a traditional course management system (CMS) supplemented by external tools including Ning. The potential for enhancing learning through the intentional addition of tools to facilitate the affective dimension of learning is demonstrated in this study of a teacher education course with learners indicating exuberance for the new tool, increased satisfaction with the online course, and self-reported positive impacts on their learning resulting from a supportive collaborative environment.

Background

While more students are experiencing distance education, few report that they make this choice primarily because they like distance learning (DL) classes. Typical reasons are more commonly related to flexibility in scheduling or geographic issues that create barriers for reaching traditional campus-based sessions (Rovai, Ponton, Wighting, & Baker, 2007). Even when students indicate that they have had a positive DL experience, many raise the issue that it just doesn't seem the same as actually being there and interacting in a face-to-face setting (Perez-Prad & Thirunarayanan, 2002). In a recent international review, Armstrong and Franklin (2008) indicated that even digital-age students who enter higher education are deeply enculturated in the traditional processes of schools and classroom learning, setting specific mental models for expectations and interactions. This view includes the hidden assumption of social interaction and engagement well understood within the traditional classroom that establishes a framework for affective aspects of learning. Considering such factors in the design of online learning is proposed as a means to increase social interaction and engagement (Perez-Prad & Thirunarayanan, 2002).

Community building in online courses is a common recommendation as one way to both improve learning from a constructivist perspective as well as establish a social context in distance learning. Further, student-to-student interaction has been promoted as one of the keystones for positive evaluations of distance learning as shown through multiple meta-analyses of DL (Tallent-Runnels, et al., 2006; Young, 2007; Zhao, Lei, Yan, Lai, & Tan, 2005). In addition, student satisfaction was shown to be related to a sense of presence, having interpersonal communications needs met, and being treated as individuals (Dennen, Darabi, & Smith, 2007; Mazer, Murphy, & Simonds, 2007). Today many online classrooms incorporate such common tools as email, discussion boards, and more recently,

blogs, wikis and various Web 2.0 tools that not only can support content learning but enhance interaction. Commonly such tools are used as part of required course discussions, with previous studies indicating use was more prevalent when required and graded (Dennen, 2005; Hamann, Pollock, & Wilson, 2006). Informal use was uneven when the opportunity was made available but not mandatory.

Social network sites (SNS) in higher education

With the growth and popularity of social networking external to formal educational settings, advocates have argued that these tools not only provide powerful affordances for community building in distance learning, but potentially are transformational technologies for higher education more generally (Hart, 2008; Mason & Rennie, 2008). Social networking covers a wide range of online environments, with many formal definitions broad enough to encompass almost any Web 2.0 tool (Alexander, 2006). Boyd and Ellison (2007) include three criteria in their definition of social network sites (SNSs) which are:

> web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system. (paragraph 4)

They note that many SNSs allow users to write comments on "friend's" profiles and send private messages although these are not universal features. Rather than communities organized by topic, SNSs are "structured as personal (or "egocentric") networks, with the individual at the center of their own community" (Boyd & Ellison, 2007). Perhaps more critical from an educational viewpoint, many of the SNSs are enhanced with multiple collaborative tools that go beyond the personal profile and "friending" links, including the ability to post and share files (text, images, audio and video), participate in discussions or blogs, co-create and edit content with wiki-like tools, and link in and tag external resources from other web sites paralleling social bookmarking. Sites such as Flikr or YouTube, despite meeting the Boyd and Ellison criteria, are in fact more commonly seen as environments primarily for sharing content, digital pictures and video respectively, rather than SNSs. Studies of users of SNSs have shown SNS sites have the capacity to increase social ties and interaction, provide an outlet for self-expression, and assist in helping with information seeking and task completion (Gallant, Boone, & Heap, 2007).

While various public collaborative environments existed on the Internet as early as the 1980s, the emergence of social networking as it is best understood today arose with the massive commercially-supported sites early in this decade, including MySpace in 2003 and Facebook a year later. By mid-2009, these two sites had rapidly moved to the top five for Internet traffic in the United States, and within the top 11 internationally as reported by alexa.com. Because Ning itself is a new SNS, limited peer-reviewed studies of its use in instruction are in print. Other studies of teaching use of social networks have been published (Mazer, et al., 2007; Minocha, 2009), while Ning education sites such as "Ning in Education," http://education.ning.com/, abound with personal testimonies to the effectiveness of Ning in teaching.

Social networking provides novel affordances for computer-supported collaborative learning (CSCL), particularly in asynchronous environments (Grant, 2008; Idris & Wang, 2009). In a recent report studying the uses of social software in the higher education, Minocha (2009) found that educational goals for employing SNSs included initiating new ways of learning, giving control to students, providing transferable skills, peer-to-peer learning, enhancing reflective learning, creating a digital identity, and fostering social engagement. The case studies reviewed showed multiple benefits in using SNSs, including retention, socialization, collaborative learning, engaging students, sense of control and ownership, problem-solving and sense of achievement, visibility of artifacts created, integration of multimedia, adding novelty and excitement to the learning environment, overcoming isolation and geographic differences, and students' positive perceptions of the educator involved in SNS initiatives.

From a design perspective, these tools are well suited to provide a learner-centered orientation and support both formal and informal learning interactions seen as critical to community and collaborative meaning-making in constructivist learning. Further, the public and no-cost nature of these tools allows designers and instructors to incorporate them in post-secondary education without the restraints often imposed institutionally on what software or support resources are available for instruction, allowing freedom to mix and match to meet specific course objectives and pedagogical strategies (Boyd & Ellison, 2007; Grant, 2008). Others have advocated for the use of social networks in formal educational settings based on the prevalence of use by the current digital generation of students and their expectations for technology integration (Hart, 2008; Pence, 2007). As noted in a recent reports on

the use of Web 2.0 tools in higher education, institutional supports are uncommon and most adoption of SNSs for teaching has been at the individual staff level (Ajjan & Hartshorne, 2008; Armstrong & Franklin, 2008), although administrative uses for recruiting and public relations have grown over the past year.

Affective domains of learning and SNSs

The implementation of intentional affective strategies in the design of online learning environments have often been ignored in higher education because of a lack of good tools and because of attitudes that equate adult learning solely with cognitive functioning (Craig, Graesser, Sullins, & Gholson, 2004; Main, 1992; Pierre & Oughton, 2007; Shephard, 2008). Pierre and Oughton (2007) note the affective domain "refers to our attitudes and willingness to take part in new things, and ability to make decisions about how we operate and behave in a variety of circumstances" (p. 3), so that it is essential for both motivation and cognition. Hudlicka (2003) stated in a review of the psychological research on affect that it is "critical for the successful completion of a task, for avoiding (often disastrous) errors, for achieving optimal performance" (p. 6). Individuals in a positive-affect condition reduce time to task completion and are more successful in completing tasks (Isen & Reeve, 2005).

Affective issues are known to "exert powerful influences on learners' ability to engage with learning and to progress" (Rose & Meyer, 2002, Ch. 2). Rose and Meyer (2002) argue that

> understanding affective issues can help teachers support all learners more appropriately. Of the three learning networks, affective networks are perhaps intuitively the most essential for learning, yet they are given the least formal emphasis in the curriculum. All teachers know how important it is to engage students in the learning process, to help them to love learning, to enjoy challenges, to connect with subject matter, and to persist when things get tough. When students withdraw their effort and engagement, it is tempting to consider this a problem outside the core enterprise of teaching. We believe this is a mistake. Attending to affective issues when considering students' needs is an integral component of instruction, and it can increase teaching effectiveness significantly. (Chapter 2)

Over the past three years, there has been increasing advocacy for and research showing the critical importance of the socio-emotional aspects in distance education (Xia, 2007), an area long recognized in the traditional classroom as a key to motivation, engagement, satisfaction, and positive interpersonal interactions leading to effective learning (Main, 1992). Based on research on distance learning courses, students are seeking presence and the immediacy of the face-to-face classroom (Perez-Prad & Thirunarayanan, 2002). Beyond interaction, social networking is enabling new capabilities to support affective domains of learning, in part because these new tools make this a more easily envisioned and achievable goal (Minocha, 2009). This study is an examination of the premise that social networks can enhance the affective aspects of learning in a distance education class.

Method

The research design is a mixed methods case study following Yin (2003) in using both qualitative analysis and rich description. The use of case studies was recommended by Godwin, Thorpe, and Richardson (2008) as a way to better understand the high variance and conflicting results of earlier studies of computer-mediated interaction in distance education. In particular, the authors noted the need to fully document the specifics of design to avoid over-generalization as well as point to variables that potentially impacted these mixed results.

This case study involved two classes representing four sections of an undergraduate educational technology course. The class was an asynchronous online course offered in summer 2008 conducted in a six-week condensed format at a large public research intensive university. No face-to-face sessions were available, although each class had two optional synchronous sessions for students with questions. Only four students total attended these optional events. Each class was taught by two instructors with a different lead in each class. The course is required for students in teacher certification programs and an elective for graduate students.

The two classes included 51 students, with 11 males and 40 females reflecting the common predominance of females typical of education courses. 60.1% were in teacher certification programs with 23 undergraduates and 8 post-baccalaureate. The remaining 19 students were in graduate programs or were practicing teachers taking summer courses for professional development. For seventeen students, the class represented their first online course experience, with twelve more having taken only a single one. The class represented a range of age groups, with 27 students in their early twenties and the rest older, including five students over 45.

Data for this analysis came from multiple sources, including course materials and teacher field notes, student artifacts, and student achievement via final grades. 48 students completed an end-of-course evaluation which included open-ended questions about the course and the use of social networking. Analysis included both statistical and qualitative coding. Data on their use and interactions was combined with post-course evaluation comments to analyze levels of interaction, tool use, satisfaction, and impact on actual and perceived learning. Analysis included coding and thematic analysis of textual comments on evaluations and social network analysis of interaction patterns recorded within the course Ning site.

The Case Setting

As part of an iterative design process which has been ongoing over four years to improve student evaluations and satisfaction with a required educational technology course for preservice teachers, a social networking tool, "Ning," was incorporated as a central component of summer classes. Initiated when a comparison of face-to-face versus online classes showed consistently lower student satisfaction ratings on evaluations, even with the same content and instructors, the course has become a laboratory for an ongoing design research study on the impact of tools and strategies on student learning, attitudes, and engagement in online learning (E. Hoffman, 2008; E. Hoffman & Menchaca, 2008; E. Hoffman, et al., 2008; E. S. Hoffman, 2009; Menchaca & Hoffman, 2009).

This course, "Computers in Education," evolved from earlier F2F and text based online versions developed by other instructors, with major online revisions in 2006 and 2008. Earlier research findings showed that increasing instructor presence had a positive impact on student end-of-course evaluations, raising the ratings on overall satisfaction and teacher factors to levels comparable to the face-to-face versions (E. Hoffman & Menchaca, 2008). But students continued to write that they missed the interaction of the classroom and either preferred or had no preference in selecting face-to-face over in-person classrooms. Few students said they would prefer a DL option if they had a choice. Discussion boards and group projects helped ensure both student-student and teacher-student interactions, and these were viewed positively. Based on student comments, still missing was the immediacy of talking and informal interactions that made classmates "real," paralleling earlier studies suggesting teacher presence is easier to establish than student presence (Russo & Campbell, 2004). These absences are the spaces where students informally note the weather, learn about what happens beyond the classroom, comment on the day-to-day events in school, view dress and demeanor, and even commiserate on the level of homework assigned, establishing a positive affective learning environment. Such conversations and interactions beyond content are part of the community building that have been more difficult to approximate in asynchronous classrooms.

The course had been designed using the institution's course management system, which changed from WebCT to a version of the open-courseware product Sakai in late 2007. Many students had experience with the CMS prior to the educational technology class as it is used both in distance education and as a supplement in face-to-face classes for education students. In this course, the CMS was used to provide content through lesson modules and assignment details. Final assignments were uploaded through the CMS, and grades posted in the online gradebook. The course does not use a textbook with the goal of keeping content highly current and linked to real-world examples, so all readings are done online with multimedia and interactive components as well as text used in presenting concepts.

The course evolved both through new tools and improved design, but a key piece in recent years has been the ability to incorporate Web 2.0 tools. In summer 2008, the most noticeable change for students was the strategic placement of social networking as a course tool with the addition of Ning. Ning was the space for required asynchronous discussions rather than in the CMS. This particular tool was selected because it was more bounded than the major public sites like Facebook and MySpace, allowing for creation of a private class-member only network. Further, Ning includes a threaded Forum tool which not only presents a student's response but also a thumbnail picture each time they post, a means of continually reminding students that the respondent was a real person. From a design perspective, a social networking tool met needs for a more comfortable, user-centered space for student-student interaction than was found in the institutionally provided course management system. Ning was particularly useful for posting student-contributed files, images, and multimedia. The course Ning became a model for the use of emerging collaboration technologies to support learning objectives while injecting a space that was familiar to the "digital natives" making up not only half the course's students, but all the children these future teachers will encounter in K-12 schools.

In the first week of class, students were required to join the course Ning, create their profile page including posting a picture of themselves, and encouraged to answer some questions on their profile page to introduce themselves to their classmates. They were informed that the Ning was limited to class members-only so that privacy was assured. No tutorials were provided although the course module linked to help documents found elsewhere

online for those who wanted additional information. The only initial problems reported were technical related to registering for a Ning account, suggesting students quickly figured out the interface. Students were then required to respond to a Forum discussion question in Ning introducing themselves as a way to ensure each understood the tool which was later used for both required discussions and sharing assignment products such as documents, useful Web sites, and lesson plans. The course design included 12 required discussions over the six week period in Ning, with half of these requiring not only a response to the posted question but a reaction or reflection to other students' posting. When not required, students had the choice of reacting to other's answers.

Other features of Ning were offered as options but not required during the course. The instructors periodically posted pictures and videos, created blog entries which included teachers from local schools sharing their experiences, and posted non-required discussions to share information and useful Web resources. Built-in features always evident to students logging in were member pictures, indications of who was online, and updates to what recent activities other students had done in Ning.

Student Actions and Reactions

Results from end-of-course student evaluations indicated that all but one student were highly satisfied with using Ning. In coded results from open-ended responses about their reactions to the course overall, almost every response was related to the social network components. Eighteen mentioned the ability to get to know the other students and 17 indicated they like the level of interaction, with over half indicating it was enjoyable and fun. In fact, several said the social connections established were better than in traditional classrooms, including these:

> I loved the personal piece of it. I enjoyed learning from my peers and seeing what works for them in their classroom. I also liked that I really got to know those students with whom I had more in common with. It was easy to communicate and nice to learn about everyone in the class, whom I may not have interacted with in a face-to-face class.

> [Ning] has various meaningful functions that can replace traditional classroom environment. It makes teaching and learning activities more collaborative, interesting and enjoyable.

Students were satisfied with the ability to discuss ideas in class and the intensity of interaction that developed. There was an appreciation of differences and a strong sense of personalization. Students wrote:

> The best thing I like about the Ning experience is the discussion activity with the use of technology. I think that it helps stimulate ideas and develop better communication skills to diverse group of individuals that I hadn't fully known or met but just through pictures and exchange of messages or ideas.

> I am on Facebook and Myspace, so I enjoyed fixing up my page to show my personality. I also think it forced the class to interact and learn more about each other which is a great thing.

> I liked that we could be ourselves in it.

The single area of complaint was that a lack of a tool integrated within the CMS for discussions was confusing to some, particularly noted by a few with experience in previous self-contained WebCT courses. Four students indicated that the need to open an external website and log in separately from the CMS required an adjustment at first, but that this was a short term reaction. All who expressed concern said they were very comfortable with the use of Ning after the first week.

From a content learning perspective, there was little evidence to support the use of this social networking experience as one that directly enhanced student learning. Student performance on required discussions paralleled that of previous classes that did not use Ning. There was variability in length and quality of discussion responses, typically matched by the performance on other assignments. Despite self-reports of increased learning, instructor assessments suggested that the level of learning was not impacted by the interaction and postings using Ning beyond what could have been done in other discussion boards. Because these students take only one course in educational technology, there was no easy way to determine if indeed an individual's performance was actually better than might have been predicted without social networking. Typically students do well in the class and this was continued in the summer 2008 iteration. Retention was excellent, with only a single student not completing all the required assignments, a rate better than in the typical educational technology F2F classes. Some students noted that the

flexibility of an asynchronous class made it easier to deal with issues outside of school that might have impacted their ability to attend classes and meet F2F deadlines. However, the contribution of social networking to high retention is unknown as other factors appear to have impacted the success rate, with course structure and delivery mechanisms as more likely contributors.

One aspect of variation that emerged in the content analysis on discussion postings when examining differences between the two classes was the level of influence a first posted response had on subsequent answers by the rest of the class. When the first response was in-depth and longer, all the following responses tended to follow this pattern. In most cases, first responses to a discussion were posted by students who consistently responded early and in general, showed high achievement on other assignments in the class. These high quality responses appeared to trigger more critical thinking even from students who were lower performing on other tasks. However, when the first response came from a less high achieving student, lacking the level of critical thinking and analysis about the question, all following responses were weaker, even from the top students. While students had a rubric for how discussions were to be assessed, and in early discussions were provided with feedback to help improve the content of responses, the students were more sensitive to what others posted than some more objective quality indicators.

Analysis of non-required contributions to the Ning discussion Forum showed a mix of short comments of support for ideas and actions, including statements of appreciation for responses that were insightful or helpful. All but four students did this at least once during the semester, with the non-contributors or "lurkers" being students who in general did the minimum required on assignments. Active social use versus lurking did not vary by age, nor by previous experience with social networking or distance education except in a single case of one older student who indicated she was unwilling to share personal information. At the same time, she liked the level on interaction in discussions and left comments on others' profiles.

One of the most notable uses in student-to-student interactions in the discussion Forums were the students who posted extensive tips to help others with assignments, shared useful tools they found, or provided technical assistance to anyone experiencing difficulties with course tools. About a quarter of the students took on this role during the semester, providing a level of voluntary peer tutoring that was unique to these two classes, went far beyond help usually seen in the technology course, and which clearly contributed to smoothing the way for more novice technology users to be successful and less stressed in the class. Many students commented on how helpful the sharing was overall in the course:

> [Ning] was new. I enjoyed all the different things that we are able to do on it, such as: commenting each other, posting discussions and commenting on them, being able to look at classmates' examples for less confusion, etc.

While all found Ning easy to use, there was a marked generational difference in the means for sharing of optional personal information that is a fundamental aspect of social networking interactions in tools like Facebook or MySpace. Students in their twenties, most of whom indicated familiarity with social networking, were more likely to produce long individual, text-based narratives describing themselves and their lives in great detail. By contrast older students tended to write few personal details but readily shared photos of family, children and pets. These latter students typically had not previously used sites like Facebook or MySpace. Students regularly posted personal, non-course related comments on each other's profile pages but this behavior generally decreased over the six weeks of the course as the assignments became more rigorous. Students had from five to 31 comments on their pages by the end of the semester, with an average of 10.1 per student. Interestingly, most comments were from different individuals with no more than five comments on one student's page coming from a single person. All but four students posted a profile comment at least once. The "friend" comments in the later part of the semester often centered around the two group project assignments where such personal comments continued. Since groups were assigned, this friendly banter and praise was generally among students who had been strangers when the semester started. In fact, in many cases, the students involved were geographically separated and would have had no contact outside of class. As one student noted, virtual communication continued beyond the classroom in some cases:

> I really liked the Ning. I feel like I made friends through the Ning and actually spend quite a bit of time outside of class (chat and email) with people I met. We plan to stay in touch!

In open-ended questions on the course evaluations, students consistently indicated that the interactions with students in Ning positively impacted their perceived learning and enjoyment of the course. All but three students echoed this broad theme in unprompted short answers in which they could have written about any aspect of the course. The most common sub-themes were related to affective aspects supported through social networking.

Students specifically commented on increased comfort in working with others they "knew," the interactions that went beyond required course discussions, and the impact of "knowing" that helped as they worked together on assignments. Many suggested Ning made the course fun and encouraged them to check in to see what others were doing, suggesting it led to a high level on engagement.

> I really loved it. It was like WebCT, but it seemed more social and friendlier to work with. It made me want to log onto it because it "tricked" me into feeling like it's not school.

Other themes on open-ended comments at the end of the course included that Ning increased and improved peer feedback, made others more visible, included multimedia capabilities, and allowed for creativity. A number who had taken previous distance classes noted how much they liked this course's design over previous examples. From an instructor perspective, the use of Ning did not impact assessed learning outcomes but did increase student self-support to figure out course requirements. At the end of the course, two-thirds of the students indicated that they believed distance learning was as good as or equal to learning in face-to-face classes, a significant change from evaluations in earlier classes.

Conclusion

Many of the findings from this research parallel that of earlier case studies of distance learning, including the impact of grading on participation and the expressions of need for interaction and social presence. In examining the impact of the use of a social network in an asynchronous class, there was little evidence in this case study to support the idea that it led to improved student learning as measured by grades, outcomes on assignments, or peer assessments done as part of the course work. In general, earlier improvements related to instructional strategies and design reported in previous design-research studies about the course had greater impact than the use of Ning. While self-reports of learning by the students in the summer class indicated they believed they had been more successful, objective evidence was not there to support their views. They were highly successful but no more than in previous classes.

However, the results are more clear when it comes to issues of motivation, satisfaction, and engagement. These students were ecstatic and uniform in describing their experiences in the class related to what happened in Ning. While some commented on the modules or quality of assignments, every student was positive about some aspect of social networking. They were particularly pleased with the connections they made to the other students in the asynchronous class. None had complaints other than over initial log in confusion which was quickly cleared up. Further, they were energized about the possibility of future DL classes.

Two areas of interest for future research emerged. In the first, despite many popular works about differences between digital natives and digital immigrants, there was no difference in terms of satisfaction or concerns. A unique finding was the difference by age grouping in the use of personal sharing mechanisms, with more text presented by younger students and more multimedia by older ones. Students propensity for socializing varies along other dimensions, possibly personal preferences or learning styles, which remains a question for future research. Lurkers seem to be equally successful and satisfied, making many current measures of engagement in DL harder to link to outcomes. The second area had to do with the social networking impact on the high level of voluntary peer-helping behaviors, particularly for technical and resource sharing. Both of these are now being examined in the context of a summer 2009 version of the course, but at this time analysis is incomplete.

This case study has pointed to the importance of affective domains which can make an online course seem less stressful, pleasurable, and worth attending and completing. These affective elements were reflected primarily in fewer complaints during the semester and in self-reports at the semester's end. Ning made it possible to accommodate individual needs for personalizing a course and creating an environment in which student presence becomes "comfortable." To the extent that student satisfaction leads to a continued desire to learn and greater comfort with new learning delivery mechanisms, adding a social dimension to the class was a low-cost effort that had a high emotional payoff as shown in this study. With new tools readily and freely available, instructors and designers have increased options for adding an explicitly affective component to online courses if they can move beyond the cognitive concerns more typical in higher education teaching.

In their recent popular book, "Disrupting Class," Christensen, Horn, and Johnson (2008) called for more student-centered learning and argued that emerging technologies now appearing will cause disruptive, revolutionary changes to the education enterprise. However, in reviewing the changing landscape of online interaction in the design research process for this course, what emerges is the potentially more gradual shift to personal learning

environments allowing individual preferences and expressions. The use of social networking tools allows evolutionary changes within existing structures and known pedagogies that result in students who are more engaged and excited by learning.

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Introducing the Self-Regulation for Online Learning Training System (SRfOLTS)

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Short Description:

This is a demonstration of a system, including a web-based self-regulated learning (SRL) tutorial and strategy application, to facilitate SRL in the online environment. It was designed based on learning strategy development literature to provide modeling and self-explanation, self-reflective practice and feedback on SRL strategies, to promote metacognitive awareness, and to enhance motivational processes. Suggestions for implementation and instructional implications will be discussed. This session may be interesting to instructors and administrators of online leaning.

Introduction

Two of the major problems facing web-based distance education are high attrition rate and low learner satisfaction. Numerous interrelated reasons, such as lack of time (Kember, Murphy, Siaw, & Yuen, 1991; Osborn, 2001) and environment (Osborn, 2001) management skills, mismatch between learners' interest and course structure (Chyung, 2001; Kember et al., 1991), and low self-motivation (Osborn, 2001; Parker, 2003), are causing students to drop out of distant programs. A big portion of these reasons is related with learners' academic self-regulation. Several researchers (Eom, 1999; King, Harner, & Brown, 2000) have identified self-regulatory strategies as predictors for achievement in the online mode. Furthermore, studies (Chyung, 2001; Ulitsky, 2000) inform us that adequate and appropriate training on self-regulated learning strategies is able to reduce the attrition rate greatly.

Zimmerman (1990) defines self-regulated learning (SRL) with three distinctive features: learners' application of self-regulated learning strategies, their sensitivity to self-evaluative feedback about learning effectiveness, and their self-generated motivational processes. The literature supports the notion that learners' self-regulation is a powerful predictor for their academic achievement (Ley & Young, 1998; Pintrich & Groot, 1990). In addition, self-regulation of learning progress is found to have a positive effect on learners' motivation (Lan, 1996; Zimmerman & Kitsantas, 1996) and use of learning strategies (Lan, 1996; Schunk & Ertmer, 1999).

New learning environments, such as web-based or web-enhanced instruction, require more learner self-control and proactive learning to construct knowledge and acquire skills. As Schunk and Zimmerman (1998) mentioned that "an area that lends itself well to self-regulation is distance learning, where instruction originates at one site and is transmitted to students at distant sites… Self-regulation seems critical due to the high degree of student independence deriving from the instructor's physical absence" (p. 231-232). Fortunately, Pintrich (1995) pointed out that "self-regulated learning is teachable" (p.7). Teachers can teach students to become self-regulated learners, while students can learn to be more self-regulated.

This system to be demonstrated was designed and developed with the hope to provide online learners training on and practice of self-regulated learning strategies in order to reduce the attrition rate and increase learner motivation and satisfaction.

Design Rationale of SRfOLTS

Instructional design principles in the learning strategy development literature served as the rationale for the design and development of this web-based SRL strategies training.

Principle 1: Promote Learners' Metacognitive Awareness of Their Behavior, Motivation, and Cognition. First, metacognitive awareness is the prerequisite for learners to be able to learn from and utilize the self-regulated learning strategies that interventions are intended to teach. It is suggested (Pintrich, 1995) that standardized assessment instruments, such as the Motivated Strategies for Learning Questionnaire (Pintrich, Smith, Garcia, & McKeachie, 1991) or the Learning and Study Strategies Inventory (Weinstein, Husman, & Dierking, 2000), can be used to provide students with an overview of their motivational beliefs and learning strategies.

Principle 2: Provide Strategy Training Using the Methods of Modeling or self-Constructions/Explanations. Strategy teaching is regarded (Schunk & Zimmerman, 1998) as a major means of promoting self-regulated learning. Modeling and self- constructions/explanations are the two major methods used to teach self-regulated learning strategies.

Principle 3: Provide Ample Opportunities for Learners to Practice Self-Regulated Learning Strategies and Feedback about Strategy Effectiveness. Two crucial elements are practice of self-regulatory strategies and feedback on strategy effectiveness. These mechanisms facilitate learning and motivation by communicating learning progress, and they also enhance strategy transfer and maintenance (Schunk & Zimmerman, 1998).

Principle 4: Incorporate Motivational Processes, Especially Positive Beliefs, into Instruction. Motivation plays an important role in developing self-regulated learning. To participate in self-regulation requires that students have the motivation or willingness to learn over extensive periods (Schunk & Zimmerman, 1998). Motivation is essential because it plays a mediating role to the effect of self-regulated learning strategies.

Principle 5: Integrate Self-Reflective Practice Systematically with Instruction on Self-Regulated Learning Strategies. Finally, across interventions there is an emphasis on self-reflective practice, which refers to students' practice of skills and reflection on their performance. Self-reflective practice often is built into the instructional procedure with independent practice or time for self-reflection (Schunk & Zimmerman, 1998).

Format of Self-Regulated Learning Strategy Training

In a learner-centered environment, such as web-assisted instruction, learners do not automatically possess the metacognitive skills required to make independent judgments and selections about how to learn (Brown, Hedberg, & Harper, 1994). However, Hofer, Yu, & Pintrich (1998)'s work suggests that an intervention that targets a range of cognitive and motivational components can benefit college students who need help with metacognitive skills. In addition, Hofer claims that there is a need for adjunct interventions that stress general strategies for at least some college students and a need for research on how to design adjunct courses regarding the tasks and instructional strategies.

Components of SRfOLTS

Based on the Instructional design principles in the learning strategy development literature, this SRfOLTS is made up of three components: 1) an online administration of the Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich et al., 1991) for pre-and after-intervention assessment, 2) an adjunct web-based online tutorial (Hofer et al., 1998), and 3) self-reflective practice (Graham, Harris, & Troia, 1998; Schunk & Zimmerman, 1998) using online forms/questionnaires.

The intervention is a semester-long (Ertmer & Newby, 1996; Pintrich, 1995) multi-strategy program (Hofer et al., 1998) that teaches a range of strategies for students to have both the "skill" and the "will" to use the strategies properly. The training tried to utilize the methods of modeling (Bandura, 1986; Kitsantas, Zimmerman, & Cleary, 2000) and self-explanation (Bielaczyc, Pirolli, & Brown, 1995) through video with real student example and ample opportunity for exercise and feedback (Ertmer & Newby, 1996; Pintrich, 1995) through interactive case study with automatically-generated feedback on knowledge of strategies, and online Study Plan & Self-Evaluation as practice for application of strategies in completing assignments. Every step of the intervention, e.g. the prior questions, the real-world cases in tutorial, the MSLQ, served the purpose for promoting learners' metacognitive awareness (Hattie, Biggs, & Purdie, 1996; Pintrich, 1995). Motivational issues (Pintrich, 1995) are addressed (e.g., building confidence through moving from knowledge to application of strategies, pintable job aids, printable certificate for completion of

tutorial) throughout the whole intervention. Learners are assessed on their prior and post motivational beliefs and self-regulatory approaches using the MSLQ, and a tutorial is used to facilitate students' revision of problematic self-regulated learning process.

SRL Tutorial

This web-based tutorial provide students with both the knowledge and practice on knowledge of self-regulated learning strategies through interactive exercises, such as multiple-choice or matching, and a test.

This tutorial focused on what SRL strategies are, more specifically, what metacognitive (planning, monitoring, evaluating), motivational (goal orientation, self-efficacy), resource-management strategies (time management, help seeking) cognitive strategies (rehearsal, elaboration, organization) are, as well as examples of them. In addition to different types of strategies, this tutorial also discussed when and how to use them (Hattie et al., 1996), which enables the students to make use of the strategies effectively.

Strategy Application Practice

After they exercise on the knowledge about SRL, the learners are encouraged to actually apply the strategies to their studying of the academic content of a particular course. A number of online forms/questionnaires were developed to implement this practice, and they can be sent to the participants as a link in emails. These online forms can be delivered as a set at the beginning (for strategic planning) and end (for self-evaluation) of each learning period of 4 weeks. A total of 2 sets of online questionnaires can be used during the process of study for strategy practice. The following is a description of how the strategies were represented in the online forms/questionnaires for learners to apply them.

Goal setting is defined as students' choice of desired standard for learning or performance. Students are asked "What are your goals (with respect to this class) for this semester?" to indicate their choice of desired standard for learning or performance and they were reminded to make sure their goals were in line with their general system of values. And, more specifically, students were asked to clarify their immediate objective by answering a question "What tasks are you planning to accomplish in the next two weeks to help you achieve your goals for this course?"

Strategic planning refers to students' identification of strategies and allocation of resources for achieving their goals. Students are provided with example of strategies, and encouraged to formulate their own cognitive and motivational strategies for studying. They are asked "What will you do to attain these goals (for the next two weeks)?" They were asked to provide a specific plan of action. Students were also asked to describe how they would allocate their resources. They were asked questions such as "When will you start working toward these goals? On what days? At what times? How often? How much time do you intend to spend on these tasks?"; "Where will you do these?"; "With whom will you do these?" and "What additional information/assistance will you need?" and so on.

Self-evaluation is the opportunity for students to analyze their performance and strategy effectiveness after a period of learning. In this system, it is implemented as an online questionnaire that allowed students to self-judge their performance and the progress that they have made for a particular study period of 4 weeks. Students are presented with their self-defined individual goals and asked questions "How well did your plan work during these past 2 weeks?" and "Did you complete the tasks you had planned during these past 2 weeks?" They are encouraged to give specific examples using a drop-down menu with choices of 1) Improved test scores 2)All homework turned in 3) Assignments completed on time 4)Readings completed 5)Notes taken for chapters assigned 6) Other, please explain. In addition, students' strategy effectiveness is assessed using an open-ended question "What learning strategies worked well?" and their self-satisfaction is assessed using multiple choice questions, such as "You feel pleased with your progress in the course", asking them to rate their feelings on a 5 point Likert-type scale, ranging from "Not at all true of me" to "Very true of me".

Suggested Implementation Procedure

This system can be implemented in 4 stages, including soliciting participation and collecting initial data on strategy and motivation (1 week), completing web tutorial on SRL (4 weeks), completing online study plan and self-evaluation (8 weeks), and final strategy and motivation assessment (1 week), and last for about 14 weeks.

Instructional Implications of the SRfOLTS

While web-based or web-assisted instructions are widely used (Warburton, Chen, & Bradburn, 2002) these days, it is still difficult for many students to manage their learning in this kind of environment. The SRfOLTS can be integrated into any online or web-assisted courses for college instructors to facilitate students' learning. This system can also be used with orientation for online students to help them evaluate whether online is an appropriate format for them and how they can prepare themselves with the strategies for online learning.

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Self-Regulated Learning (SRL) in Community College Student Success

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Introduction:

This literature review first discusses an existing problem with community college student success, a high incompletion rate. Then, it covers the theories and research about SRL and learning strategy development. SRL strategy training has been found effective to promote learning achievement, motivation and strategy use. It was proposed that using SRL strategy training, implemented in the format of remedial or study skills courses, might be a solution to community college student success.

Issues in Community College Student Success

Community college is an important channel to provide postsecondary education in the United States. It has a large enrollment and is considered an affordable means for educational attainment. According to a National Center for Educational Statistics report, community college students represent about 40% of all undergraduates, or about 7.6 million students in the whole U. S. (Horn & Nevill, 2006). Yet, student retention in community colleges is a big concern for many educational researchers and administrators.

A problem of high attrition rates has been discovered along with the lower expense and open-access policies at community colleges. According to studies conducted by the U. S. Department of Education and some other institutions, about 35-44 percent of college students who began at 2-year institutions dropped out without completion (Bradburn & Carroll, 2002; Cofer & Somers, 2000; Hoachlander, Sikora, & Horn, 2003). Most nonpersisters left during the first year of enrollment (Bradburn & Carroll, 2002).

Students' drop-out of community colleges have close correlation with numerous reasons, such as: students' demographic characteristics, including age, family responsibilities, working full-time, part-time enrollment, their insufficient prior educational preparation (Hoachlander et al., 2003; Horn & Nevill, 2006; Wirt et al., 2004), unsatisfactory prior achievement in colleges (Bradburn & Carroll, 2002; Cofer & Somers, 2000; Hoyt, 1999) and lack of learning strategies (Byrd & MacDonald, 2005; Ley & Young, 1998; Schmid & Abell, 2003).

Need for College Success Courses and Study

Because of their nontraditional demographic characteristics and educational preparation, there is a higher tendency for community college students to leave without a credential after they begin their postsecondary education. What can be done to help solve this issue? Compared with the large number of freshmen, minority, and first generation students who are entering community colleges, not enough research has been conducted to understand and help this population (Wild & Ebbers, 2002).

Remedial or study skills courses can assist in providing underprepared students with math, reading, English, and study skills to succeed in college (Byrd & MacDonald, 2005), to enhance achievement (Stovall, 2000; Tuckman, 2002, 2003a, 2003b), and to improve retention (Cofer & Somers, 2000; Derby & Smith, 2004; Stovall, 2000; Tuckman, 2003b). As a result, several researchers (Byrd & MacDonald, 2005; Hoyt, 1999; Schmid & Abell, 2003) emphasize the need for interventions that concentrate on the academic needs of students and call for the use of remedial education and study skills courses to help students understand learning strategies, to appreciate the importance of consistent studying rather than cramming (Schmid & Abell, 2003), and to assist colleges in teaching students skills for time-management, focusing on goals, and self-advocacy explicitly in their first year of college (Byrd & MacDonald, 2005).

Many of these remedial or study skills interventions are designed and developed on the basis of the theories and research on academic self-regulation (Shafer, Lahner, Calderone, Davis, & Petrie, 2002; Tuckman, 2003a), yet how to make these courses more effective and efficient at community colleges is an area awaits/worth investigation. This literature review attempted to examine the connection between self-regulated learning strategy and Community College Success, and to explore the implications this connection has on instruction. This coincides with Young & Ley (2003)'s recommendation for research on the function of self-regulated learning support in remedial education, using either qualitative or quantitative methods.

Theoretical Framework about Self-Regulated Learning

The core of college success courses is the theory and research results about self-regulated learning. This following section introduces concepts about self-regulated learning and presents research on self-regulated learning strategies and development of self-regulated learning.

What is Self-Regulated Learning?

Generally speaking, self-regulated learning is a multidimentional construct, which involves students' self-generated application or adjustment of motivation, cognition, and metacognition (Alexander, 1995) for achieving optimal performance outcome. Every learner is self-regulated for academic learning to some degree (Zimmerman, 1998), but there are significant differences among students. Self-regulated learning can be developed through personal discovery or training (Ertmer & Newby, 1996; Zimmerman, 2000).

Zimmerman & Martinez-Pons (1990) defines self-regulated learning (SRL) with three distinctive features: learners' application of self-regulated learning strategies, their sensitivity to self-evaluative feedback about learning effectiveness, and their self-generated motivational processes. They differentiate academic self-regulation from mental ability, such as intelligence, or an academic skill, such as reading proficiency. Zimmerman (1998) suggests that it is a "self-directive process through which learners transform their mental abilities into academic skills" (p. 2).

Research about Self-Regulated Learning

Research conducted over the last decade, in controlled settings, has consistently found a positive correlation between academic achievement (Lan, 1996; Schunk, 1996; Zimmerman, Bonner, & Kovach, 1996), motivation (Schunk, 1996; Schunk & Ertmer, 1999; Zimmerman & Kitsantas, 1996, 1999) and self-regulated learning. However, even though the use of self-regulated learning strategies is very helpful for students to achieve better learning and motivational results, it might be intervened by some motivational characteristics, such as goal orientation (Ames & Archer, 1988; Greene & Miller, 1996), self-efficacy (Bouffard-Bouchard, Parent, & Larivee, 1991; Zimmerman & Martinez-Pons, 1990), and interest and valuing (McWhaw & Abrami, 2001; Miller, Behrens, Greene, & Newman, 1993). Some of these characteristics, such as self-efficacy and goal orientation, might even affect persistence (Miller et al., 1993).

Field tests of comprehensive training on self-regulated learning strategies to students in traditional classroom settings have found effects on improved task performance (Butler, 1998; Graham, Harris, & Troia, 1998; Hofer, Yu, & Pintrich, 1998; Paz, 1999; Weinstein, Husman, & Dierking, 2000) and metacognitive understandings

(Butler, 1998; Ching, 2002), more positive motivation (Butler, 1998; Ching, 2002; Graham et al., 1998; Hofer et al., 1998; Weinstein et al., 2000), more strategy use (Butler, 1998; Hofer et al., 1998; Weinstein et al., 2000), and even a better retention rate (Weinstein et al., 2000).

A number of studies measure the effectiveness of SRL strategy training using the e-learning environment. In these seven studies that reported empirical evaluation of this kind of training in a field setting, five of them (McKeachie, Pintrich, & Lin, 1985; Shafer et al., 2002; Tuckman, 2002, 2003a, 2003b) have been found effective to promote learning achievement, three of them found positive effects on use of strategies (Hartley, 2001; Hofer & Yu, 2003; McKeachie et al., 1985), 1 found positive effects on motivation (Hofer & Yu, 2003) and one found benefit for student retention (Tuckman, 2003b).

Integrating Self-Regulated Learning into Community College Success

Self-regulated learning strategy training has been found effective to promote learning achievement from numerous studies, either in lab-controlled experiments (Lan, 1996; Schunk, 1996; Zimmerman et al., 1996), or comprehensive field interventions (e.g., (Butler, 1998; Graham et al., 1998; Weinstein et al., 2000). Self-regulated learning strategy training might help community college students achieve significantly higher average course percentage score and average scores for each of the major course activities. Achievement is one of the primary causes to the high impletion rate in community college (Bradburn & Carroll, 2002; Cofer & Somers, 2000; Hoyt, 1999). Improving learning achievement creates the possibility for promoting learners' self-efficacy and satisfaction, and eventually reducing drop out rate and increasing cost effectiveness of education provided at community colleges.

Providing comprehensive training on self-regulated learning strategies can bring about more positive motivation in terms of attribution (Butler, 1998), self-efficacy (Ching, 2002; Graham et al., 1998; Hofer et al., 1998; Weinstein et al., 2000), and interest and mastery goal (Hofer et al., 1998). In addition, students' engagement in self-regulated learning behaviors also seems to bring about self-satisfaction (Zimmerman & Kitsantas, 1999). Therefore, it is reasonable to assume that students' task value, self-efficacy intrinsic goal and self-satisfaction would be higher, and their extrinsic goal would be lower if/after they participate in the a training on self-regulated learning strategies.

Since motivational learner characteristics, such as goal orientation, self-efficacy, and interest and valuing, might further influence the future use of self-regulated learning strategies. Some of these characteristics, such as self-efficacy and goal orientation, might even affect persistence. Improving learner motivation, through the use of training on self-regulated learning strategies, makes it possible for promoting students' future use of learning strategies, and may ultimately lead to a decrease in drop out rate at community colleges.

Deficiency in learning strategies has been identified as another major cause for the high incompletion rates in community college education. Providing comprehensive training on self-regulated learning strategies can lead to more strategy use (Butler, 1998; Hofer et al., 1998; Weinstein et al., 2000), and even a better retention rate (Weinstein et al., 2000). Engaging learners in learning and implementing self-regulated learning strategies through the training might improve their strategy use. The potential enhancement in learners' strategy use might lead to increase in completion rate.

Instructional Implications

Remedial or study skills courses, designed and developed on the basis of the theories and research on academic self-regulation (Shafer et al., 2002; Tuckman, 2003a), has been found effective in providing underprepared students with study skills to succeed in college (Byrd & MacDonald, 2005), to enhance achievement (Stovall, 2000; Tuckman, 2002, 2003a, 2003b), and to improve retention (Cofer & Somers, 2000; Derby & Smith, 2004; Tuckman, 2003a). Therefore, it is logical for researchers (Byrd & MacDonald, 2005; Hoyt, 1999; Schmid & Abell, 2003) to call for the use of remedial education and study skills courses to help students understand learning strategies and improve achievement and retention (Byrd & MacDonald, 2005; Schmid & Abell, 2003) in community colleges.

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Learning Information Technologies as Empowering Tools to Narrow the Gender Gap in the Rural-Urban Spectrums - a Review from Global to Domestic Perspective

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Abstract

Information technologies are rapidly reshaping the world, but the digital divide has been a growing concern both in the domestic and international discourse. Generally speaking, the poor and the disadvantaged tend to live in the remotely isolated rural areas. Gender plays a role in this scenario. This paper provides a review of learning technologies as empowering tools for rural low income women from global and domestic perspectives.

Introduction

Though information technology (IT) is no longer considered a luxury in many affluent societies, the digital divide[1] continues to be a major concern both in domestic and international discourse (NPA Report, 2002; PEW, 2004). Statistics shows a significant gap in access and knowledge of IT among the rural, urban and suburban areas where socio-economic status, gender, and racial background distinguish such disparity (World Bank, 2002). Issues with accessing opportunities and resources relating to IT imply the increasingly marginalization of low-income rural mothers. As Dean (2000) remarks those who with lack of access to information technologies will become the second class citizens of the future.[2]

Rural low-income women are disproportionately burdened with task loads, and have the least social mobility to access resources and services such as health care, child care facilities, social supports, education, and job opportunities. Many government policies, including U.S. Welfare Reform in the 1990s intend to support low income mothers' independence by providing job and skill training, education opportunities and other relevant self-sufficient strategies. Learning technologies have been deemed as powerful tools to transform many aspects of human lives (Brown, et al, 2009). The following are some practices gleaned from different regions of the world.

A Brief Review from the Global Perspective

At the global level, in its Gender and Development Plan of Action, the Food and Agriculture Organization (FAO) of the United Nations recognized the power of IT in transforming both natural and human capital development. It pointed out that changes could accelerate progress through gender equality. It calls for policymakers, practitioners and communities to give attention to the risks and burden that women bear and suggested that unless women have access and use new technologies, the inequality could be exacerbated (FAO, 2002). We reviewed several countries across different continents regarding their conditions and practices.

International Labor Organization (ILO) focuses on necessary basic-needs of technology-related framework for the low income women/populations. The Technology Programme of the International Labor Organization has had an antipoverty thrust to improve the poor's access to basic goods and services in rural areas.[3] The International Women's Tribune Centre (IWTC) works in partnership with the International Development Research/Eastern and Southern Africa Office (IDRC/Nairobi). This organization has developed a new information tool that offers direct

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[1] The term "digital divide" refers to the gap between the haves and have-nots in terms of the access to the computer and the Internet. In the last part of this paper, a boarder definition incorporated various factors was introduced.

[2] Refer to http://www.netschools.net/whynetschool/cs_hundred.htm
[3] Refer to http://www.idrc.ca/en/ev-28596-201-1-DO_TOPIC.html.

access to information for women who are among the most marginalized in development. The program initiative is a CD-ROM -Rural Women in Africa: Ideas for Earning Money for rural women to learn via a user friendly process.

European rural women are not a homogeneous group. They have different roles and occupations, and work on farms and in family businesses, in employment and in community activities. But they have been affected by the globalization processes that lead to the restructuring and decline of the agricultural sector and the growth of the service sector and increased emphasis on technology.[4]

Patricia Liths's (2002) "Uganda: ITCs, empowerment and Women in rural Uganda", investigated African women's social, technological and information contexts.[5] This work identified barriers to women's full use of ICTs, and then developed strategies for overcoming those barriers.

In Australia, the community networking and interactive communication technology (ICT) projects was based on feminist or social justice principles usually aiming to include a broad diversity of community members. Groups often targeted include women, indigenous people, people of non-English speaking backgrounds or with low incomes, and people living in rural and remote areas (Harrison, 1998).

Asia and South Asia present showcases in providing cutting-edge expertise to drive the global information technology industry. The Asia-Pacific region shows great diversity in gender-related indicators and differential gains in the advancement of women and girls. In the mid-1980s, several studies looked for areas where improved technology could both reduce the workload of and generate income for rural women in South Asia.[6]

With this brief glance of gender and technology in developed, developing and underdeveloped countries, the following section focuses on the conditions in the U.S and reviews research related to IT use and needs from a multistate longitudinal project on rural low income mothers' well being.

<center>A Review from the Domestic Perspective</center>

In America, there are approximately 59-65 million adults living in rural communities, or 21% of the U.S. adult population. Rural Internet penetration has remained roughly 10 percentage points behind the national average - 67% of urban residents, 66% of suburban residents, and 52% of rural residents (PEW, 2003).

As expected, among rural residents, low income women's access to computers in general, was quite limited. They tend to have less access than that of men, urban, and suburban women to information technologies (PEW, 2003). When the 1996 Telecommunications Act was passed, Congress was explicit that telecom service in rural areas be comparable to what was available in urban areas, including access to advanced telecommunications and information services. At the current stage of broadband deployment, rural residents do not have equal access at reasonable rates despite measures by the FCC to insure universal access.[7] Subsequently the National Policy Administration (NPA) established the Digital Economic Opportunity Committee (DEOC) to examine the information technology skills gap. The committee's objective is to turn the digital divide into digital economic opportunities (NPA Report, 2002). Furthermore, welfare reform policy intends to support the low income mothers' independence by providing job and skill training, education and other relevant self-sufficient strategies. Based on this policy implication, we were curious about whether the computer/Internet usage played a role in mothers' daily lives that assisted their work or family responsibilities.

The data of this research were generated from the Rural Families Speak (RFS)[8] - a multistate longitudinal research project focusing on the well-being of rural low-income families in the context of welfare reform. The original project began in 2000 across 17 states, targeting on mothers with at least one child under the age of 12

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[4] Refer to http://europa.eu.int.

[5] Refer to http://www.wougnet.org/News/cdupdate.html.

[6] Refer to http://www.fao.org/docrep/005/ac788e/AC788E03.htm.

[7] Refer to http://www.jhellerstein.com/rural.html (3 of 11).

[8] Rural Families Speak Project involves two project identification numbers of NC-223 and now NC-1011. There have been researchers in seventeen states involved at different periods of time. Two major pieces of legislation have driven the welfare reform discussions. Public Law 104-193, The Personal Responsibility and Work Opportunity Reconciliation Act of 1996 (PRWORA), and Public Law 104-180 The Agricultural, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 1997 (Food Stamp legislation). The legislation governing Food Stamps appropriations is passed each year. The latest one is Public Law 106-387. The reauthorization of the PRWORA continues to be discussed. There are other pieces of legislation that influences low-income families, but the team is focusing on these pieces. All the states have supported the data collection and preparation of data set. The overall purpose of the research is to assess changes in the well-being and functioning of rural families in the context of policies that reform welfare. Refer to http://www.cehd.umn.edu/fsos/centers/RuralFamiliesSpeak/projectDescrip.asp

living at home and with an income at or below 200% of the federal poverty line. Data were collected from 413 families in rural counties (with population centers of less than 20,000). This was not a random sampling from the fifty states but was a purposive sampling. Participants were interviewed by trained researchers for approximately 2-3 hours in a semi-structured format with open-ended questions either at their homes or in another mutually agreed-upon location. Qualitative and quantitative data were gathered in areas such as community and housing characteristics, child care, parenting, financial stability, food security, employment, transportation, health, mental health and education.

Questions regarding low income mothers' job training, educational opportunities and family life revealed serendipitous information relating to computer and the Internet usages. These face to face interview results provided an opportunity for investigation of IT use in the rural low income mothers' lives. Based on this discovery, we formulated our research question to probe into low income mothers' relationship with IT - *"What are rural low income mothers' perceptions, experiences, barriers and supports relating to computer and Internet usage*?"

Basic Demographic Information

Most of low income mothers in the 413 sample are non-Hispanic white (63.9 percent) with smaller proportions of Hispanic (21.3 percent) and African-American (8.7 percent) and other ethnic groups. The majority of mothers were in their early 20s to mid-30s (51.6 percent). Almost one out of two mothers did not complete high school (45.5 percent) or had some college training. Close to half were either married (44.8 percent) or living with a partner (14.8 percent). The average family income is $15,522. One third (33.8 %) of them had an Internet connection which, in 2001 when this data was gathered, was much lower than the national average (PEW, 2003).

Method and Data Analysis

We read through original transcripts several times.[9] A search through interview texts for the words 'computer" and "Internet" via software Maxqda2 revealed 165 cases with segments containing the searched expressions. To examine the salient themes from computer usage and Internet access, we tabulated the collected segments to extract the essences that potentially contribute to a theme. All the proper segments went through thematic reduction process and qualitative analysis techniques (Miles & Huberman,1994; Strauss & Corbin, 2002).

After several readings of the extracted texts of 165 cases, 33 were identified with meaningful segments related to perceptions and experiences with information technologies. Based on the above criteria, the similar statements of participants' expressions were grouped into categories which were then clustered into sub-codes and codes.

Through back and forth inductive, deductive, and abductive reasoning processes, similar segments were clustered into three primary themes: general usage, barriers, and supports.

The primary and sub-codes were organized and explained as follows:

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[9] During 2007-8, I had an opportunity to join RFS project at University of Minnesota-Twin Cities as a research assistant for Dr. Walker.
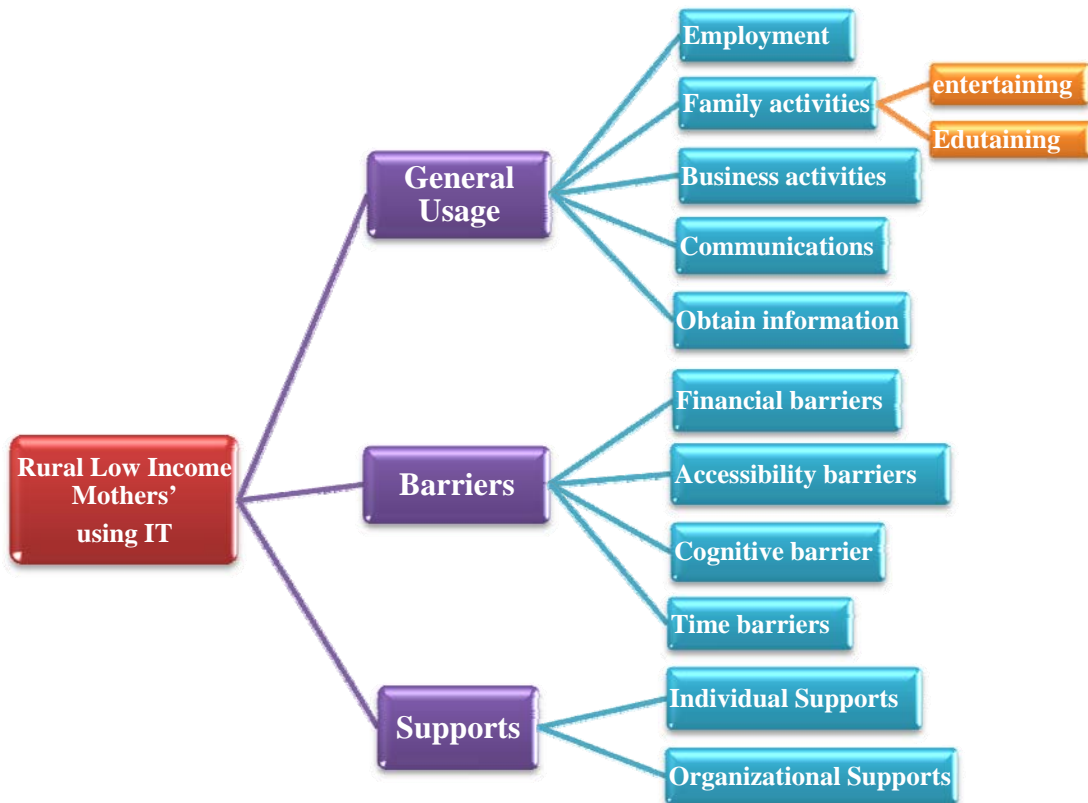
Figure 1: Primary Codes and Sub-codes of Rural Low Income Mothers' Using IT

General usage

The general usage was defined as the common usage that most people will/can do. The sub-codes are:

a) Employment, including working with computer; job training with computer

b) Seek information, including job hunting; obtaining education, finance, health and parenting information.

c) Family activities, including family entertaining and edutaining, such as parent engaging with children via computer games; parent providing educational games for children; and monitoring children's online activities.

d) Business activity, including online business, online shopping, downloading free merchandises, and applying public assistance.

e) Communication, such as online dating, online chatting, online making friends, and keeping anonymity, as well as personal routine activity in the online environment.

Barriers

A barrier is defined as the interviewee's expression of frustrations, obstacles or undesirable conditions that impede access to computer and the Internet. The sub-codes are:

a) Financial barriers: hardware, software, and accessories expenditure; the maintenance fee, and connection service charges.

b) Accessibility barriers, geographical obstacles, such as lack of transportation to community centers or social service agencies; physical challenges such as weights illness causing the immobility; inadequate electronic connection, such as having computer yet not having Internet connection or using out-of-date computer and accessories; and having the slow dial up Internet connection; as well as personal felony records prohibiting the access opportunities.

c) Cognitive barriers- lack of IT knowledge, such as lack of the basic computer skills; being a computer illiterate; and experiencing frustrations when computer breaking down.

d) Time barriers - constraints, such as juggling between motherhood, house chores, jobs, and other commitments.

Supports

Social supports refers to the functions including instrumental, informational, and emotional assistance that is provided to individuals by significant others including family, supervisors and friends (Thoits, 1995), and by social service institutions or non-profit organizations.

a) Supports from Individuals, such as receiving help from participant' parents, boyfriend, partner; close relatives such as siblings; and friends and neighbors.

b) Supports from organizations, including obtaining assistance from local community libraries and job centers; social programs from public and non-profit organizations providing computer training certificate programs and access to software and hardware.

Results

General usage

In the general usage code, the most frequent category of use was family activities. Family entertaining and edutaining with children were the major responses indicating that computers were used in the homes of rural poor mothers by their children or for mothers to interact with their children. Mothers reported that the most available and inexpensive family activities that most children enjoyed related to working on computers, doing Internet activities and by some, playing with video games if they had one. Some mothers expressed the value of having a computer available to their children. For example,

"Yes. I'm pretty sure he'll go to some kind of college because he already knows how to use the computer and he's 4 years old. I gave him my old one to play with. And he made it do something that I tried for months to figure out how to do."

Another mother expressed:

"Johnny likes playing computer, and Jenny likes to watch, so we have educational computer programs on the computer, that he can play. And then I sit down with him and help him with some of them, but he's a really smart kid. So he's teaching me stuff on the computer that I didn't know."

The second most frequent category of usage in the general usage code was employment relating categories which included four types - working with computer, job training with computer, job hunting, and online business. Most mothers describe actual use of computers related to work; work was planned or hoped for (e.g., working with a computer being an ideal job, if available; looking for education or training opportunities to enhance computer skills; and having desire to take computer courses to enhance employability). A mother shared her successful story by taking advantage of computer training opportunities,"I changed my job. I took a couple of computer classes and I moved up to working at the newspaper in the city" Finding information was the third most frequent category of use and communication was the final category of use.

Barriers to IT

The major barriers the participants expressed were affordability, knowledge about using computer and time issues.

The cost of purchasing and maintaining a computer, or paying for the Internet was beyond the capacity for many families. As one mother plainly said, "No. We don't have a computer. We just can't afford it". Others expressed placing payment for a computer or the Internet at a low priority, after other utilities and household bills were paid. Or they indicated a combined concern for cost and the amount of time that their children were spending on the computer. Cost was also a consideration to repair a broken computer. As one mother said, "…cause the timer or something-something about the computer was off and instead of just fixing that part, they just have to do the whole thing and it cost a lot of money."

For time and cognitive barriers, mothers expressed their frustration at not being able to use or learn computers because of other demands on their time. For example,

"…it's my intention to return to college in the fall of 2002. I've already checked into getting him (her son) into Early Head Start… since he turns three before September, he would automatically be eligible for the program for next September for all day. So I could be in school all day to study computer science."

Supports to computer and IT access

To overcome the lack of access to the computer and Internet as well as limitations imposed by the high cost of various service charge and soft/hardware problems, rural low income mothers expressed the following available resources to solve their own problems.

Public facilities. The top resources are the local community centers and libraries that provided access to computer facilities, education programs and job training opportunities. Responding to a question about her job, one mother mentioned that she took advantage of the state Adult Education program of 50 hours training to obtain a pass for the computer, she said, " Cuz that's the only way I would spend any time together with my family….That way my kids can teach me how to do it. Pretty soon my 4 year old could. She knows more about computers than I do." Another mother said, "I took a couple of computer classes through Community Action They paid for them… I just decided I would like to do that."

Workplace. Workplace also facilitates the opportunities to access the Internet. One mother occasionally had to deal with work and child care issue, and found an advantage to computer access. She said,

> "So, usually, it's been a couple of times that I've needed childcare and I just take her to work with me…They (the employers) don't say anything because she's really good. She doesn't run around, she'll stay with me. The last time I took, I took her, I just took her, her computer games in the computer lab (at her workplace.)

Relatives and Neighbors. Help from neighbors to share the usage as well as relatives' assistance are extra resources to the mothers. One luckier mothers appreciated her "possession" by saying, "A hand-me-down from my parents, 'cause they got a new one. It's a Compaq ninety-five, I think, so it's pretty old, and it's pretty slow, but it's better than nothing. It works."

<div align="center">Conclusion and Discussion</div>

General speaking, rural low income mothers revealed the uses of IT, primarily for family and employment purposes, which encountering barriers to access and relaying on family and friends, community and employment resources as supports. Cost was the largest barrier, and most mothers reported not having the Internet in their homes. Based on mothers' comments, many did not have computers at all due to the cost of purchase or maintenance.[10] Using computers in public places and at work were resources for mothers' use. Family and friends also were supports, letting mothers use their computers, or giving them old computers. This issue resonated Hargittai's (2002) the double levels of digital divide: the first level of computer ownership and the second-level of multiple effects on digital divide, which extend to broadband access; machine vintage; connectivity; online skills; autonomy and freedom of access; and computer-use support (Hawkins, Rudy, & Nicolich, 2005).

Horrigan (2004) pointed out that solving the availability problem would get higher IT adoption in rural areas. Broadband technology is the ideal mechanism to narrow the divided gap. Practical uses of technology in diverse learning environments, in particular, the remote rural areas, the distant killers can conquer the distance barriers.

Having access to broadband Internet means that rural low income mothers obtain new kinds of support systems to provide the communication mechanism for their children, schools, teachers and other stakeholders. It opens up new ways of exploring resources and opportunities, which has impact on children's well being. Such learning environment includes local libraries, community centers, and K-12 schools where all members of the community have access to meaningful programs and providing useful lifelong knowledge and skills.

As of today, we know Finland is the first country to announce every Fin citizen to access a 1 megabit-per-second broadband connection in next year, and a 100 megabit-per-second broadband connection at the end of 2015. This move inspires other countries to start perceiving broadband as citizens' inalienable legal right, akin to part of the First Amendment.

Domestically, many non-profit organizations,[11] promote a wide range of free broadband access and neutrality issues. They have been organizing grass-root movements to raise the consciousness and to persuade policy makers. For example, Socialfreenet advocates free broadband Internet access to low-income families that are in need of high-speed access to attain financial, educational and employment goals. We suggest that US federal government play a more active role to shorten the digital divide in broadband access. This means investing and renovating IT

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[10] At the end of 2005, only 24 percent of rural Americans had broadband access, compared with 39 percent of urban and suburban dweller, according to Pew Internet & American Life Project, Rural Broadband Internet Use, memo, February 2006, http://www.pewinternet.org/pdfs/PIP_Rural_Broadband.pdf.

[11] Such as Freepress (http://freepress.net/media_issues/internet), SaveTheInterent (http://www.savetheinternet.com/), Finding Dulcinea (http://www.findingdulcinea.com/guides/Technology/Internet/Free-Use-Media.pg_05.html,) , and Socialfreenet (http://socalfreenet.org/mission).

infrastructures at local public organizations, such as community centers, child care facilities, transportation agencies, job centers, libraries, schools and churches can open up wider opportunities for learning, training, and guidance to low income mothers.

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What is the Lived Experience of Designing and Teaching Multiple Delivery Methods -Live Meeting, Hybrid, Online, and Face To Face (f2f) within a Semester at a Technical College Setting?

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Abstract

This is an introspective account of the author's lived experience in facilitating web-conference (using software Live Meeting), hybrid, pure online, and face to face (f2f) with web-enhanced four delivery methods for 4 courses of Sociology, Diversity, Developmental Psychology, and Contemporary American Society in the spring semester of 2009. The dynamics of coordinating and adjusting structures and functions of each learning environment among the author, students, IT department, and administration policy illustrates the challenges of both non-instructional and instructional issues situated in a highly contextualized setting.

Introduction

Technical colleges play a key role to bridge PK-12 and 15 to 20 for many higher educational institutions. Though most two year technical colleges, comprehensive community colleges, and four year colleges tend to be lumped together as the post-secondary educational system or "higher educational" institution, they are fundamentally different in many aspects. Such as educational missions, climate, diversity of student and faculty body, specific roles of instructor and staff, funding, infrastructure and the overall ecological configuration, just to name a few, comprise the uniqueness of 2-year technical colleges that stand out as a special and controversial educational entity. These are the main reasons

Due to the historical necessity, 2-year colleges (community and technical) have been playing unique and multifaceted roles to meet the socio-cultural and economic needs of our society. Nevertheless, the issues of scholarship in the 2-year colleges have been interpreted with different values and emphasis due to its hybrid structure and functions. Having been a grad student and instructor crossing over a research oriented educational institution, a 4-year polytechnic university, and to my current working at a 2-year technical college, I have been experiencing the role of "cognitive migrant" for seven years.

Stokes reflected on the "Pasteur's Quadrant," suggesting the dual focus of building basic theory while simultaneously improving practice. One of the puzzling issues is that most theories and practice in teaching and learning tends to focus on PK-12 or at the university level, leaving the most dynamic, diverse, demanding educational setting of the 2-year college with less adequate research and interests. Lord (1988) once pointed out that most people did not associate 2-year colleges with the terms "scholarship" and "research." One reason was that the college mission statements rarely included "scholarship and research" to be a necessary part of "teaching excellence". Furthermore, in higher education most people define scholarship as being equivalent to publication. Other academic activities outside publishing are neither noted nor appreciated. This led to some stakeholders' anti-elite style of publication that "neglected" what true education was about. The conundrum that excellent teachers will not be competent researchers nor excellent researchers rarely are good teachers reinforces such a stereotyping.

The question is that if pursuing the mutual enhancement between theories and practice is an important educational goal, then balancing research and teaching is a necessary step to reach that aspiration. If this is the case, then only focusing on teaching without the input from the "formal scholarly activity or research"[1] about what is really happening in the core of teaching and learning is similar to telling a story without contents, or building a house on the loose sands.

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[1] Ernest Boyer (1990) proposes a broader view of scholarship:
  1. The scholarship of discovery 2. The scholarship of integration 3. The scholarship of application
  4. The scholarship of teaching

Therefore, this case study intends to highlight a lived experience to bridge research and practice within a unique context where teaching 18 to 21 credit loads (an average of 7 classes) per semester is the norm, making scholarly research challenging. Besides, it also addressed some concerns, such as the emerging participatory technologies creating a new generation of learners who are familiar with the anytime, anywhere, and anyhow, as well as "any-what" learning style and demands, in addition to the economic uncertainty that reflects in educational budgetary constraints demanding more versatile and accountable in the teaching enterprise.

To attend to the above concerns, my research question is: What is the lived experienced of a social study instructor facilitating 6 classes via four delivery formats within a semester (from January to May, 2009)?

As to two terms in this paper, the "instructional issue" is defined as any concern that directly relates to the basic interaction between teachers and students. The "non-instructional issue" is defined as conditions beyond virtual or physical classrooms in the school setting.

The purpose of this research has two levels of significance. At the individual level, this paper examines issues from the instructional perspective to obtain first-hand experience to highlight 2-year college scholarship issues. It also surveyed the author's navigation among different instructional strategies (e.g., across pedagogy, andragogy, and huetagogy) between constructivism and instructionism, At the institutional level, the author also explored issues from the non-instructional perspective to illustrate the dynamics among the instructor, students, IT Department, and administration's anticipated learning technologies to provide accessibility and efficiency.

Research Background

While there is a considerable literature on the characteristics of successful online courses and on how to bring good pedagogy into the online learning environment (Conti, 1985b; National Center for Education Statistics 2001; Allen et al. 2002; Migliete and Strange 1998; Post et al. 1998; Parisot, 1997; Lowes, 2008), research on the multiple delivery formats of multiple courses on teaching and learning is sorely inadequate, particularly for the 2-year college setting.

In online learning environment, researchers and scholars have been touting the potential to transition higher education from a teacher-centered orientation to the constructivist student-centered approach (Sherron and Boettcher 1997; Beaudoin 1990; Dillon and Walsh 1992; Chanchaem 2001; Berge 1997; Kearsley 2000). But other researchers also indicate that there is a discrepancy between the promoted learner-centered style and what is happening in the online learning environment.

Online facilitation is different from the face to face instruction in terms of pedagogical approaches and learning technologies application (Zhao, 2003). However, online instructors tend to carry face to face pedagogies into the online environment (Connolly, Jones, & Jones, 2007). Sheely (2006) examined factors directed to answer "why online instructors cannot stop lecture online". Parisot (1997) stated "little has been done to understand the changing role of faculty in adapting to technology and the changes in the psychological and physical environment promised by distance learning". A decade later, Barrett et al.'s research echoes such observation, "….each new technological advancement engenders great expectations regarding its impact on instruction. Regardless of the changes in technology, teaching style has not changed and remains teacher-centered" (Barrett, Bower, & Donovan, 2007).   In order to implement quality online course, Kochtanek and Hein (2000) contend that transformation of the instructor's role from instructor to facilitator was an important initial step. They argued that a successful student-centered learning environment requires that the instructor's role to change from a knowledge transmitter to a knowledge facilitator.

Moving debates beyond f2f and online, within the limited multiple delivery format literatures, Lowes (2005) pointed out that "trans-classroom teachers" experienced very different cultures and social practices between two delivery environments: online and f2f. She suggested that their migratory journey to and from the online classroom can transform teacher's f2f classroom practice in subtle and important ways. Furthermore, Zirkle et al.

(1999) pointed out the transition to instruction through multiple delivery systems[2] has given rise to several issues and concerns. One of them relating to this paper is that teaching courses through multiple delivery formats requires high levels of expertise on the part of faculty.

As aforementioned, there are multiple purposes of this exploratory study. At the first cycle, this paper concentrated on the instructional and non-instructional aspect of study. It also focused on the subjectivity and inter-subjectivity between the author and her four delivery formats in examining the concepts among the wide spectrums of pedagogies between instructionism and constructivism.

Research Method and Procedures

To gain better understanding of the aforementioned scholars' research and suggestions, the author situated herself beyond the traditional dichotomy of online vs. on-ground by adding the hybrid and the currently piloting web-conference (using Microsoft Live Meeting to replace the high cost ITV and increase the accessibility to students) into the repertoire. With the above understanding in mind, through a year's planning and preparation via various type of professional development programs, the author obtained the opportunity to gather four major delivery formats started from last semester (beginning on January 12, 2009)– online, hybrid, web-conference via Live Meeting (similar to Adobe Connect/Breeze), and traditional face to face with web-enhanced methods for her six social studies courses: three sociology classes- one f2f, one hybrid, and one web-conference; one online Diversity Study; one f2f Developmental Psychology; and one f2f Contemporary American Society.[3]

The method applied in this introspective paper was an auto-ethnographical case study. The "situated adventurous teaching" experiences were documented in the daily and weekly class logs for each delivery format with a modified small scale of design-based research component.[4] There were 3 stages of construction described as follows:

Constructing the Basic Research Conditions and Procedures

1. Prior to implementing the multiple delivery formats : organizing the non-instructional resources
   - Understanding school's policy and concerns regarding delivery formats
   - Participating in relevant professional and curricular development projects and software learning processes
   - Constructing a sound technical supporting network.

2. During implementing multiple delivery formats : constructing the instructional process and assess products
   - Constructing collaborative wikiblog for learners' participation and reference. (e.g., http://cvtcsocialscience.wetpaint.com)
   - Construct experiential teaching Resources-Based websites for personal usage. (e.g., http://cvtcscholarship.wetpaint.com)
   - Informing incoming students and gather basic demographic information and technical skills.
   - Discerning student prior knowledge on subject matters and technical skills.
   - Documenting teaching and learning activities in class logs on daily and weekly basis for each delivery format (e.g., in the above wikiblog and BlackBoard master copy archive).

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[2] In Zirkle et al.'s case, students have the option of taking courses through one of four delivery formats: traditional on-campus delivery, IHETS (Indiana Higher Education Telecommunication System) satellite, videotape, and the Internet. Faculty members in the department teaches at least one course each week via multiple delivery. The faculty teaches the traditional course to on-campus students in a specially designed studio while distance students at the remote satellite sites participate simultaneously. After each class, videotapes of the session are mailed to those students who have requested that mode of delivery. The instructor then accesses the course Web site and posts lecture notes, presentation slides,

[3] In my current work setting, the average of teaching loads per semester is 7 classes or 21 credits. The national average ranging from 15 to 18 credits. The formal research and publications in the academic community is not required.

[4] My original design research method intent was cancelled after the first 3 weeks' cycle due to a frequent technical difficulty among far site learners, network issues and software affordances during the pilot period.

- Designing and implementing cyclical (3-5 weeks) teaching and learning conditions and assessing specific pedagogical/andragogical issues in each cycle from the instructor designed feedback system.
- Redesigning the teaching and learning environment and beginning another new cycle.

3. At the end of the whole cycle of the multiple delivery formats
- Analyzing the class logs and communication documents among the instructor and the relevant administrators.

Instrumentations

Three instruments were used in this retrospective study. One was student basic information survey (age, gender, GPA, income, employment conditions, level of technology familiarity, delivery format preference) designed by the author and was given to each student at the first day of school. The other one was "The Principle of Adult Learning Scale" (PALS, developed by Gary Conti in 1978) to be my self-report to discern the author's teaching style. The last instrument was a simple self report on performance satisfaction[5] measuring pedagogical fulfillment designed by the author for this paper.

Results

This retrospective auto-bio-ethnographical analysis went through inter-subjective categorization and reduction processes from recorded class logs and communications with school relevant administrators. I identified the following categories emerged from the data analyses. Three levels of themes emerged.[6] Due to time and space constraints, this paper focused on a theme from the microscopic aspect of "teaching meeting learning" and the relating instructional and non-instructional issues.

The Need of Differentiated Instructional Strategies

Teaching style can be one of the components to facilitate a desirable teaching and learning environment. Dede et al. (1999) maintained that to create an optimal environment for learning, instructors need to consider the confluence of not only technology and subject matter but also learner characteristics and pedagogical principles. These are the ingredients they propounded as a true synthetic learning environment (SLE). Instructors'

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[5] This subjective construct was based on f2f practices as the frame of reference. There are 4 items with Likert scale of 1 to 5 designed to tailor the instructor's characteristics to assess the optimal performance. This Self Report of Scarification includes the following items briefly described as follows:

(1) Technological affordances to facilitate pedagogical fluidity: Measure each format's capacity to support a specific pedagogy or instructional strategies. For example, will the delivery format allow the instructor's spontaneity in incorporating learning resources to happen seamlessly? Will the delivery format enhance the collaboration both synchronously and asynchronously?

(2) The need for the instructor's course management time: will the format demand extra technical preparation? For example, web-conference Live Meeting demands instructors to pre-load learning materials in a static format in each meeting session. It also needs extra course management system, such as BlackBoard to assist relevant learning activities.

(3) Dynamic interactive capacity: For example, when I need to present a video from Youtube in a timely fashion, will the delivery format facilitate that possibility without latency? In our current Live Meeting software, the course content has to be preloaded, and once preloaded, the content becomes static, e.g., the hyperlinks, and relating interactive functions would be lost. No document camera functionality (like the old Elmo) was available to demonstrate serendipitous information.

(4) Optimal performance: A delivery format enhances the strength and decrease the weakness of the instructor's characteristics in applying a specific instructional strategy? For example, personally I love podcast for my online class, but the accent that I carry much discourages such facilitation after a couple of attempts.

[6] These three themes are (1) the macro level relating to contextual, or school ecological issues, such as school climate, internal and external policy regarding budget, curriculum, retention, and accreditation, (2) the meso-level regarding the dynamics between classroom (both virtual and physical) and intra-institutional practices, such as student recruitment and orientation, academic service, and career and personal counseling , and (3) the micro-level of what really happened in the physical and virtual classrooms.

characteristics can also add up one more dimension into their repertoire. The instructor's characteristics, such as teaching philosophy, personality, and academic background and research interests also play an important role in the teaching and learning environment.[7]

In the SLE model, subject matter and pedagogical principles are controllable and manageable. The technology ingredient largely depends on the interactions among instructors, administrator and school policies. The most challenging factor will be the learner characteristics. The open admission policy of 2-year colleges accepts diverse learners based on first come first serve principle. The wide spectrums of student body consists of disproportionate numbers of learners who work, unemployed, displaced from jobs, raising families, or arriving college with academically unprepared (AACC, 2006; U.S. Department of Education, 2007). Without various types of Federal, State, and local financial supporting systems, majority of our current students would not have opportunities to access the post-secondary educational opportunities.

Via "The Principle of Adult Learning Scale" (Conti, 1978) self report test, I identified myself as a constructivist type of learner and facilitator.[8] On the student side, the informal student basic information surveys at the beginning of the semester (age, gender, GPA, income, employment conditions, level of technology familiarity, delivery format preference) showed the consistency with the profiles of 2-year college learners in the national statistics.[9] Typically, in my classes, a majority of students identified themselves as working class or (or non-middle class, from the annual income report), as well as the first generation to attend college. Learning with disabilities, ex-offenders, high school dropouts, displaced workers, returning aspirants for further knowledge or skill training comprised occupational, remedial, and transfer three major categories. As Cross (1981) pointed out by the time the 2-year colleges were developed, most young people from the higher socioeconomic groups and most of the high aptitude aspirant were going to 4-year colleges. And the majority of student entering open-door 2-year colleges came from the lower half of the high school class, academically and socioeconomically. This depiction of the general student profiles also provided an epitome of the continuous debate over the issue of hybridization of 2-year colleges in terms of being a comprehensive institution with university transferring preparation, or narrowing its roles by offering vocational training, adult and remedial education. No matter which path the 2-year would go, the diverse, under-served and disadvantaged student population will be continuously growing.

Facing the increasing diverse learners, though not all agreeing upon a simplified formula, Ertmer and Newby (1993) suggested to combine different theoretical perspectives into a simplified formula:

"….Employ the behaviorist perspective in situations in which learners have lower levels of task knowledge and for learning goals requiring lower cognitive processing; use the cognitivist perspective for middle levels of task knowledge and cognitive processing; and consider the constructivist perspective for situations in which learners have a higher level of prior knowledge and are working on higher level tasks, such as complex problem solving in ill-structured domains" (pp. 68–69).

Between a constructivist instructor and structured guidance needed learners posed many challenges in delivery methods. Gagne (1995) pointed out:

"….there are, after all, some useful human activities that are acquired without instruction, and others that result from self-instruction. But most practical and purposeful activities, such as the pursuits involves in vocational and technical training, are learned in settings that employ instruction" (p.17).

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[7] For example, in terms of self-efficacy, being a cross-cultural instructor, leaving the cultural comfort zone and moving back and forth within and between various teaching and learning subcultures is part of daily routines. My multi-disciplinary academic background (5 majors and 4 minors) , prior working knowledge and experience in military and government as well as the current Learning Technologies major also play a supportive role for this adventure. These advantages facilitate the author to take on multiple delivery formats for multiple courses as part of her teaching and learning endeavors.

[8] In last 10 years' student evaluations and comments, I got the pattern of recognition as a passionate and helpful instructor mirroring the constructivist type of description.

[9] As of 2009, the national profiles show there are 1,177 2-year colleges with 11.7 million enrollments, which comprise 44% of the total undergrads. Among them, 58% are female, the average age is 29. Above 21 years of age is 53%, and minority counts for 38 % of total enrollments (with 13% of African Americans and 16% of Hispanic is 16%, 7% of Asian/Pacific 7 %,l and 1% of the Native Americans). 40% of students enrolled as full time, and 60% are part-time.

Fortunately, the proliferation of research has provided results across the spectrums between radical constructivism and minimal guidance instructions. These solutions provide alternative instructional strategies (e.g., derived from pedagogy, andragogy and heutagagy) for different audiences and learning goals.

Differentiated instructional strategies involve providing students with different avenues to acquiring content; to processing, constructing, or making sense of ideas; and to developing teaching products so that all students within a classroom can learn effectively, regardless of differences in ability (Tomlinson, 2001). This type of synthetic or differentiated method is a solution in my daily virtual and physical classrooms.

From the instructional or pedagogical perspective, the instructor needs to be equipped with a wide range of instructional strategies falling between the highly structured direct guidance on one site to the ill structured facilitation at the other. Inside the toolkit, based on learner characteristics and delivery format's technological affordances, adjusting appropriate pedagogies, strategies and migrating among different teaching and learning environments is a key factor to be successfully engaging the diverse learners in the different delivery formats.

The following themes described such interface between the pedagogies and delivery formats from the 4 delivery formats of my spring semester 2009.

The Symbiotic Relations between Pedagogy and Delivery Formats

(1) Face to Face Delivery Format

Among the 4 delivery formats during spring 2009, f2f was the most manageable, effective and efficient method compared to other 3 methods. I heavily relied on non-verbal communications and spontaneity in my teaching. [10] "Well structured" learning activities or hands-on projects tends to fit majority learners' needs. Approximate 15% of students were self-motivated with stronger subject matter and relevant prior knowledge, who fit into various types of pedagogies. Among this able group, 3-5 % showed a similar type of the expertise reversal effect.

From the non-instructional perspective, this format was the least demanding IT support except minor classroom multimedia station problems which usually students and I could fix without sending service requests. To avoid sending tickets became a reflex starting 3 years ago. For school's scrupulously budgeting issues, the outsourcing IT jobs to private company made requesting timely technical service difficult. F2f class teaching also earns the lowest teaching loads – 14.4% per class with 27 students as the cap. [11] In this delivery environment, I had highest Self Report on Satisfaction score with 4.5 points on the 5 point scale. The student evaluation was above average (3.3/4.0). So, among the 4 formats, f2f was my most favorite delivery method.

(2) Online Delivery Format

Though the design principle provided social, cognitive and content presence for the online facilitation, it mainly lost my signature of spontaneity and dynamics as an expressive instructor who heavily relies on dramaturgies and body languages! Though missing the idiosyncratic features, I supplemented with timely feedback to compensate the missing ingredients. Interestingly speaking, I earned the highest evaluation among the 4 methods (3.5/4.0) which meant that without physical presence, I did better job than that of my dynamic f2f class performance! One speculations of mine was that the online learners were exempt from my third language accent and way of expressions that I had "imposed" on my f2f classes.

The other factor was that the prospective online learners were encouraged to take READI test to obtain online learners' capability profile in terms of reading comprehension, technical skills, and self motivational

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[10] For I am not a native speaker- English is my third language.

[11] Between 90 to 105 % is counted as full time teaching. Currently administration and union negotiations resulted in the following load counting: each f2f is 14.5%, online 15%, hybrid 15.6%, web-conference 18%, and high-school ITV is 21%.

characteristics. This step functioned as a filter to discourage learners who were not ready for online classes. Generally speaking, online learners possess higher reading and writing ability than that of students in other delivery formats.

From the non-instructional perspective, BlackBoard is our course management system (LMS). Though the constant updated versions are available to enhance interactive possibilities, due to the cost, the basic version did fulfill major teaching and learning goals. Recent studies show the limitations of proprietary LMS or CMS systems do not match up the emerging ubiquitous and serendipitous participatory learning. However, since majority of our students were not from middle-income households, the high-end devices and high-brow cognitive capacity were not part of the key discourse. In this delivery environment, my own Self Report on Satisfaction score was at 4 points on the 5 point scale- my second favorite delivery format.

(3) Hybrid Delivery Format

Hybrid, according to the available literatures, has been touted as the best of the two world method. As an educator, I enjoyed hybrid facilitation. This method allows a wide spectrum of pedagogical maneuvering in both settings. Nevertheless, it also posed challenging to incorporate two types of pedagogy and two systems of interactions and learning assessments which demand much more work in course management and complicating the mental migration between the two worlds within a delivery format.

From the non-instructional perspective, again, due to budget issues, eliminating pure online courses to be substituted with the less expensive hybrid offering has been a policy. The negotiation of class-size and work-loads has been a hot button issue between administrators and the teachers' union.

In this delivery environment, my Self Report on Satisfaction score was at 2.5 points on the 5 point scale, due to the complexity of migrating between two worlds and students' preferring the online part of engagement and less interest in the resident requirement (at least 50% of the seat time for every hybrid course) for variety of reasons.

(4) Web-conference Delivery Format

Last semester (spring 2009) was the second phase of the pilot program, and was my first attempt to try out this method. So far, this format consumed most of my teaching time. Among 6 classes of 4 courses, 40% of the preparation and teaching loads was spent on this method due to the limited software affordance to support certain type of pedagogies. The need to facilitate student learning with intense emails and BlackBoard, as one facilitator put it, " It was equivalent to teaching two courses in one format – one online and the other one was audio live conference." Data collected from the first phase pilot showed majority of students (144 students in 9 classes) expressed the negative evaluation on this method. A total of 8 Instructors participating in the pilot program presented 50- 50 positive and negative evaluation on this delivery format (CVTC, 2009).

Personally, Live Meeting web conference presented tremendous challenge in intended pedagogies. Via web-conference, due to the network technical difficulty, the webcam installation decreased the audio quality of all 3 far sites. Thus, the multifunctional web-conference was regressed into an "audio synchronous conferencing". Audio synchronous communication exposed my unique characteristics as a non-native speaker in this environment. Compared to my previous 3 semesters of facilitating ITV (interactive TV for multiple learning sites), the real-time virtual visual communications compensated the proximity inadequacy . The multiple remote site learners were able to see and interact with far-site learners and conducted collaborative projects in the synchronous fashion. Thus, comparing between ITV and Live Meeting conferencing, I prefer the former due to the visual interactions between far site learners and me.

From the non-instructional perspective, the network supporting system and students' technical skills were the essential for Live Meeting web conference to be functioning well. Both learners and facilitators need to be familiar with Live Meeting software and BlackBoard LMS systems. Unfortunately, each system has its own limitations. The limited technological affordances confine certain pedagogical possibilities.

The major reason for piloting this method, mainly was a top down decision making due to the budgetary concern and intended to provide an alternative access for students who would not be able to take other formats. It

resulted in replacing the much more expensive yet more effective ITV delivery method. In this delivery environment, my Self Report on Satisfaction score was the lowest at 1 point on the 5 point scale.

Conclusion and Discussion

This reflective paper resulted from a multi-levels of involvement with school system. It was an idiosyncratic monologue within the author and her delivery formats. Prior to taking off the multiple delivery formats, the original idea has been evolving from previous years conscious planning and preparation. The author used her situated and experiential teaching conditions to address two major concerns relating to technological affordances and pedagogies in one of the emerged themes. These two major concerns are: (1) the paucity of research and interest in the fields of 2-year colleges relating to learning technologies, in particular, the multiple delivery formats, (2) the circumstances between a differentiated knowledge transmitter and knowledge facilitator associated with instructional and non-instructional factors that affected teaching and learning engagement.

Overall, what lesson did I learn from this pre-meditated adventure? I concluded that being a pan-classroom[12] facilitator enhances the following conditions: [13]

- Being an adventurous instructor, flexibly situated oneself in an diverse teaching environment.
- Being an organic cognitive migrant, fluidly migrating among multiple teaching milieus.
- Being a 4A Self-organizer, accustomed to bridging the anytime, anywhere, anyhow, and any-what (informal learning) learning conditions.
- Being a serendipitous facilitator, comfortably being a ubiquitous 4A life-long learner.
- Meeting school mission statements to facilitate diverse students' access and intended success.

As to other positive and non-positive experiences being a multiple delivery faculty at a 2-year college setting, I concluded as follows:

1. The positive effects are:
    (1) At the psychological level:
        - Enhancing self efficacy.
        - Being aware of technological affordances in each environment.
        - Being adaptive to the pedagogical adjustments within and between different delivery formats.
    (2) At the pedagogical level:
        - Being responsive to diverse students' characteristics and learning needs in different formats.
        - Being able in evaluating hardware and software capacities and limitations.
        - Being at ease to integrate contents, pedagogies and technology.
    (3) At the socio-cultural level:
        - Creating opportunities to network with IT department and relevant administrators.
        - Being a better problem solver.
        - Being a part of change agent team.

2. The non-positive effects are:
    (1) Community of practice: it is not a popular journey because not many faculty members choose to deliver multiple methods. Thus the community of practice is inadequate for further professional development via the wisdom of the crowd.
    (2) Idiosyncratic features: It exposes my idiosyncrasy in certain delivery format, such as the audio web-conference which does not manifest my pedagogical strength.

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[12] Lowes coined the trans-classroom teachers as instructors who facilitate and migrate between f2f and online. In this paper, I used "pan-classroom teachers" as instructors who migrate between more than two environments.

[13] It might not be the case in other faculty's condition. For example, I am the only faculty member in the department having the Learning Technologies as one of my majors. For some faculty, facilitating we- conference can be an unfathomable nightmare. The multiple delivery format entails knowledge management skill, some hardware knowledge and software knowledge, adjusting the cognitive migration among different delivery formats. The simplest way to start multiple delivery is to begin with hybrid, then move toward other combinations.

(3) Teaching loads and scholarship climate: the emphasis on teaching with an average of 21 credits or 7 class teaching loads leads to tremendous difficulties to conduct research. So how to nurture a scholarly environment to promote the Pasture's Quadrant is an imminent yet complicated task.

Further research is needed to address the macro- and meso-level issues beyond merely the interface between learning technology affordances and pedagogies. Furthermore, the economic uncertainty and other non-instructional factors could impose constraints on the instructional sphere, thus, enhancing the variety of pedagogical practices and adopting technological affordances will be a solution. Additionally, the emerging participatory learning entails educators to be versatile and adaptive in integrating emerging technologies with pedagogies and content knowledge.

Empirical study at this micro-level regarding multiple delivery formats can be extended to the measurements of effectiveness and efficiency. Forming a larger community of practice from faculty who facilitate multiple delivery formats can facilitate that goal. From this aspect, it is also urgent to call for a systemic change in 2-year college scholarly engagements to redefine the educator's roles in bridging theories and practice and in integrating educational technologies to facilitate diverse students' learning needs.

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Evaluation Framework For the Use of ICT in Education: CIPO Model

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Abstract: With the development of the use of ICT in education in China entering a new phase, the original analysis framework has difficulty in further guiding the further development. This paper brings forward a new analysis and evaluation framework for the use of ICT in education based on CIPO Model, which consists of four levels: *Context Analysis and Evaluation, Input Analysis and Evaluation, Process Analysis and Evaluation, as well as Output Analysis and Evaluation*. The model analyzes the use of ICT in education from the macro, meso and micro perspectives, in hope of bringing new inspirations to educators, such as policy makers, researchers, facilitators, practitioners, and IT manufacturers, etc.

Keywords: CIPO Model, ICT in Education, Context Analysis, Input Analysis, Process Analysis, Output Analysis

1 Introduction

Along with using of ICT in education in China transforming from the phase of "large-scale deployment period" into that of "using skill upgrading period", all levels of education authorities are actively preparing the future development plan for ICT in education. The premise of formulating a scientific and reasonable plan is a comprehensive analysis and evaluation of the use of ICT in education in China. This paper will give an in-depth analysis for the four aspects of ICT in education based on CIPO model.

The CIPP model put forward by Stufflebeam (2003) not only is widely applied in the educational field, but also provides a more comprehensive guidance for the assessments of various project managements, especially for those projects that are ready to be carried out for a long time and hope to acquire sustainable improvement. CIPP model is also known as "decision-oriented evaluation model", consisting of four parts, which are Context evaluation, Input evaluation, Process evaluation and Product Evaluation, each of which provides different information for decision-makers. The greatest value of CIPP model is that it gives a detailed study on the evaluation subjects from the background of its occurrence and development to the affective factors, development process and its results, which has great significance and value for the overall review and guidance of the project.

2 Evaluation Framework For the Use of ICT in Education: CIPO Model

This research sets up CIPO model of use of ICT in education (Zhang Jinbao, 2008) with the reference for the two core ideas of CIPP model, one of which is introducing the objectives into evaluation field and evaluating current objectives themselves before the process of context evaluation, while the other is emphasizing on the evaluation throughout the whole process. Based on it, the research further develops it into an analysis and evaluation framework of ICT in education. See Figure 1. And:
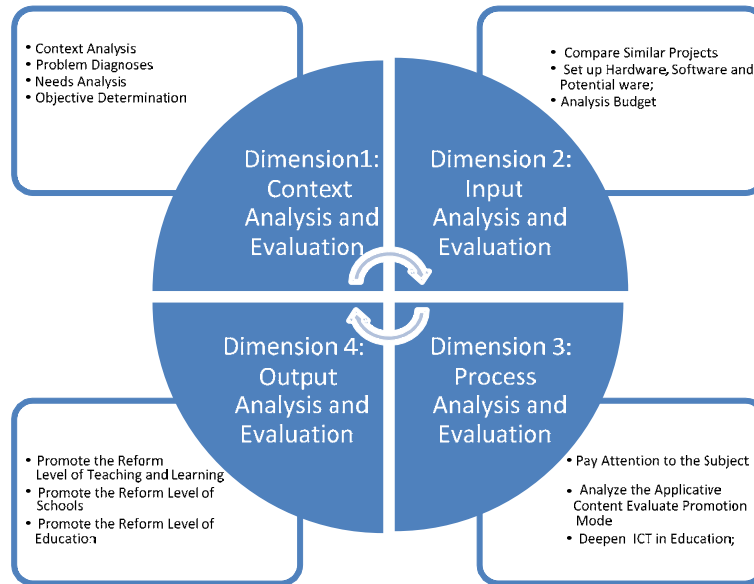
Figure 1 Analysis and Evaluation Framework of ICT in education Based on CIPO Model

⑴ ***Context analysis and evaluation***. A combination of factors that affect the objectives, necessity and feasibility of ICT in education include the aspects of education, culture, economy, technology, institution and so on. In this part, the "information technology industry" in the original "six elements of informationization" should be considered as the element of this level;

⑵ ***Input analysis and evaluation***. That is the part that a variety of ICT in education projects directly invest in, generally including hardware input, software input, service input (including training) and supporting input. In this part, the "infrastructure", "resource development", "professionals", and "policies, regulations and standards" in the original "six elements of ICT in education" should be considered as the elements of this level;

⑶ ***Process analysis and evaluation***. That includes the issues such as the subjects of the application (initiator, facilitator, transforming agents and policy makers), application contents (concepts and methods, tools and systems), promotion mode (decision-making, adoption and dissemination), and deepening the application and integration of informationization;

⑷ ***Output analysis and evaluation***. That focuses on the analysis of promoting the reform at three levels, which are the reform of teaching and learning, that of schools and that of educational system.

The introduction of ICT in Education evaluation and analysis framework based on CIPO model makes the original over-flat analysis framework have a clearer hierarchy and the status and role of each element in the whole ICT in Education becomes more accountable. In particular, the process of ICT in Education changes from the original " utilization of information resources and application of information technology" to four operational elements including "human beings", "content", "promotion", and "implementation", which has more significant meaning of guidance for researchers and practitioners.

Next, we will analyze each of the four aspects involved in the model and discuss the questions that need paying attention to.

3 Context Analysis and Evaluation of ICT in education

For the education-oriented informationization, the international circumstances, such as globalization and diversity, and the domestic circumstances, such as education, science and technology, culture, society and economy are all external factors, which cannot be ignored, in the development of ICT in Education. Globalization is a wave of social rationalization and integration which takes the economy as the guide, the values as the core, the politics as the supplement and the general culture as the main body; while informationization is the process transforming from the society dominated by the material production to that dominated by information industry. One of the main reasons for the countries all over the world to compete in investing in ICT in Education is the inevitable product in the trend of globalization and informationization, especially that the rapid development of information industry demands for opening up much broader market space for itself.
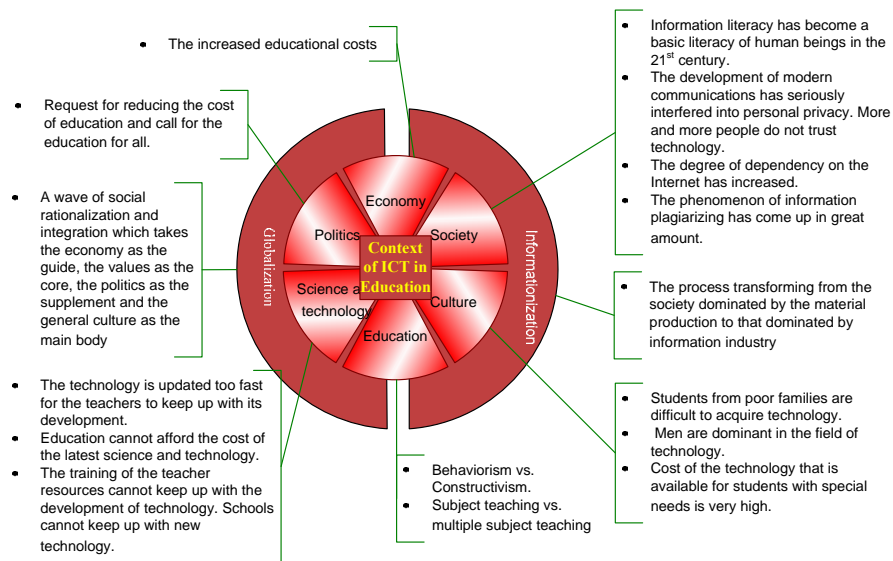
Figure 2   Context of ICT in Education

Since the link between the objectives of economic development and social progress and the development of education, especially that of ICT in Education was established, strong political overtones have been added to the development of ICT in Education. The 16th National Party Congress has set up a strategic goal of building up a well-off society in an all-round way at a higher level in favor of the population of over 1 billion by 2020. Thus, the Chinese government is actively adapting itself to the need of international competition in the circumstances of globalization, and also fully understands that informationization is the general trend of the development of the present world as well as the important power that promotes the economic and social reform. Education has been endowed with a key role in responding to the challenges of globalization and informationization by the Chinese government. Through the process of the 16th National Party Congress, the 3rd and 4th plenary sessions of the 16th National Party Congress and the National Conference on Human Resources, the strategy of rejuvenating the country through science and technology and education and that of reinvigorating the country through human resource development have been gradually clarified.

By examining the relationships among various contradictions within education, we can also see that people have great expectations for ICT in Education. From a macro perspective, the education in China faces the following

four critical challenges, which are the lack of investment in education in general, extremely unbalanced development of education, unreasonable personnel structure and mode for talent training, and incomprehensive ideas of educational institutional reform (Zhang Jing, 2005). And those aspects are influencing the ideas and approaches of the educational reform and development in China. As information technology has obvious advantages, it makes ICT in Education be regarded as an important force to facilitate or accelerate the educational reform and development in China. As early as in 1998, an official of the Ministry of Education of China has put forward the assertion that modern educational technology is the commanding height and breakthrough of education reform and development, which has been further verified to be an ME proposition by the academia (He Kekang, 1999).

Above all, the development of ICT in Education has a strong historical and social background. It is the requirement of the nation in realizing economic development, social development, educational development and technology development and so on. In such a broad context, the implementation of ICT in Education requires us to be aware of the related requirements generated by all aspects, to comprehensively review them and to design systematically so as to formulate the strategic objectives for the development of ICT in Education.
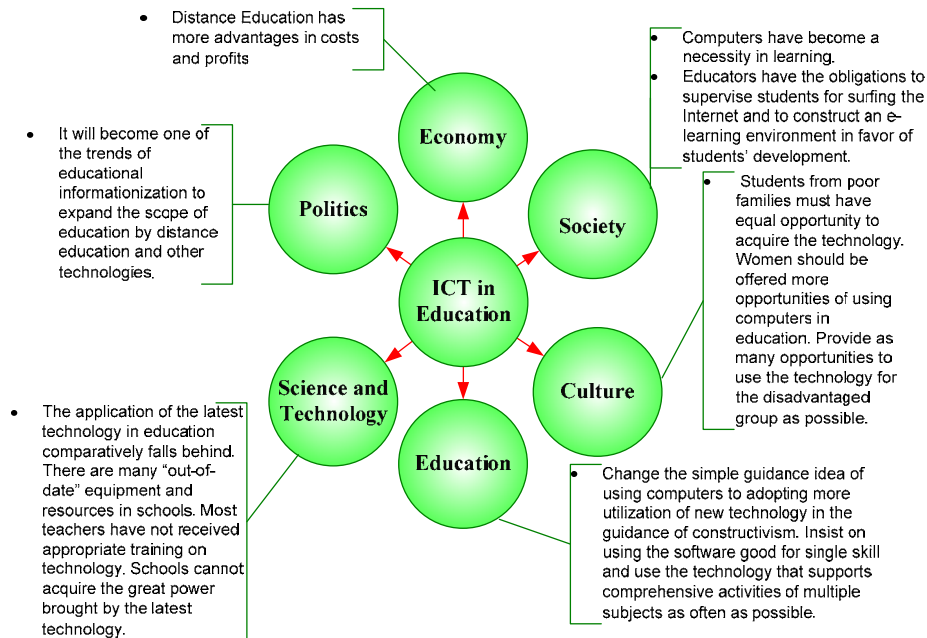
Figure 3　Analysis and Evaluation of the Input of Task for ICT in Education

A research report (OECD, 2005) shows that the infrastructure of ICT in education is becoming more and more popularized both in developed and developing countries. In the "six elements framework of ICT in Education " that we are familiar with, four of them are the directly operational objects to promote ICT in Education, which are the "infrastructural construction", "information resources construction", "training for informationization talents" and "policies, regulations and standards of informationization", corresponding to the three sections, which are "hardware", "software" and "potential ware", in the investment of ICT in education

"Infrastructural construction" refers to a variety of equipment, such as computer equipment, networking equipment, mobile terminals, multimedia equipment, satellite equipment and their construction and maintenance. It aims at equip current educational institutions through the use of ICT equipment to promote educational innovation and development so as to enhance the quality of education. On the premise of the constraint of funding for education, how to provide more advanced and faster computing devices for education, how to provide more secure and stable

network equipment with wider bandwidth and faster response speed for education, how to provide more handy multimedia equipment and mobile terminals with higher definition for education which can better satisfy the needs of education are the problems to be solved in this aspect. As the specialty of the education field, profit and funding are difficult to guarantee, so ICT in Education is required to solve the problems, such as "effective input", "on-demand design", "strengthening the maintenance and management," "improving efficiency", and "enhancing profit" and so on.

"Information resources construction" can be divided into resources related to supporting teachers' instruction, those related to supporting students' learning and those related to supporting educational management. Digitization of information resources is an effective way of sharing educational resources of high quality, and also a necessary precondition to carry out the integration of information technology and curriculum in education. This aspect has received the amount of investment from the nation only second to the aspect of "infrastructural construction". Over recent years, it has got a large amount of educational resources and established a number of focused educational resources databases. As the construction of educational resources is not simply digitalized, but concerns the needs of users, so the top priorities of current construction of information resources are how to get more investment to develop the themed educational resources with more specific focuses, how to strengthen the mechanism of resource sharing and opening up, including standards for resource construction in order to deliver more free resources to the units in need of them and how to build up a more intelligent resource searching and classification system.

"Training for informationization talents" includes not only IT teachers and other technical supporting staff, but also the informational literacy and informationization skills of subject teachers and school administrators, which is of great significance to ensure the smooth development of ICT in Education and also is the important service in the investment of ICT in Education. Training for informationization talents has to make great efforts to train IT teachers, subject teachers and students as well as to strengthen the building of multidisciplinary faculties.

"Policies, regulations and standards of informationization" includes the investment planning and financial policies of ICT in Education, the incentive policies for encouraging the application of information technology, and various series of specifications and requirements for hardware, software and services, etc., which is an important guarantee of ICT in Education. However, the problems in this aspect are the coordination among national policies and the differences of systematic educational reform and the reform itself, which cannot be solved by a single reform approach.

"To build for use" is an incontestable truth. However, so many challenges that present ICT in Education faces cause people's doubt about its construction. One important aspect is how to measure the cost and profit of ICT in Education. According to the research report by World Bank, currently there still lacks an effective measurement for the costs of the construction of ICT in Education. Therefore, it is very necessary to focus on the research into the costs of ICT in Education.

Here are some research fields worth focusing:

⑴ The contents of total costs of ICT in Education, such as opportunity costs, equipment costs, maintenance costs, ownership costs, calculation method, etc.

⑵ Correlation study on the input and output of the investment in education in different regions, different phases and different educational methods. For example, which kind of ICT in Education should be currently carried out in western China to produce maximum profit?

⑶ The problem of costs for achieving the objectives with different technical plans and different forms of media. For example, cost differences in Internet access, cost differences between resources development and

delivery and maintenance, etc.

⑷ Research into the cost of specific forms of ICT in Education. For example, the launching costs in distance education, the average cost of learners, the average cost of graduate students, as well as the problem of cost transferring and the enormous cost in the using and maintaining the donated computers.

⑸ The impact of financing mechanisms of ICT in Education on cost saving, such as the methods of government investment, public-private partnerships, local credit, personal credit, etc.

4 Analysis and Evaluation of the Promotion Process of the use of ICT in Education

Although the infrastructure is gradually popularized, the effect of application has not reached the required level. A very important reason is the problem in promoting the application of ICT in Education. In the past, the analysis of the application of ICT in Education mainly focuses on the input elements of ICT in Education, such as system design, equipment performances and maintenance, resource development, the quality of the users and so on, but seldom focuses on the process of application, which prevents the proper promotion of the application of ICT in Education.

Based on the theory of Diffusion of Innovation by Rogers (1995) and Concern Based Adoption Model by Hall et al (2004), we divide the analysis and evaluation of the promotion process of the application of ICT in Education into four aspects:

⑴ The main body of ICT in Education, including all kinds of educational policy makers and administrators, initiators, facilitators and the ultimate users of the application of ICT in Education, As the differences of roles, different stages in career (eg, pre-service, in-service, and post-service), individual factors (such as life stages, families, hobbies, personal characteristics, life crisis, critical events, etc.), social factors (such as rules and regulations, management methods, the public trusts, social expectations, experts' opinions, the units one works for, etc.), differences of innovation and degrees of risks (such as pioneers, early adopters, early majority, late majority, those who are left behind), differences of the adoption and decision-making process (such as autonomous decision-making, collegial decision-making, authorized decision-making), the communication and exchanges among the main bodies of ICT in Education has become the key to the application of ICT in Education.

⑵ The content of the application of ICT in Education, including the application of information-oriented concepts of education and instruction (also known as "innovative concept"), methods of instructional design and instructional strategies (also known as "innovative technology"), information-based tools and information-based systems (also known as "innovative product") and so on in education. Because they are different in comparative advantages, compatibility, complexity, the features for observation and experimentation, there will be great differences in the concrete promotion process, which has to draw the attention of all practitioners in the field of ICT in Education.

（3）Promotion mode of ICT in Education. It directly affects the speed and effects of the proliferation of the content of the application of ICT in Education. The effects of dissemination and proliferation are affected by media channels (such as mass media, interpersonal communication, administrative orders, etc.), dissemination mode (such as point-to-point mode, vertical dissemination mode, horizontal dissemination mode, etc.), degrees of users' engagement in the innovation and development (such as function-oriented development, user-oriented development, demand-oriented development, reform-oriented development, etc.).

（4）Deepening information-oriented education. It is the key to realize sustainable development of ICT in Education and ultimately realize the goal of ICT in Education. Users experience three phases of "focusing on oneself", "focusing on work" and "focusing on the effects in cognition, experience eight phases of "unused", "orientation", "preparation", "rote implementation", "routinization", "specialization", "integration", and "update" in behavior. Adjusting the promotional activities and process according to the users' feedback and providing necessary support for them are indispensable work in promoting ICT in Education to a further development.

It should be pointed out that the concrete application of present ICT in Education is often constrained by four aspects, which are the effectiveness of application, the specificity of application, the routinization of application and the conditions of application. Those problems have been affecting the whole process of the application of informationization, and they are also the four aspects of promoting the application of ICT in Education.

5 Analysis and Evaluation of the Output of ICT in Education

The analysis of the output of ICT in Education reflects people's attention to the effects of ICT in Education. On the one hand, people are eager to know the status quo of its development; on the other hand, it is the evaluation of the degree to which the objectives have been achieved. Because people's expectations and purposes for ICT in Education are different, the focuses on the analysis of the output of ICT in Education also vary. According to the report by World Bank, there are not widely accepted criteria for evaluation at present. For example, the criteria of ISTE for students, teachers, administrators, technical staff, "Performance Indicator System of ICT in Education" developed by UNESCO (2003) and so on. In addition, different countries have obvious differences in the evaluation indicators (shown as Table 1).

Table 1 Evaluation Index Levels and Indicator Types of the Effects of ICT in Education in Some Countries

Countries	Levels*	Qualitative Evaluation Indicator	Quantitative Evaluation Indicator
USA, Canada, Europe (Denmark, Sweden, Finland, Norway and UK), Australia, South Korea, South Africa	3	√	√
New Zealand	2	√	√
Japan, India, Malaysia, Thailand, Uzbekistan, Commonwealth of Independent States countries and Baltic States countries	2	√	
Indonesia, the Philippines, Vietnam, Slovenia	1	√	

* Level 1：only includes input indicator；Level 2：includes input and process indicators；Level 3：includes input, process and output indicators.

This paper argues that, although there are certain differences among the evaluation system developed by different countries or agencies, we cannot arbitrarily determine that the higher the level of evaluation is, the more comprehensive it will be. The starting point of selecting or developing their own evaluation indicators should be based on their own objectives, that is the purpose of the evaluation. According to the author's understanding, the

analysis of the output of ICT in Education can be divided into three levels, which are "promoting the reform of teaching and learning", "promoting the reform of school" and "promoting the reform of education".

5.1 The Level of "Promoting the Reform of Teaching and Learning"

The ultimate objective of ICT in Education should lie in promoting the development of students and teachers' profession. The Minister of Education, Mr. Zhou Ji said, "We should insist on fostering people-oriented and student-centered education and insist on talent-oriented and teacher-centered operation of schools. The core of this dialectical relationship is two points. What is the development of our education for? For people. How should we develop education? By people. "(Zhou Ji, 2005) The application of information technology in education should firstly point to the development of people in education. Reflected in the output of ICT in Education, the teaching reform in the context of ICT in Education reflects changes in three aspects, which are the change in the roles of teachers and students, the change in the process and methods and the change in the evaluation process. Therefore, the analysis of this level should focus on the facilitating effects of the changes in the above three aspects.

However, the research into the analysis of the output of the level of "promoting the reform of teaching and learning" shows that the popular four approaches of the application of ICT in American school education are still computer teaching, lesson preparation, instructional inquiry, as well as word processing and presentation. The successful mode of the integration of ICT in or out of school instruction is still unclear. In other words, further efforts are needed for promoting ICT in Education in the reform process of teaching and learning process (World Bank, 2007).

The report by OECD points out that currently ICT is far from being the core of the learning process, although it is believed that ICT will have a positive impact on learning performances; and there is still a lack of evidence for a positive impact of ICT in Education on students' performances. However, some researches show that if ICT in Education is related to education, it will be much easier to have a positive impact on students' performances; and from the perspective of motivation, the application of ICT in education effectively encourages teachers and students. And some other researches finds that the opportunity of obtaining ICT will influence users' confidence and the utilization of ICT can enhance learners' autonomy. Those are part of the issues to be focused on when analyzing the output of ICT in Education on this level (OECD, 2005).

5.2 The Level of "Promoting the Reform of Schools"

The reform of ICT in Education involves the reforms of school management, instructional working habits, and infrastructure and so on. However, any reform is subject to the school's cultural traditions, management system, teachers' working conditions, working habits and working services. Thus, a comprehensive reform is difficult to break through only by the school's own culture and system evolution. Unless someone with strong achievements in technology, theory and instruction, etc. strongly push it, together with the institutions and organizations with strong educational backgrounds, backgrounds of educational technology theory as well as technical problem-solving capacity that break the cultural inertia by external attacks in order to promote the reform of schools.

On the level of the reform of schools, data collection and decision support provided by informationization help to improve the scientific and planning school management, to promote the implementation of school-based management, to realize the "off center-oriented" in the process of school management, and to realize openness and transparence of school administrative affairs. Therefore, those are important aspects of informationization in promoting the reform of schools.

Both OECD countries and those with low level of development have some successful experience about the utilization of ICT on the level of promoting the reform of schools. Some of the successful experience has been well

documented, such as the series of reports on "Education for Tomorrow" by OECD. However, on the whole, successful experience or failure lessons of ICT in Education are rarely widely disseminated, or there are no easily acceptable approaches presented for decision makers; nor have they been clearly examined in the educational context related to the Millennium Development Goals. Therefore, there is still a lot of work to be done by informationization on the level of the reform of school management system.

5.3 The Level of "Promoting the Reform of Education"

On the level of promoting the reform of educational system, ICT in Education will finally make the realization of the "Education for All" possible and help to reduce the uneven distribution of educational resources among different regions to achieve fair requirement for education. In addition, the enhancement of the degree of informationization will also contribute to the diversification of educational objectives and evaluation.

The report by World Bank points out that the utilization of ICT in improving the efficiency of educational organizations and educational system, including the application of it in anti-corruption work in the departments of education is currently the very period of high rate of return for developing countries (World Bank, 2007).

Research report points out that on the level of the reform of educational system level, different countries have different government departments responsible for the work of ICT in Education and successful policies for ICT in Education need to take the main bodies of multiple interests into account. The report also shows that informationization does play a good role in the field of special education, such as in helping the handicapped, etc., which will contribute to the realization of educational equity, but the informationization itself has the possibility of expanding unfairness to form the so-called digital divide. In the areas with a higher marketing degree, informationization helps to the dissemination and sharing of educational contents.

6 Conclusions

Various factors push forward the necessity of making great efforts in developing ICT in Education, and promoting the development of ICT in Education definitely requires us to thoroughly understand the inherent regulations by implication. As the ICT in Education in China has entered a new stage of development, it is the goal that researches relentlessly pursuit to look at ICT in Education from a higher and more comprehensive perspective so as to have a positive impact on future theoretical research and practical activities. In this paper, the author attempts to develop ICT in Education analysis framework based on CIPO model from the six-element model of ICT in Education. As the first attempt, the analysis of mutual relations and internal elements is slightly stiff with many deficiencies. However, the author firmly believes that the analysis framework with the general background of informationization development as the important starting point, "hardware", "software" and "potential ware" as the input elements, four aspects of promoting "the application process" as the process and the realization of "the reform on three levels" as the output reflected by the analysis and evaluation framework presented in this paper, will bring new inspiration to educators of ICT in Education such as policy makers, researchers, facilitators, practitioners, IT manufacturers, etc. from the macro, meso and micro perspectives, and will provide important guide for promoting educational modernization by ICT in Education in the new five-year development stage in China as well as realizing the leapfrog development of education.

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"We are hitting home runs!"
Investigating Early Impacts of Online Professional Development Courses on School-wide Systemic Improvement in New York City Schools

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I. Introduction

WIDE World (WIDE) at the Harvard Graduate School of Education offers research-based online and onsite professional development (PD) programs to help educators achieve systemic and sustainable educational changes by improving student learning, teaching and leadership. WIDE's 12-week online courses aim to support teachers and leaders to understand and enact research proven and practical strategies through interactive and coach-supported learning activities. Often accompanied by onsite workshops, WIDE online courses also encourage teachers, teacher-leaders, and school leaders to apply ongoing reflections and collaborative teamwork to their everyday practices to establish schools as coherent, professional, and systemic learning communities. The current topics of WIDE courses include teaching for understanding, differentiating instruction, engaging multiple intelligences, integrating technology into curricula, data-driven educational improvement, and school leadership.

In August 2007, WIDE received a grant from the Harvard Club of New York (HCNY) Foundation to support professional development for New York City educators. WIDE World doubled the impact of this generous funding by requiring participating schools to match the grant funds, thereby enabling 130 teachers and leaders from six New York City (NYC) elementary and middle schools to take advantage of WIDE World's offerings in the school year of 2007-08 (Year 1). Moreover, this grant also allowed the WIDE's Research and Evaluation Department to carry out an in-depth case study to document and analyze early impacts of WIDE on educational improvement in key areas of learning, teaching, and leadership in these schools.[1] Thanks to the successful outcomes of this first cohort, the HCNY Foundation approved of a second-year grant, which was also matched by participating schools, to extend WIDE's collaboration with NYC schools into 2008-09 (Year 2).

From September 2007 to May 2009, a total number of 184 teachers and leaders in six of NYC's public schools have taken the following eight WIDE online courses.[2]

- **DI**   Differentiating Instruction: Strategies for Effective Classroom Practice
- **DW**   Getting Started With Data Wise
- **LfU1**   Leading for Understanding 1
- **MI**   Using Multiple Intelligences as a Tool to Help Students Learn
- **TfU1**   Teaching for Understanding 1: Focus on Student Understanding
- **TfU2**   Teaching for Understanding 2: Understanding in Practice
- **TSNT1**   Teaching to Standards with New Technologies 1
- **TSNT2**   Teaching to Standards with New Technologies 2

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[1] Preliminary Progress Report to the Harvard Club of New York Foundation (September 2007 - April 2008)

[2] Refer to the WIDE World website at http://wideworld.gse.harvard.edu for more detailed information on these courses.

Three schools out of the six Year 1 schools continued their participation in Year 2. All located in Bronx, the schools and their principals are:

- **Connected Neighborhood Elementary School (CNE)**: Principal Jones
- **Every Child Elementary School (ECE)**: Principal Miller
- **Technology and the Arts Middle School (TAM)**: Principal Ellis[3]

One of WIDE's main research goals is to understand both the process and the specific impacts of WIDE courses on instructional practices, student outcomes, school leadership, and on broader system-wide (e.g., school or district) improvement. By providing high-quality, research-based professional development courses using networked technologies, WIDE aims to support teachers and leaders in educational systems to achieve more coherent, transformative, and long-lasting improvement on a wide scale.

In recent years, United States schools have been preoccupied with meeting accountability requirements mandated by legislation such as No Child Left Behind Act (NCLB) for all public schools and students.[4] These requirements include annual testing for all students in grades 3-8 to ensure that every student makes Adequate Yearly Progress (AYP). The three schools in this study are included in this mandate. Although each school approached WIDE with different goals and outcomes in mind, they all had common interests in using WIDE courses to address challenges identified in their external assessments and to meet the educational accountability standards of both NY State and NYC. Thus, as described in this report, these three principals purposely selected WIDE courses and recruited selected teachers and leaders, with the intention of meeting the specific accountability challenges faced by their schools.

This report begins with an overview of the Systemic Educational Improvement Model that guides the design and analysis of WIDE World's professional development programs, followed by a brief description of the methods used to conduct this study. To situate this study in its policy context, we provide a short summary of the educational reform priorities and some key accountability systems in New York State and NYC. In the next section, we introduce each school in this study, including their goals and intended process for working with WIDE.

The Outcomes sections synthesize salient themes and particular accomplishments of the three schools. They summarize both the direct impact on individual participants (i.e., teachers and leaders) and the secondary impacts on students and schools, with a particular focus on the schools' efforts to meet their accountability challenges.

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[3] I have used pseudonyms for the names of the three schools presented in this study. I have not made any other changes to information presented in the report from each school.

[4] http://www.ed.gov/policy/elsec/guid/states/index.html Four areas of NCLB are 1) accountability for results, 2) an emphasis on using results from scientific research, 3) expanded parental options, and 4) increased local control and flexibility.

II. Research Context and Methods

Conceptual Framework: WIDE World Systemic Educational Improvement Model

Since its inception in 1999, WIDE World has gradually evolved its goals from improving classroom practices of individual teachers to foster broader improvement of educational systems over time. The conceptual framework shown in Figure 1 depicts a simplified and idealized overview of this process and intended outcomes.
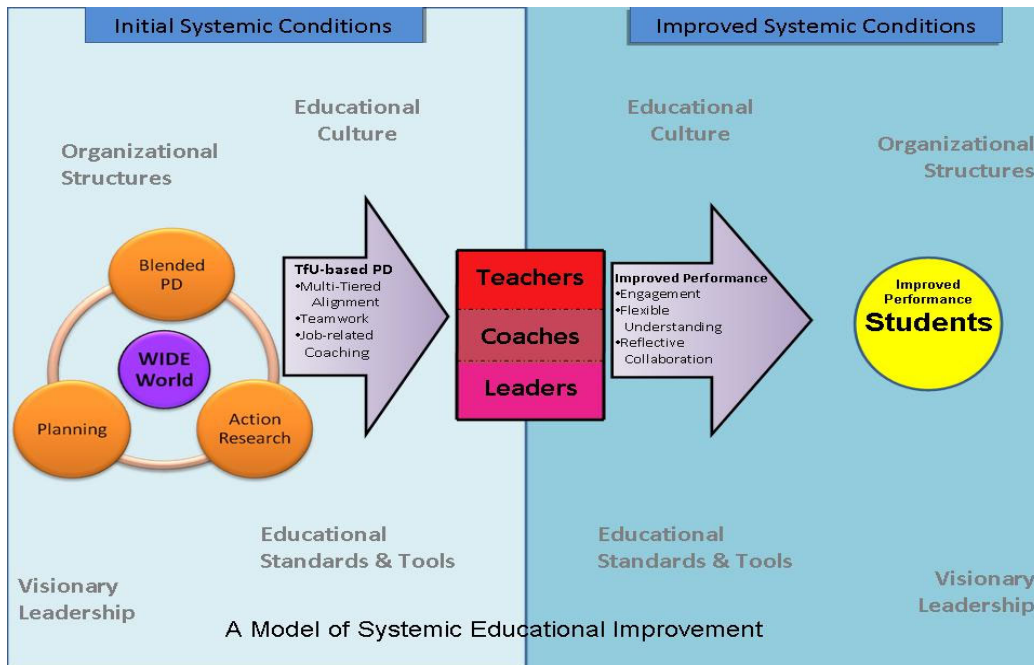
[Fig. 1 Systemic Education Improvement Model (SEIM)]

We define an educational system as a group of educators working in an organization (e.g., school, district, or country), whose practices are influenced by a set of initial systemic conditions broadly named as *Organizational Structures*, *Educational Culture*, *Educational Standards and Tools* and *Visionary Leadership*. At the beginning of WIDE World's relationship with an institutional client, we collaborate with them to conduct informal assessment of the initial conditions and co-construct a plan for blended (online and onsite) professional development. We also plan a means of conducting action research with the client to support ongoing assessment of the process and impacts of the professional development activity that will inform further planning.

The first purple arrow next to the orange circles identifies key characteristics of the professional development programs supported by WIDE that help teachers and leaders to improve their practices. The second purple arrow, on the right, indicates categories of improved professional performance that we think are key outcomes for teachers and educational leaders. These components are: increased *engagement* in school work, *flexible understanding* of high quality teaching and leadership, and more *reflective collaboration* with colleagues. These outcomes are displayed in an arrow because we believe that better performance by educators leads to improved student performance, conceptualized in the same three categories: increased *engagement* with their studies, better *flexible understanding* of their school work, and more *reflective collaboration* with peers. These student outcomes are consistent with the active, meaningful, continuous learning and collaboration that is often described as the necessary for student success in the 21st century world.

The model also indicates that improvements in performance by teams of teachers and leaders engaged in coherent, multi-level professional development ultimately have a positive impact on the systemic conditions of *Organizational Structures, Educational Culture*, *Educational Standards and Tools,* and *Visionary Leadership*. Although the diagram suggests change over time in a left-to-right progression, we believe that the systemic improvement process is cyclical. Improved systemic conditions create a new context for another round of professional development until the client organization develops sufficient expertise to foster ongoing learning and action research that support its continual improvement.

This study of WIDE's professional development programs in New York City schools has allowed us to derive and apply this model to analysis of our extensive two-year research data. The Results section of this report organizes our findings according to this model to highlight the system-wide change process in the three schools and derive valuable crosscutting themes from these cases.

Accountability Systems in New York State and New York City
In this section, we briefly explore ways in which New York State and NYC carry out their accountability requirements in order to illuminate the policy context within which these schools participated in WIDE World's programs.

In July 2002, NYC Mayor Bloomberg appointed Mr. Joel Klein, a graduate of NYC public schools, as the first Chancellor of the newly-reorganized Department of Education (DoE). The NYC DoE serves over one million students in about 1,500 schools located in Manhattan, Queens, Brooklyn, Bronx, and Staten Island. According to the NYC Department of Education (DoE), the Bronx is the third largest borough which serves more than 200,000 students as of October 2008.[5]

Coming from a background in government and business, Chancellor Klein has developed a comprehensive and innovative education reform program, Children First, to improve student academic performance as well as to "transform the nation's largest public school system into a system of great schools."[6] The Children First Initiative (CFI), for example, includes comprehensive academic supports for most struggling students with more high-quality educational choices (e.g., before or after school tutoring), and most importantly increased principals' authority over how they run their schools from classroom instruction to management, while holding them accountable for successful or failing results with clear consequences.

With accountability as its centerpiece, the goal of Children First Initiative is to "raise academic standards, close achievement gaps, encourage more school accountability, and offer more choices to families and students."[7]

Under requirements of the federal No Child Left Behind (NCLB) act, both the NY State Education Department (SED) and NYC DoE carry out a series of formal and informal assessments each year to identify every school's performance in relation to its annual yearly progress (AYP) benchmarks. Currently in NY State, AYP is determined based on each school's progress toward meeting the NY state's proficiency level (Score 3) for all students in English language arts (ELL), mathematics, science and/or high school graduation rate. If a school does not meet requirements in these assessment criteria, it is placed on the list of "Schools in Need of Improvement" for two years. If it makes no further improvement, the school becomes a "Corrective Action School" and faces school restructuring in the coming year.

In order to accomplish this multifaceted task, NYC DoE uses a range of assessment mechanisms such as attendance data, school-based assessment results (e.g., teacher-developed evaluations), Learning Environment Survey, and Progress Report. Its annual Quality Review integrates all these activities by assigning a score on five Quality Statements.

Along with these new standards and tools, the Children First Initiative also encourages teacher-leader collaborations to implement school-level empowerment and data-driven accountability. The Inquiry Teams (IT), for example, consist of three to six members in a school including Principal, teacher leaders, and a Data Specialist. Based on the assessment data available at their school, Inquiry Teams identify a target group of the lowest performing students in a particular content area (e.g., 7th grade students whose math scores fall between 1.0 and 2.5 on NY State exams), develop and implement differentiated instructional practices to promote student progress, and continuously monitor and share their analysis on these students' academic improvement with the use of accountability data.

Because this study examined the three school's use of WIDE courses to meet NYC's accountability requirements, let us briefly look at two of NYC's particular accountability instruments: Progress Report and Quality Review.

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[5] http://schools.nyc.gov/AboutUs/Data/Stats/default.htm
[6] http://schools.nyc.gov/AboutUs/leadership/chancellorklein.htm
[7] http://schools.nyc.gov/RulesPolicies/NCLB/Overview/default.htm

The Progress Report is performed to measure student year-to-year progress, to compare the school to similar schools in NYC, and if applicable to reward any success in improving all children's academic performances, especially children with the greatest needs (e.g., special education students). It assesses each school's progress on the following four areas of improvement.

- School Environment: uses results from the Learning Environment Survey to measure necessary conditions for learning: attendance, academic expectations, communication, engagement, and safety and respect.
- Student Performance: measures skill levels in ELL and Math.
- Student Progress: measures average student improvement from last year to this year in ELL and Math.
- Additional Credit: given to schools for exemplary gains among high-need students to close the achievement gap.

Schools are assigned letter grades, from A to F, based on their overall Progress Report scores. Schools that get As and Bs are eligible for rewards. Schools that get Ds and Fs, or 3Cs in a row, face consequences, including change in school leadership or school closure.

According to NYC DoE, the Progress Report results are then integrated into its annual Quality Review which evaluates the following areas: Gather Data, Plan and Set Goals, Align Instruction, Build and Align Capacity, and Monitor and Revise. [8]
Every year, each school receives an overall Quality Review Score as well as a separate score for each of the five categories shown above in the range of Well Developed, Proficient, Underdeveloped with Proficient Features, or Underdeveloped. Together with the Progress Report, the Quality Review serves as a major set of accountability benchmarks for principals to continuously assess all students' academic progress as well as to allocate the school's time, personnel, and resources for improvement results. What is noticeable here is that the Quality Review criteria align precisely with many aspects of WIDE online courses such as teaching for understanding and differentiating instruction courses (Quality Statements 2 & 3), effective use and analysis of the student data in the Data Wise course (Quality Statements 1 & 5), as well as leadership focused on collaboration to improve instruction and student performance in the Leading for Understanding course (Quality Statement 4).
While analyzing early impacts of WIDE World on the schools in this paper, therefore, we will refer to the most recent years' Quality Review scores of each school as well as how the teachers and leaders in these schools have made sense of their WIDE participation in regards to their schools' accountability requirements.
In the following sections, we highlight connections between NYC accountability requirements and WIDE offerings as we describe how the three schools applied WIDE course ideas and experiences to their everyday practices to meet external accountability requirements.

Research Methods

This research project employed multiple data sources, both quantitative and qualitative, and developed several research instruments including *Interview Guides* for teachers and leaders, *the HCNY Codebook* to systematically analyze the data, and *the HCNY Coding Summary* to examine emerging and cross-school themes. The following section briefly explains our data sources and each of the instruments.

Interview Guides and Classroom Observations (used in research visits in schools)
In addition to three site visits in Year 1, Dr. Joo also visited the three schools in November and February of Year 2 (2008-09). In each research visit, Dr. Joo conducted individual leader interviews, focused teacher group interviews, informal classroom observations, and document collection.

In Year 1, our main site visit goal was to carry out a series of individual and focus group interviews to study the WIDE participants' understanding of the goals, processes, and early impacts of WIDE courses on their teaching or leadership practices. In Year 2, with increased awareness of school-wide changes in these schools, our interviews complemented the original questions by adding items on the school-based support structures that influenced systemic educational improvement, as well as items to identify first-year to second-year experience differences. For school leaders, we asked more specifically about their visions for the school, leadership styles, and any deliberate

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[8] http://schools.nyc.gov/Accountability/SchoolReports/QualityReviews/Scores/default.htm

efforts they made to create school-wide educational changes using lessons learned from their participation with WIDE. To complement these interviews, we conducted informal classroom observations, typically shadowing the Principals in each school.

Online Course Surveys (used in online courses)
Each WIDE course collects online data from participants through pre-, mid- and end-of-course surveys. In each survey, course participants answer both quantitative (multiple-choice) and qualitative (open-ended) questions.

WIDE Teaching Portfolios (used as supplementary materials)
As in Year 1, WIDE distributed to eight teachers an updated version of a portfolio guide called "*WIDE World Teaching Portfolio: What is It Like to Learn in Your Classroom?*" to be used to document and assess classroom practices where WIDE course ideas were applied. The content of this portfolio includes the Portfolio Instructions, Table of Contents, Class Reflection Log, Student Work Reflection Log, Photograph Log, and the Student Consent Release Form.

In Year 2, we have received three portfolios, one from ECE and two from TAM.

All the collected data were systematically analyzed to identify emerging themes and key findings, applying a series of qualitative analytic tools (e.g., *HCNY Codebook* & *HCNY Coding Summary*) developed throughout the two-year study period.

III. From Planning to Outcomes in Three Schools

At the beginning of this project, WIDE conducted a selection process, requiring school leaders to submit a proposal. Leaders were asked to outline the way that WIDE professional development would complement existing and envisioned efforts to improve instruction and student learning at their school. Among the requirements of the application was that the schools would assume responsibility for up to 50% of WIDE World service fees, including online courses and on-site workshops. This co-payment helped to insure that the schools were invested in the opportunity. WIDE World invited proposals from participants in the summer 2007 Urban School Leaders, a week-long institute offered by Programs in Professional Education at Harvard Graduate School of Education. We also contacted schools through the Children's Aid Society's network of Community Schools in New York. Of the six schools that were selected to participate in Year 1, three schools chose to continue in Year 2: two elementary (CNE & ECE) and one middle school (TAM).
 The table below summarizes the overall enrollment data per school during Year 1 (2007-8) and Year 2 (2008-9):

School	Total # of WIDE terms	Total # of WIDE courses	Total # of WIDE participants	Total # of participants with 2 or more courses	Average rate of course completion[9]
CNE	4	7	16 (5 admin. & 11 teachers)	11 (69%)	100%
ECE	4	4	21 (5 admin. & 16 teachers)	11 (52%)	81%
TAM	3	5	27 (7 admin. & 20 teachers)	16 (59%)	72%

[Table: HCNY Overall Enrollment Data per School, Fall 2007-Spring 2009]

Each school and its principal had responsibility for planning particular implementation steps for WIDE participation, and recruiting administrators and teachers to particular WIDE courses.

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[9] To complete a course, participants must carry out 32 out of 45 possible course hours (used to determine Professional Development Points) over the six sessions of the course.

The following section introduces each school in the following structure:
- School mission and current educational priorities
- School demographics data based on the NYC Quality Review 2007-08
- Specific goals for taking particular WIDE courses
- The selection/recruitment process of participants
- The summary of the enrollment data with WIDE per term

Connected Neighbor Elementary School (CNE – Principal: Ms. Jones)

CNE serves students in pre-k to fifth grades. CNE's mission is "to promote learning for all students in an active, respectful and skill-building environment. We believe that every child is important and valued. Our students will become self-confident, self-motivated and self-reliant learners." (CNE Fact Sheet, 2007)[10]

More specifically, CNE aims to teach problem solving and critical thinking skills, promote self-esteem and nurture love of learning among the students as lifelong learners. CNE also emphasizes learning for all students in collaboration with parents, community, and community-based organizations. In 2002, CNE began its partnership with the Children's Aid Society, a non-profit organization that operates twenty-one community schools in New York City, to develop after-school programs and to promote collaboration among NYC schools, the families of students, and the wider gamut of community services, including the Bronx Family Center.[11]

A Bronx native, Principal Jones has worked in the NYC school system for over 25 years and served as a teacher, speech therapist, special education supervisor, assistant principal, and since 1998, Principal of CNE.
The following table summarizes the overall enrollment data at CNE in the year of 2007-08.

CNE (2007-08)	
Total Enrollment	**371 (PreK-5 grades)**
- by gender	52% Male; 48% Female
- by race/ethnicity	69% Hispanic, 29% Black, 1% White, 1% Asian
- Special education students	16%
- English-language learners	10%
- Eligibility for free lunch	83%
Attendance	**93%**

[Table: CNE Enrollment Data]

In terms of educational priorities, CNE as an urban community school, was facing two immediate goals: to provide high quality education to meet different student needs and to use the student assessment data to improve its NYC Quality Review results.

According to the 2006-07 Quality Review, CNE was identified as "in need of improvement – Year 1". This meant that, if the school did not improve their accountability status in the next year, it would face serious consequences, including a change in school leadership or possible school closure.[12] The Quality Review said that "CNE teachers are not differentiating learning enough to affect the student outcome, and students who are performing well are not getting the attention that they need." The Review continued that "many students are not actively involved in their own learning. They are not sure of what they are learning and why and how they can improve their work." In our first interview with Principal Jones during Year 1, she confessed that this review was a complete shock to her. She believed that her school was doing well and meeting all areas of accountability, including student outcomes.

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[10] Accessed from the CNE School website.

[11] http://www.childrensaidsociety.org/communityschools

[12] Information from the NYC DoE's Progress Report.

Upon reflection, Principal Jones concluded that the low performance was mainly due to the school's inability to collect, examine, and present student assessment data effectively to the Quality Reviewer. Therefore, for the 2007-08 school year, she set a clear priority to increase the leadership capacity within the school as well as to develop a comprehensive and systemic way to collect, catalog, and analyze student assessment data (the major component of the Quality Review). At the same time, she wanted her teachers to learn more about effective curriculum development and the major principles and practices of differentiating instruction.

In our first interview during Year 1, Principal Jones explained how carefully she selected WIDE courses to match her school's goals and then identified participants for those courses. For example, she explained that she selected aspiring school leaders, experienced teachers, junior teachers, and staff of the Children's Aid Society to take courses on Teaching for Understanding (TfU1) and Leadership (LfU1) during the first term with WIDE (Fall 2007) because she wanted to build a collaborative team among teachers and potential leaders to deal with "school-wide issues." (CNE FG4, 69-73). For the next term (Spring 2008), her leadership team, including her, enrolled in the Data Wise (DW) course while a different group of teachers took the Differentiating Instruction (DI) course.

For the Datawise course, Principal Jones assigned an administrator as Data Specialist, whose nickname became "Data Guru" or "Data Dude", among the CNE faculty. This Data Specialist worked closely with Principal Jones and the teachers to create various data sets from student assessments, including NY State and NYC exam results. Using Excel, he was able to produce comprehensive, reader-friendly tables and charts. According to Principal Jones, "Anything that the teachers need, he has it!" In addition, the specialist provided a series of professional development activities for teachers that made use of the school data.

Along with recruiting key school personnel to WIDE courses, Principal Jones designated every Thursday as an after-school period for WIDE participants to work together in the school library.

Thanks to Principal Jones's careful selection, a majority of the first year cohort have stayed together to take a series of WIDE courses in Year 2CNE and Jones other, new teachers and administrators joined their ranks in that second year.

Principal Jones set up an open enrollment policy where teachers could feel comfortable making their own decisions to continue with the program or not. "I don't want anybody to feel that if I asked them that they'd have to do it or I'd be holding something against them." [CNE Jones2] Two WIDE participants echoed this open enrollment process by explaining that "Ms Jones invites us, but we choose if we want to stay or not" [CNE FG1_MI] and "it [recruitment] is definitely our choice and we saw the value in it when we did the first one, and so we have continuously done this. However, she has made it open to other people". [CNE FG1_MI]

Since the fall of 2007, a total of 16 CNE participants (5 administrators and 11 teachers) have taken seven WIDE courses over four terms, as shown below. Eleven out of sixteen participants took WIDE courses for more than two terms, for a 69% (11/16) ongoing participation rate, and five participants including Principal Jones took four courses, one course per term. The course completion rate in this school is very impressive.

WIDE term	WIDE course[13]	Total # of enrollment	Course Completion Rate
Fall 07	TfU1	8	100%
	LfU1	5	100%
Spring 08	DI	4	100%
	DW	5	100%
Fall08	MI	3	100%
	TSNT1	6	100%
Spring09 (current term)	DI	3	N/A
	TfU2	6	N/A

[Table: CNE overall enrollment in WIDE courses, 2007-09]
Every Child Elementary School (ECE – Principal: Mr. Miller)

ECE's stated mission is to "create a community of lifelong learners in pursuit of academic excellence, where all students learn the necessary skills to become caring, creative and productive citizens. We will provide a standards-driven curriculum that targets the different learning styles of all our students, including special needs, high achieving and ELL students. We will involve community, parents, staff and students in maintaining high levels of participation and achievement in an ever-changing global society."[14] According to the school's 2008-09 Comprehensive Educational Plan, ECE concentrates its efforts around clear and high expectations for teachers and students, meaningful assessment aligned with the NY State standards, and effective data-driven professional development based upon the differentiated needs of students and teachers.

With nearly thirty years of experience in the NYC public education, Principal Miller came to ECE in 2003. At that time, the school was about to be closed due to low performance, and so Principal Miller started to create new services, reach out to parents, and secure grants to fill budget gaps. According to the NYC 2006-07 Quality Review, this school "has made dramatic improvements in achievement and attendance while reducing behavior incidents" since the current administration took charge.

Located in three separate buildings, ECE serves over 580 students as shown in the following enrollment table.

ECE (2007-08)	
Total Enrollment	583 (PreK-5 grades)
- by gender	52% Male; 48% Female
- by race/ethnicity	73% Hispanic, 22% Black, 3% Asian, 2% White
- Special education students	13%
- English-language learners	12%
- Eligibility for free lunch	71%
Attendance	**93%**

[Table: ECE Enrollment Data]

Although ECE's 2006-07 Quality Review gave an overall rating of "well-developed school," it also identified that the school needed to "increase professional development regarding the use of data for differentiating instruction for individual students" and "devise collaborative practices and structures to support the vertical alignment of curriculum and instruction in all content areas."

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[13] The full name of each course is as follows.
- **DI (**Differentiating Instruction: Strategies for Effective Classroom Practice) - **DW (**Getting Started With Data Wise)
- **MI (**Using Multiple Intelligences as a Tool to Help Students Learn) - **LfU1 (**Leading for Understanding 1)
- **TfU1 (**Teaching for Understanding 1: Focus on Student Understanding) - **TSNT1 (**Teaching to Standards with New Technologies 1)
- **TfU2 (**Teaching for Understanding 2: Understanding in Practice)
[14] Accessed from the ECE School website.

In the first term with WIDE (Fall 2007), Principal Miller selected teachers whom he thought would benefit from WIDE's Data Wise course. As he reflected upon his mandatory enrollment decision later, he realized that "they [the first cohort whom he assigned by himself] were not interested in taking the program. Some of them had problems with the use of computer; some of them said it was other people's job to keep the data. As shown below, the course completion rate in the first term was 57%.

In his second year, Principal Miller simply announced the WIDE courses to all teachers and administrators, and allowed them to decide. If teachers were interested, he encouraged them to sign up for a course as a team, in order to promote collaboration at the school level. "Now [the school people are] free [to choose] and people who want to study, just sign up. And it is much better," said Miller.

Since ECE had been already successful in data-driven decision making with respect to instruction and overall management in Year 2, Principal Miller's particular priority for WIDE was to "meet the needs of all our learners" by involving all 13 WIDE participants in the Differentiating Instruction (DI) course in order to strengthen "a vertical alignment of such instructions across K-5 grade levels."

Like Principal Jones at CNE, Principal Miller arranged teaching schedules to reserve a common meeting time. The ECE WIDE participants met Monday afternoons to work together on the DI course, and that continued throughout the term.

The following table ECE shows the enrollment and course completion data for ECE over the last two years.

WIDE term	WIDE course[15]	Total # of enrollment	Course Completion Rate
Fall 07	DW	7	57%
Spring 08	LfU1	8	100%
Fall08	DI	15	87%
Spring09	TfU1	6	100%

[Table: ECE overall enrollment in WIDE courses, 2007-09]

Technology and the Arts Middle School (TAM - Principal: Ms. Ellis)

The mission for TAM, established in 2001, states that TAM aims "to provide a standards-based curriculum, to create a school community dedicated to promoting continuous learning and achievement through technology, and to nurture and prepare our community to adapt to meet the demands of an ever changing world." By nurturing and enhancing students' learning, TAM teachers and leaders want their students to understand the connection between what they learn in TAM and the skills needed in the real world through the use of technology.

As a middle school located in a challenging neighborhood in Bronx, TAM serves 364 students from grade 6 to 8. Note that the eligibility level for Title 1 funding among TAM students is almost 90%, much higher than the average in the area.

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[15] The full name of each course is as follows.
- **DI (**Differentiating Instruction: Strategies for Effective Classroom Practice) - **DW (**Getting Started With Data Wise)
- **TfU1 (**Teaching for Understanding 1: Focus on Student Understanding)   - **LfU1 (**Leading for Understanding 1)

	TAM (2007-08)
Total Enrollment	364 (6-8 grades)
- by gender	51% Male; 49% Female
- by race/ethnicity	64% Hispanic, 34% Black, 1% White, 1% Asian
- Special education students	21%
- English-language learners	15%
- Eligibility for free lunch	87%
Attendance	**85%**

[Table: TAM Enrollment Data, 2007-08]

In 2006-7, the year before WIDE collaboration started, TAM's Progress Report stated it was a school with "D: Planning for Restructuring" grade and its previous year's NY State performance review designated the school as "In Corrective Action." Although there was no narrative data available in these reports to describe the issues at the time, our first year research experience at TAM offered a glimpse of various difficulties with school-related issues and out-of-school challenges (some students from very difficult family and community surroundings). In one of our interviews during Year 1, for example, a staff member commented that they struggle with serious matters, such as student pregnancy, drug use and prostitution, in addition to the more typical issues of disciplinary problems and high student turnover, common to many urban middle schools.

Despite those issues, the 2006-07 Quality Review actually labeled TAM as "a proficient school with many well developed features", including the use of data to drive all aspects of development as well as the existing school structures in place to improve student outcomes. The Review identified three main areas of improvement for TAM: to make greater use of high levels of educational technology to support learning, to differentiate teachers' instruction more consistently and rigorously based on data, and to ensure that "all teachers complete the move from teacher-centered instruction to facilitative learning."

For the first term with WIDE (fall, 2007), Principal Ellis enrolled all of the school's permanent staff in Teaching to Standards with New Technologies 1 (TSNT1). Due to timing issues, she was not able to inform teachers about the course until they reported to work on their first day of school. Forty percent of the teachers dropped out of the online course early, and, of those who remained in the course, 18 of 27 (67%) completed the course. From our interviews with administrators and teachers at TAM, it was evident that the low participation and completion rates reflected a lack of communication and the absence of common understanding among school members.

In the second term of Year 1 (spring, 2008), participating TAM faculty divided into two groups, each with much smaller enrollment. The leadership group, including Principal Ellis, took Data Wise and the teacher group took Differentiating Instruction.

One of the lessons learned from this first-year experience was the importance of organizing professional development so that it systematically addresses both the internal needs of the school and the external accountability requirements. Internally, TAM needed to improve its communication patterns between the administration and teachers, between teachers and students, as well as among teachers. Externally, TAM needed to strengthen its technology integration into the curricula in order to provide engaging and effective instruction for all students and to monitor and improve the student assessment data on an ongoing basis.

In Year 2, the leadership group moved into the Leading for Understanding 1 course, while the teacher group enrolled in the Teaching to Standards with New Technologies 2 (TSNT2) to build their expertise in curriculum technology integration. Thanks to this coordinated effort, the following year's Progress Report assigned TAM with a "C: Well-developed" grade.

WIDE term	WIDE course[16]	Total # of enrollment	Course Completion Rate
Fall 07	TSNT1	27	67%
Spring 08	DI	6	67%
	DW	6	100%
Fall08	LfU1	8	100%
	TSNT2	3	33%

[Table: TAM overall enrollment in WIDE courses, 2007-08]

Taking into account the unique goals and expectations of each school, the following Results section highlights salient themes across all three schools and celebrates particular accomplishments of each school.

IV.   Outcomes for Teachers and Leaders

Our Year 1 research indicated that schools, which met at least two of the following three conditions, appeared best equipped to take full advantage of WIDE World professional development programs:

- The school had a coherent educational focus that aligned with WIDE World content
- The school had intact professional learning communities, bolstered by the collaborative process of participating in WIDE courses
- School leadership, whether the Principal or the leadership group, had a clear vision and support structures in place to facilitate the integration of WIDE professional development as a process as well as pedagogical content

The second year's research confirmed the importance of these conditions and all three schools showed improvement during Year 2, due to their continuing participation with WIDE.

As introduced in the Research Context section, the WIDE Systemic Educational Improvement Model (SEIM) is used as an analytic framework to conceptualize detailed examples of both individual- and school-level changes. Because WIDE courses are offered to teachers and leaders, we will begin with direct impacts on the professional practice of teachers and leaders. In the next section, we will trace the indirect impacts of improved practices on student performance and on the overall school system.

In this section, **Outcome for Teachers and Leaders**, findings are presented in the following three categories of the SEIM model:

Understanding for teachers and leaders: The capability to apply one's knowledge creatively and appropriately in a range of everyday situations at work.
Engagement of teachers and leaders: Enthusiasm, interest in, commitment to, and caring about the work one does at school. Although it may contribute to improved performance, this category refers more to attitudes and beliefs regarding one's identity as a professional, whereas the *understanding* category refers to patterns of practice.
Reflective collaboration for teachers and leaders: The capability to participate in inquiry that includes analyzing and attempting to improve one's work in relation to explicit criteria or definitions of high-quality practice. Collaboration is a capability and desire to converse and work together effectively with one's colleagues within and across system levels to achieve the common goals of systemic improvement.

Within each category, findings will be presented for each school (CNE, ECE, and TAM).

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[16] The full name of each course is as follows.
- **DI (**Differentiating Instruction: Strategies for Effective Classroom Practice)   - **DW (**Getting Started With Data Wise)
- **TSNT1 (**Teaching to Standards with New Technologies 1)   - **LfU1 (**Leading for Understanding 1)
- **TSNT2 (**Teaching to Standards with New Technologies 2)

Understanding

1. **CNE**

One teacher at CNE explained that a lot of teachers in her school thought that their job was "just collecting the data" without knowing "what that really meant or what to do with it." While taking the Data Wise course, she said that "we [WIDE participants] started to see, really see, kids who were not moving or suddenly start to move because of the decisions I made based on my [DW] information. That's when you start to see the teachers saying, 'Ah! It works!'" [CNE FG1_MI] Another teacher at CNE pointed out that "DW was sort of a launching pad for us to get our data going.... The quality reviewers were there, but we didn't know how [to carry out the quality review]..... I think the DataWise course helped us to see how. It gave us a how to do it, and a focus. … So the DataWise course helped put us on a good track: what we need to focus on, how we can probably get together, and work this through."

According to a teacher who took the Multiple Intelligences (MI) course, "the MI course helps me to be able to appreciate where our teachers are coming from, because sometimes you want to be able to reach them. We reach our children at their levels, yes, but it's sometimes more difficult to get buy-in from the teachers. The multiple intelligences course helps you to sort of understand where people are coming from, why they are the way they are, and why they may think the way they think." [CNE FG1_MI]

After taking her first WIDE course, one teacher reflected upon her experience in view of the state exams her students were taking. "Prior to this course, I thought that if my students were able to answer questions on a test, it meant that they learned the topic taught. I now understand that true understanding is not something that is measured by a specific test. Now when I teach a unit, I look for a variety of measures to assess the students with. I want to know that they really comprehend on a variety of levels." [End-of-course online survey, Fall07, CNE-TfU1, 11547]

Regarding to the Differentiating Instruction (DI) course, CNE teachers offered concrete examples of how they combined DI strategies with ideas from other WIDE courses to improve students' understanding. A pair of teachers who took TSNT 1 and DI together, explained that "we incorporate technology into the classroom and we're able to differentiate, like you could go to different websites, have the kids use different tools, calculators, all sorts of visual aids like Power Point, the Smart Boards. It shows that kids can actually make more connections and they can actually get more out of the lesson by bringing technology into the classroom." [CNE FG2_TSNT1]

2. **ECE**

Teachers at ECE provided abundant examples of how the DI course helped them in their classroom teaching. One teacher explained that "I think the philosophy is that students should know their individual strengths and abilities and should take responsibility for their own learning… starting in the first grade where I teach. I think it's important as kids go to second grade that they know what their strengths are and what their needs are and who to go to for help and where they can be responsible for their work." [ECE_FG] Another teacher described her effort in carrying out her writing initiatives as "a differentiating activity." She continued, saying that "when I sit with a student and pre-assess where they are and write observation notes of what they can do in terms of their letters, sounds and writing to determine the teaching point, I assess my students in their individual abilities and I try to understand where they are coming from, what's their style, how their letters are forming, what's their focus so in the pre-assessment, the designing of the writing task. In the post-assessment, I always look at the student's individual learning." [ECE_FG]

Another teacher appreciated the iterative way that WIDE course activities encourage classroom applications, which was very helpful for her understanding. She said that "what we learned about differentiation [in the online course] is to connect it to the way we tried it in the classroom. We [WIDE participants] had a larger question about the differentiation and tried it in the classroom and got back to the [online] course. That was very helpful- to have a chance to make mistakes and step back and try things again. The technique of differentiation - you have to try it in a small group first and then try it on a whole class and that's what we did to understand." [ECE_FG]

In the End-of-course online survey, one ECE teacher described the ways she applied the WIDE course concepts to her social studies unit on New York City. "Before the [WIDE] course, I would have most likely just done a lecture - having all the students read the same material and then gather to discuss what they found. However, what I have decided to do is to differentiate the instruction not just by providing various activities to address Multiple

Intelligences but also to ask myself as the facilitator 'why am I doing this' and 'what is it that I want the students to learn'. I have not finished the unit yet but it has worked very well and most importantly the students understand what they are doing and why." [End-of-course online survey, Fall08, ECE-DI, 15057]

During the research visit to ECE in November 2008, Principal Miller and Dr. Joo observed a Kindergarten class, taught by one of the DI course teachers. As the picture below shows, her students were divided into different groups, based on their interests, during a science lesson. The 25 students were busy, doing their own hands-on experiments in different corners of the classroom, while the teacher circulated and worked with individual students or groups. After our observation, Principal Miller, who conducts frequent informal visits to classrooms, applauded that teacher by saying "I am just proud to see how [the teacher] was teaching her Kindergartners. That was DI at its best." [ECE_Miller]
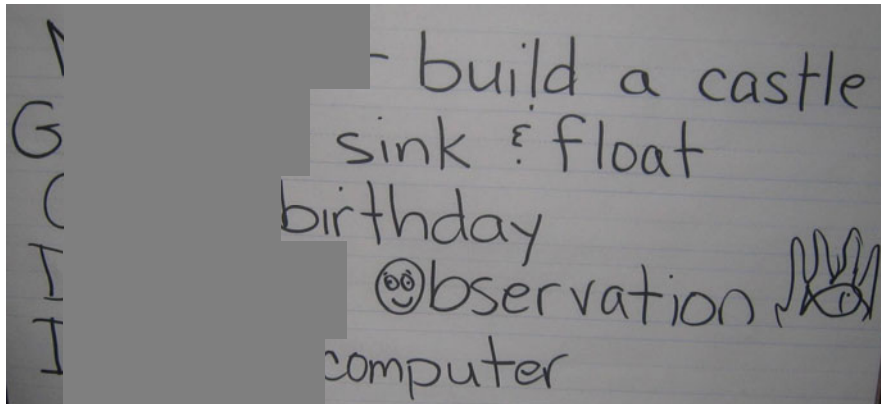
[Picture: ECE teacher's display on student groups in a Kindergarten class]

Administrators in school leadership positions also expressed changes in their understanding of what was going on in the school. One of the ECE administrators wrote that "as an administrator of the school, things that I would not ordinarily think about in the course of a school day were brought to my attention by the teachers. The [WIDE] team was helpful in rolling out the concept of differentiation to the rest of the school, and served as providers of information to others with similar classrooms and classroom needs." [End-of-course online survey, Fall08, ECE-DI, 10833]

In the individual interview, Principal Miller explained that "as someone going around the school and seeing its complexity, it's been very interesting to me to observe this [DI] lesson and see the course working, see how kids were divided according to their strengths- someone was writing, someone was doing research activity, someone presenting, it was really great to see this work. DI is so well embedded already in their [his teachers] philosophy of teaching. They don't even realize that they are doing [DI]. … When you are a really good teacher, sometimes, it is very difficult to articulate the work that you do in the classroom, you just do it." [ECE_Miller]

3. **TAM**

Referring to the change in her leadership style from "dictatorship to understanding-ship," Principal Ellis shared a story about her changed understanding of her role as a principal. "When I came here [TAM], it [my leadership] was like a dictatorship. It was more like top-down. Some of the teachers resisted. Some didn't say anything, but they wouldn't do anything either … passive-aggressive," Principal Ellis confessed. After taking the Leading for Understanding 1 (LfU1) course with her leadership team, Principal Ellis explained some beginning changes that occurred to her. "It is helping me to analyze myself in every decision that I make. I'm always reflecting. I always take into account that decision is for the best of the children and the school." [TAM Ellis Nov20] She continued that "I guess leading. ...I do have to communicate with people. And I would like them to be able to hear what I'm saying and I'd like to hear what they're saying instead of being a dictator. It's all about understanding and communication. And just making sure we're all on the same page and something is done, but not done because I'm making you do it...just because you want to do it... to internalize." [TAM Ellis2]

Ellis believes teacher accountability is very important and has learned to seek it in a more nurturing and a caring way by listening and questioning her teachers. When something is amiss, she said that she wonders first whether there was a misunderstanding and "tries to see things from their points of view.""It doesn't have to be a dictatorship… I can lead through questioning," Principal Ellis explained.

However, there were some course participants who reported difficulties in WIDE courses, especially due to the wide-range of roles (teachers vs. administrators), teaching subjects, and grades among the course participants. According to one administrator, the unbalanced course content, which is geared toward classroom teachers or leaders, made it difficult for her to understand and participate in the curriculum development activities with her team members. [End-of-course online survey, Spring08, CNE-DI, 11575]

Engagement

1. CNE

One of the key teaching strategies promoted by WIDE courses is to move teachers from being lecturers to become facilitators of student learning. Many teachers in our study shared their experiences modeling this facilitator role. One teacher said that "what I've noticed, instead of being a teacher all the time, I could be the facilitator, where the kids can actually teach themselves, and they can assess themselves. Like aligned with the reflection pieces, the kids are asking themselves what do they learn, what do they need to improve on. And basically they're being more accountable to their learning." [CNE FG2_TSNT1]

The increased level of engagement with students and their academic achievement also made a teacher feel "more professional after I started using the data." "…Because when I sit down with parents, instead of just saying, well, your child is struggling I want him to read more, I could actually say, 'your child is having difficulty analyzing the main idea. What he needs to do is this.' And it gave me real usable information, and I can really tell their parents, 'This is why your kid is having a hard time.' It was concrete and it made me feel like a professional. Because before that, I couldn't necessarily articulate....." [CNE FG2_TSNT1]

One CNE teacher indicated that WIDE courses helped her with the challenge of balancing student engagement with ultimate accountability for the material. "I think one of the things that sometimes we [teachers] struggle with is that we're given curriculum, we're told to make it fun, make it interesting. But we have to teach it, and we have to cover so many standards and so many topics. If we don't make it meaningful for the kids, then it's just us talking and them not really getting it. And I think that this [TSNT course] gives us a way to kind of bring them [students] in, and reminds me to include them in the thinking and the planning and the doing [of my lessons]." [CNE FG2_TSNT1]

This heightened sense of professionalism was also shared with Principal Jones who took two years of WIDE courses. She confessed that "I have taken a whole different approach. Maybe it's like the comfort level. … I'm more confident now than I was eight years ago." Having an individual folder for each teacher with student assessment data, Principal Jones explained that "the [DW] courses are making the impact [on me] and making me a better leader. I'm more confident of myself. I can see that the things that I'm learning from here and that they're helping the school." Since their participation in the DW course, Principal Jones notes that, in meetings with individual teachers as well as in departmental meetings, they constantly use the DW products in order to "help design how a teacher is addressing the children" in an differentiated way.

As shown in the picture below, Principal Jones displays a board in her office which shows every teacher's student assessment data as color-coded dots for individual students (e.g., red dots for lowest performing vs. green dots for high performing students) so that everyone can easily monitor their progress over time. Thanks to the school-wide approach to the data, every teacher and administrator at CNE understands and engages with each other, with parents, and with the NYC quality reviewers.

[Picture: Each teacher's student assessment data displayed in Principal Jones's office]

2. TAM

To Principal Ellis, her experience in the Data Wise (DW) course proved to be "very effective and useful" and helped her develop the engagement skills she needed. She wrote in her survey that "It [the DW course] was very practical and allowed me to see my weakest area as an administrator: engagement of the whole faculty. In addition, it gave me a range of procedures and protocols to enhance the ability to involve the whole faculty in many different ways." [End-of-course online survey, Spring08, TAM-DW, 10411] In addition to establishing school-wide groups focused on student assessment data, Principal Ellis improved communication with her staff and teachers and began sharing her decision-making authority. "I ask a lot more questions. I have been allowing the teachers to take more ownership of running the meetings. Not just running the meetings but making decisions. That has really made our teams sort of responsible for the things that we decide. So it is not a decision that I have made; rather it is a decision *we* have made," explained Principal Ellis.

Reflective Collaboration

1. CNE

One of the most critical ingredients for CNE's success was the professional collaboration, working together as the "Harvard Team", every Thursday afternoon. When gathered in the school library, the faculty could work in close proximity to one another.

During the first-year interviews in Year 1, all CNE team members reported that they benefited from this established collaborative time. One teacher said with a sense of pride at their accomplishment, "It was a long day but it was our 'Harvard day'…"

Another teacher also described Jones's never-ending enthusiasm and her full participation in the WIDE courses. "She [Jones] led by example. Ms Jones had her professional development done, but she went [to the DW course] and dug into that data. She came back and she modeled for us. She said, 'this is what I learnt' and therefore we are going to do it together. So it was a team effort.

Going into its second year, CNE participants agreed that working together as a team "just seems to go by faster." According to one teacher, "we have been on the same team and now, we really have come to a point where we can

sit down in a lesson and immediately figure out who can do which parts [of the WIDE assignments] and then come back together and say "ok, this is what we have and this is what we're doing." [CNE FG1] In an online survey, one CNE teacher reported that "Being able to work with team members was fantastic. I was able to build relationships with co-workers that I previously did not know in this way. It was great to learn new things together, bounce ideas off each other, and have professional discussions about topics that we were all interested and passionate about." [End-of-course online survey, Fall08, CNE-MI, 11585]

This increased level of reflective collaboration among teachers increased their use of that strategy in their classrooms. "We [teachers] definitely seem to be more ahead than we've ever been. It trickles down from us to the way we instruct the kids, because you put them in a group and you get to find out which child is stronger in something and which one can do something else. Then they all work together. So it's like one child teaching another child. So it's starting from us and going down to them," explained a teacher. [CNE FG2_TSNT1] This comment was echoed by Principal Jones, "So we're doing [in WIDE courses] what we're trying to get the kids to do. … We're in a collaborative group, and we're taking ownership of each other and their learning, and we all depend on each other." [CNE Jones2]

2. ECE

At ECE, where 13 teachers took the Differentiating Instructions [DI] course as a group, the participants explained "it builds community. We have many teachers from different departments: from special education, from early education, etc. When you talk about a vertical alignment, that's what happening now. This course was a wonderful opportunity for collaboration across school," [ECE_FG1] according to another teacher, "the [DI] course has forced us to have cross-grade conversations. It's not just one grade but we have to work with different grades and we hear different opinions of how they work and apply what we're learning in this course across the grades." [ECE_FG1] "This course was an excellent experience for all who participated. It brought us closer as a professional learning community, and established protocols for collaborative thinking, and professional discussion around a topic of importance to us all." [End-of-course online survey, Fall08, ECE-DI, 10833]

Principal Miller gave a concrete example the way he and his teachers used this opportunity to meet their school's needs. "I specifically collaborated with 3rd and 5th grade teachers to build a coherent program. We talked with 3rd and 4th grade teachers about what we can do earlier so that, when kids go to 5th grade, they are as capable as possible. We've been just talking about how we do what we need to do and still present the material in a way that is accessible for 5th graders. This course made several 5th grade teachers collaborate and think together. It is really wonderful to see the seamlessness going on through the differentiating instruction," explained Principal Miller.

Principal Miller explained that "the difference between a good school and a great school is that a good school teaches and a great school teaches and learns." His emphasis on life-long learning was particularly evident at ECE. The "Harvard Team" was "really about learning – learning at work." Principal Miller explained, "I tell them [teachers] that I know I have tried a thousand things and failed at a lot of things. So I give them a lot of opportunities to learn from that experience because that is the way I learned … in order to make teachers feel very comfortable and very supported. So they can come and talk about their failures and lesson learned from that experience. They sense that trust."

3. TAM

Collaboration similar to that at ECE took place at TAM, in the second year. "The team members' role for each session was given ahead of time, so doing the task for a particular session was just easy," one teacher reported in the end-of-course online survey [Spring08, TAM-DI, 10388] Another teacher in the same course highlighted the mutual support that each team member gave and received: "my team work was quite helpful to me because I am not too conversant with navigating information from one [internet] site to another. But my fellow teammate is computer literate, so we were able to navigate our postings and links from one site to the other very easily." [End-of-course online survey, Spring08, TAM-DI, 10390]

To meet the internal needs for improved communication and collaboration, TAM teachers came up with seven cross-grade and cross-departmental Inquiry Teams to help out lowest performing students in the school. In the 2007-08 year, TAM had only one Inquiry Team. Thanks to their successful results, they have added six more

Inquiry Teams in 2008-09 that will target a student group with the lowest academic scores in math exams. This teacher explains the process in detail, "last year, we had one Inquiry Team to for the whole school and we followed the same idea [this year] as we discussed how to run it, how to find better practices, how to build an action plan on that. … We have seven [Inquiry] Teams now. And we are focusing on any student that scored a 1 [the lowest score] on their math [state exam]. We are trying to figure out how to help those forty-one 1's and trying to find interventions to help them." [TAM FG1] According to Principal Ellis, "now we made up enough [Inquiry] teams to make sure that they are school-wide. We have the over-age; we have bilingual; we have the ELA; we have math. I mean we have every need that you can think of. And we have [data] matrix to show what they need, so we're watching them." [TAM Ellis]

V. Outcomes for Students

In this section, we describe indirect impacts of teacher and leader improved professional practice on student performance. Since WIDE did not have direct interaction with students, the following examples were selected from interviews, teaching portfolios, and open-ended questions in our end-of-course online surveys completed by the participating teachers and leaders.

Overall, each portfolio contained a series of comprehensive lesson plans with goals, relevant NYC state standards, sequence of different performances (e.g., independent or group work), materials/equipment to be used, and, in some cases, student homework. The teachers' Reflection Logs and the classroom photographs show teachers and students engaged in these lessons.

For instance, Mr. Scott, a 4th grade ECE teacher at ECE, applied the TfU framework to organize and document his environment unit. His portfolio clearly showed how his students' learning activities were related to specific understanding goals and different performances throughout the unit. The two portfolios from TAM, in the subjects of English and science, were mostly a collection of teaching materials and the students' worksheets. This might be due to the fact that middle grade work is more worksheet-based than is elementary school work. Another difference between ECE and TAM portfolios was that TAM portfolios contained mostly short, hand-written comments on student work without elaborated explanations as to how their rubrics, included in the portfolios, were used to assess the work.

Despite these limitations, the portfolios show a rich and diverse collection of materials from the teachers who generously shared them with us. All portfolios showed various levels of improvement in terms of their students' understanding, engagement, and reflective collaboration and provide details that highlight those three SEIM model categories for student outcomes.

Understanding for students: Developing and demonstrating mastery of the learning goals, including an increased capability to apply knowledge creatively and appropriately in a range of circumstances, which are consistent with the TfU framework.
Engagement of students: The sense of student enthusiasm, interest in, commitment to, and caring about their learning and school work, including intrinsic or self-generated motivation.
Reflective collaboration for students: The capability and desire to participate in inquiry that includes working together effectively with one's peers towards common learning goals.

Understanding

Two CNE teachers took the Multiple Intelligences [MI] course as a team in the Fall08 term and explained how the course changed their understanding of student academic performance and self-esteem. One of the CNE teachers explained, "I am a teacher working with economically disadvantaged youth in an inner city school. We are trying to help students take ownership of their learning by making them aware of their [academic] levels, their strengths and their weaknesses. Unfortunately, because we as teachers are always looking to see what else a student needs to learn, there tends to be a focus on student weaknesses. This can lead to low self-esteem in the students. Through the MI course, I am starting to change my lens of focus. Instead of focusing on weaknesses, the Multiple Intelligence theory looks at student strengths and intelligences. The student is validated for what they can do and the teacher sees the strengths as entry points to move towards supporting the weaknesses. We are now, as a professional development

team, bringing this focus to the teachers in our school." [End-of-course online survey, Fall08, CNE-MI, 11585] A second teacher added, "Our school has always struggled with the challenges that present themselves with regards to student performance and motivation. We have looked at student weaknesses and tried to address them without looking at students' strengths and intelligences as inroads to deal with those deficits. Through this [MI] course, I have had a complete change of focus. I now look at students through different lenses. I try to discover students' strengths and intelligences and use them to help them better and possibly master their weak areas. … Students are becoming more motivated because we, as teachers, are using the information to reach the students and we are also using real-life connections to help see how what they learn is relevant to their lives." [End-of-course online survey, Fall08, CNE-MI, 11582]

An ECE teacher explained ways in which he applied Differentiating Instruction to his learning activities and student assessments in order to improve student understanding. In the middle of teaching an election unit, he decided to "modify certain aspects [of learning activities] and broaden the scope to allow more methods of production." His expanded lesson plan included "music, map making, mock elections and more as activities. Within those activities, students were able to create alternate forms of product for assessment." He continued that "having one mode of assessment, in my estimate, could only benefit about 40% of the class, the middle. It neglects both the 30% below and the 30% above. Having created alternate ways for students to show their knowledge allowed for a more robust and exciting teaching environment. In addition, the students were able to take away more from the lessons." As a result, he indicated that he reached "more students with a deeper meaning of the election" and realized more individual "talents and capabilities" that he can integrate into other subjects in the later units. [End-of-course online survey, Fall08, ECE-DI, 15055]

For the middle school students at TAM, using various technologies and small group work helped them to focus on their learning and improve their in-class behavior. In her end-of-course online survey, one teacher explained, "Initially, I found myself explaining the skills to students repeatedly. The idea was the use of technology that simulates the skills. Students followed a model and worked independently with technology to solve and graph from simple to more complex inequalities. The Teaching for Understanding [framework] through the use of appropriate and effective technology enhanced students understanding. Once they understood, they did not want to stop working". [End-of-course online survey, Fall07, TAM-TSNT1, 10394]

Another teacher reported in her survey, "In my class, I have 25 students who learned at different pace and some with behavior problems. The use of differentiated instruction really helped. Even the most challenged students achieved learning with understanding at their own pace. If I hadn't used the idea of differentiated instruction, the most challenged students would find it difficult to catch up with the more able group. Hence, there would be less motivation and some behavior problems. Students are motivated to do the task and they love the idea that they can present concepts in line with their interest as well as do self-evaluation and peer critique." [End-of-course online survey, Spring08, TAM-DI, 10388]

A further example from the end-of-course survey, "I work with students who have diverse needs. During any class activity, the students work in groups of 3-4 students who are made up of general education and special education students. I differentiated the task according to the students' abilities. The students demonstrated their understanding of the writing assignment differently while some students chose their own topic to write on. The other group was given a topic with samplers and graphic organizers to help them gather their ideas in a format. At the end of the assignment, both groups of students completed their task appropriately. Differentiating the task enabled each group of students to demonstrate their knowledge of writing". [End-of-course online survey, Spring08, TAM-DI, 10390]

A TAM 8th grade English teacher described the way she implemented the WIDE course ideas with her students, who are mostly English Language Learners (ELL). In her adolescent literature unit reading 'The Watsons Go to Birmingham", the class worked to identify issues related to the history of school segregation and the U.S. civil rights movement. Her differentiating approaches to the unit included:

1) Student readings were differentiated by interest and ability level and similar level students worked together as a small group
2) Students studied texts using a variety of media (i.e., picture books, images, and graphic organizers) to communicate their understanding

3) Students were given ample opportunities to assess their own learning using a variety of self-assessment tools.

Throughout the unit, this teacher provided the Learning Log Questions and what she called "Ticket out the Door Questions". After the lesson, each student had to answer these and, in doing so, reflected on their own learning. In her Class Reflection logs, this instructor indicated that most of her lesson goals were met and her students "formed a broad understanding of the texts while determining the important and relevant information." She also observed an increased level of engagement, noting that the students remained on task during the lesson and sometimes stayed after to class to continue the discussion

Engagement

At CNE, a first-grade teacher described student engagement in her class, "What we [her class] can learn, what's important to them, and how we can fix a problem [of the unit]." Asking her students for their input on lessons proved to be very helpful for her as she structured her learning activities. "I do use the input of the children more, and actually give them the problem of saying 'how are we going to fix it, what are we going to do.' This is working for me and even just in the first grade, they're pretty good at it," explained the teacher. [CNE FG2_TSNT1]

Using student data in the classroom also improved the level of student engagement as they assessed their own progress at CNE. There were a number of teachers who shared exciting examples. One teacher explained, "I created a graph, so that the kids could look and see [their assessment data]. 'Wow, ok, I started here, and then I move this much from September to January and then I moved that much from January to March and this much from March to June.' So they can see themselves, what they did." A second teacher added, "The children had developed goals based on that data. So the children know, 'I'm right here now, I'm a 2 (in the assessment rating). ... They know the terms, and they know what they need to do to move up there. So our teachers have really bought into it and they have channeled that information to the children, and they do that to the parents as well." [CNE FG1_MI] Another teacher shared, "after a while [sharing the student data], the children realized the importance of the movement rather than the score. It was how much gains I made, and then that was the motivating factor. It wasn't that I was, maybe a bottom, but look at the gains I made, and that made the difference." [CNE FG1_MI]

One ECE teacher shared his story about how his scaffolding effort in small groups helped to engage students in the lessons. "I was trying to scaffold my students' understanding of division and its real life applications. I decided to group my students heterogeneously, and to have that group simulate ordering a Chinese food meal consisting of an appetizer, a soup, and an entree. Groups were provided with hard copy menus for choosing their items, and, respectively, decide the breakdown of monetary contributions by each member to pay for the order. Discussions about math took place and students learned about 'consensus.' Students designed charts and displayed their work. I am now more focused on designing activities requiring more group work, especially during mathematics. This was one of the most engaging lessons for my students... they continued to work a little into their recess period." [End-of-course online survey, Fall08, ECE-DI, 15052]

At TAM, integrating technologies into various curricula activities greatly improved student engagement and many teachers shared their stories about incorporating a range of WIDE course ideas into their lessons. One teacher shared this insight, "The idea I got from this [TSNT1] course is the several web sites and technology resources that were useful in our lesson design. I added them as part of the lesson design. This technology tool makes the lesson more interactive and encourages most challenged students to participate fully in the lesson. In my class, there are many struggling readers but with the use of technological tools and resources I have acquired from this course, these students will be able to participate and interact with their groups." [End-of-course online survey, Fall08, TAM-TSNT1, 10390]

Two 8th grade science teachers from TAM created a unit on understanding mass, volume and density based on the principles learned in their TSNT1 and DI courses. In the new unit, students first learned how to measure and record the mass and volume of objects using scientific instruments. Then they explored the concept of density through hands-on experimentation and group discussions. Lastly, they demonstrated their understanding of these concepts through individual work and summary reports. The teachers developed new rubrics for student work that reflected the variety of student performances. In the Class Reflection Log, the teachers indicated that students were "very creative" and showed "intrinsic motivation" and "ownership of

their learning" because they were involved in the rubric development, conducted hands-on experiments, and collaborated with one another in their small groups. They also allowed students to produce differentiated products based on their learning styles. As a result, the teachers reported that "our students enjoyed what they were doing and their performance was of high standard, based on the rubrics."

Reflective Collaboration

Mr. Scott is a 4th grade teacher at ECE who took *Differentiating Instructions* (Fall 2008) and *Teaching for Understanding 1* (Spring 2009), submitted our third portfolio. His class, comprised of 25 students from many different parts of the world, including Latin America and the Caribbean, had varying levels of English reading abilities. His portfolio unit was an interdisciplinary project on the environment, central to 4th grade social studies, science and literacy. Mr. Scott applied the DI strategies with the TfU framework to design and assess this unit.

The project's overarching goal was to increase student awareness of the environment around them and to understand their role in its change. Students also turned their research into action and created a variety of projects that made their learning tangible.

His four understanding goals (UGs) were:

1. The environment is all living and non-living things on earth. Keeping it healthy is vital for all.
2. Humans have the greatest effect on the environment and can make a huge impact on its health.
3. Changes in one part of the environment and ecosystem have effects on other parts of the environment and ecosystem.
4. By conserving natural resources and practicing the 3R's (recycle, reduce, and reuse) we can keep our planet healthy.

In order to achieve these goals, Mr. Scott designed a series of Performances of Understanding which included two initial performances, one inquiry-based performance, and two culminating performances, and connected the performances to the understanding goals.

The following descriptions provide a brief summary of each performance and some selected part of Mr. Scott's reflections from his Reflection Logs.

- Initial Performance 1: Recycling Program in classroom (addressing UGs 2 & 3)
As an introduction to the unit, Mr. Scott brought in a range of everyday objects. After discussing different materials we discard, students broke into groups and created definitive lists to separate the items into categories (e.g., plastic, paper, trash). Based on this small group activity, the class as a whole created a recycling program in which all students participated.

Mr. Scott's reflection on the recycling program reported that "students in similar reading groups were able to collaborate better. I realized that, if I put my students in groups based upon reading level, I could give them appropriate reading materials."

- Initial Performance 2: 100 Day Challenge (addressing UGs 1, 3, & 4)
The second initial performance happened on the 100th day of school. Students got into groups and discussed ways in which they can help the environment. After a discussion period, students select categories to act upon such as recycle, conserve, and so on. Each group then took responsibility to come up with 20 ways to help the environment and displayed their ideas in a planet poster on the classroom wall. A representative student for each group made a presentation to the class.

In his reflection log on this performance, Mr. Scott indicated that "there was great excitement in trying to reach the 100th day mark of the school. The students felt personally responsible for being the ones to tell the rest of the school how to help the planet. It was 95% success with great ideas and group work. The project came together."

- Inquiry Performance: Environmental Booklet (addressing UGs 2 & 3)

This performance consisted of several written assignments. Students first prepared a non-fiction writing piece by examining what the environment is and why it is important to us. Students then collected pictures from magazines and periodicals and designed an environmental booklet as a group to inform the public about their impact on the environment.

"The process was clear and the student involvement was high. Students showed materials and ideas while creating their piece. Students with higher creativity were paired with those less with success. The booklets were well done and students spent a lot of time and didn't rush. Creativity and interests were high," wrote Mr. Scott. By pairing up students with mixed abilities, he attempted a different mode of collaboration among students.

- Culminating Performance: Formal Assessment (addressing UGs 1, 2, 3, & 4)

Mr. Scott was also aware of the needs for the formal assessment of his unit. Based on the materials in his portfolio, he used multiple-choice and open-ended questions to assess his students' understanding of the topics with regard to all four understanding goals of the unit.

- Culminating Performance: Final Project (addressing UGs 1, 2, 3, & 4)

As a last culminating performance, Mr. Scott assigned students to groups, depending on their learning style. Within their groups, students discussed what they learned throughout the unit and demonstrated their understanding in one of the following performances: a dramatization, a poster, a PowerPoint presentation, a pamphlet, or a toy made from recycled goods. At the last lesson of the unit, students performed the dramatizations, passed out their pamphlets to other students in the school, displayed their posters, and shared their recycled toys with the lower grades.

Mr. Scott pointed out some difficulties in the approach. "My pairing of students did not always mean that the project I selected was perfect for them. Some students were not getting along though they had the same learning styles," confessed Mr. Scott. Despite this, he explained that his students' interest remained high throughout the unit. He realized that "having a variety of performances centered on the students' best skills had the students feel like they were prioritized." Mr. Scott's portfolio clearly showed, his WIDE participation helped him develop and attempt a variety of opportunities for his students to collaborate in their learning activities.

VI. Systemic Shifts

In addition to the individual-level educational improvements, our data showed systemic improvements at these schools, as a result of their experience with WIDE, in the areas of Educational Culture, Educational Standards and Tools, Organizational Structures, and Visionary and Distributed Leadership. As emphasized in the beginning of this paper, these elements interact with one another in an ongoing and cyclical way. Improved systemic conditions, for example, not only change the existing context for more effective planning and implementation, but also create a new context for further levels or forms of educational improvements.

Keeping in mind the NYC public schools accountability requirements, the following analysis considers ways in which these schools' teachers and leaders used the WIDE program to effectively achieve their educational priorities for the last two years as well as other relevant initiatives that happened before and during the WIDE participation.

Educational Culture

In the NYC schools studied in Year 1, we observed various changes in school culture due to the WIDE PD activities. For example, creation of clear and common goals, the development of shared language to practice and assess effective teaching and learning, and more open and supportive interactions and collaborations among teachers and administrators. Some of the participants in Year 1 identified the WIDE contribution to the development of "open-mindedness," becoming "reflective" practitioners, "taking risks," asking critical questions, and attuning to "lifelong learning."

In Year 2, the course participants in the three schools explained how their WIDE participation supported positive changes in their school culture. Many of these changes were detailed in previous sections of this report, but the description of educational culture transformation at TAM is worth highlighting.

Principal Ellis, at TAM, explains what it was like when the school first opened. "In the beginning, there was a lot of animosity… among the teachers and towards the leadership team. Teachers were more passive," recalled Principal Ellis. [TAM Ellis1 Feb09] When the leadership team called for a staff meeting, for example, it often became "a place to vent out [teachers' frustration or dissatisfaction]. We were there to vent." Therefore, these meetings were used "to generally grumble or complain about specific students" in the beginning of her leadership.

After taking WIDE's Leading for Understanding (LfU) course, Principal Ellis and her leadership team realized the school-wide changes they had to make. They knew they needed to create a common vision of TAM as "an open, calm, and welcoming place for students, parents and teachers alike." [TAM Ellis1 Feb09] In order to do that, the first step was to make this vision public. "You are going to see the mission and vision of the school everywhere [in the school], said Principal Ellis. [TAM Ellis1 Feb0409] At the same time, the leadership team encouraged the teachers to participate and to be more engaged in the decision-making. For example, Principal Ellis now meets one-on-one with each teacher three times a year.

Compared to our first visit in the fall of 2007, we saw significant improvement in the school environment in the second year. There was classical music playing in the hallways and teachers and students were seen exchanging warm greetings. In the interviews with Principal Ellis and the WIDE participating teachers, the term "nurturing" and "caring" was used to describe the school environment.

Thanks to the improved understanding and engagement among teachers and leaders, their meetings are "different" and the TAM teachers now take more "ownership," according to Principal Ellis. "That was very rough, but we were able to surpass. I was able to present it [the change] to them to show that it would benefit all of us." [TAM Ellis1 Feb09] "Now, they [teachers] talk about what can be done to improve things in the school… The conversation is wonderful," said Principal Ellis. [TAM Ellis Nov20]

Curriculum, Standards, & Tools

To make school-wide systemic changes, the three schools undertook critical examinations of their existing curricula, standards, and assessment tools used to meet the NYC's accountability requirements.

In the Fall07 term, the CNE Leadership Team divided into two groups, the Quality Review Team and the Inquiry Team, while taking the Leading for Understanding 1 (LfU1) course. One teacher in the Leadership Team explained how these two groups worked together to develop a leadership capacity in the school, to address their lack of understanding, and to make better use of student assessment data in order to improve their status in the upcoming Quality Review.

The two groups became active members of our leadership team. … "We all share the common vision that our school and staff provide students with the necessary tools to be lifelong learners. First, we used this [LfU] course to prepare for our annual Quality Review which rates the school on how we use data to drive instruction and promote student achievement. Second, gathering in an after-work situation strengthened our relationships and respect for each other. We are spending more time working collaboratively, looking at new ideas, data, programs, and ways to provide our students to become independent learners and be responsible for their learning." [End-of-course online survey, Fall07, CNE-LfU, 11583] The same teacher took the Data Wise (DW) course in the Spring08 term and reported that "we [the leadership team] have become more open to looking at all aspects of our teaching - using learning walks and student talks - meeting as a team with each teacher every six months to discuss their students. Teachers are becoming more effective each day using data to drive lesson planning and implementing lessons. They are seeing the effectiveness of using data. We are seeing positive feedback regarding student making progress." [End-of-course online survey, Spring08, CNE-DW, 11583]

With ongoing help from the Data Specialist in the school, many CNE teachers were able to improve their understanding of individual student assessment data as well as create their own graphs and charts to analyze their students, showing progress in reading or mathematics over time. During the third term (Fall08) with WIDE, when the whole school was applying the DW principles to their data use and analysis, several teachers illustrated concrete examples of the way they integrated DW into ideas from other WIDE course taken in previous terms. Having gone through two years of WIDE courses, one teacher at CNE summarized their improved use of data like this, "right now, our teachers are very very savvy [with the data]. They want to see the data. They want to use it. So we are

grouping our children. We're looking at the disaggregated data, how well our students are doing, the ethnic groups of students, and how the boys do versus the girls. … So we're looking at the data from every aspect possible and the teachers are buying into it because they see the value." [CNE FG1_MI]

Thanks to the longer engagement with WIDE courses, ideas from different WIDE courses have been integrated into more coherent standards on effective teaching and learning at CNE. One teacher who took both DataWise and the Multiple Intelligences (MI) courses said that "I think also the whole approach of looking at the performances [data] and different types of [MI] assessments, kind of pulling it all together. I think that is also in line with what the school is trying to do: looking at the children as individual learners, looking at the data that we have on those children, trying to figure out where we can help them best, and where we are weak, and where we need to get better. And I think that it kind of all pulls together in the same spot." [CNE FG2_TSNT1]

At ECE, one administrator articulated how his school's WIDE participation affected every aspect of the learning and teaching, "Differentiation is an essential concept in both the elementary school classroom and when providing professional development [PD] to a staff. The concepts surrounding differentiation for teachers must also take into consideration the entry point of staff, their learning styles, content of core strategies and product. Teachers are eager to help one another, and to seek support that addresses their individual needs. Teachers are now focused on designing individual goals for students, and students are part of the process. Students are now able to describe their own learning styles, their interests, and what they need to do to move on to the next level." [End-of-course online survey, Fall08, ECE-DI, 10833]

CNE also carried out their Quality Review preparation based on their learning experience in the Data Wise course. In the Spring08 term, for instance, one Inquiry Team participated in the Data Wise (DW) course in order to "decide what area to work on with our chosen [targeted lowest performing] students" and combined already existing assessment tools in the school while taking the DW course. "The Questioning protocol helped us [the DW team] brainstorm to choose the area of concentration. We then displayed a plan and assigned team members for different tasks. We created a newsletter to share results with the staff [in the school]," reported a member of this Inquiry Team in the course survey. [End-of-course online survey, Fall07, CNE-LfU, 10390]

When asked to reflect upon their three-term experience with WIDE courses, Principal Ellis described the impact of various WIDE courses in the following way: "The first [Teaching to Standards with New Technologies course] guided us a great deal and improved technology in our school. Even though the name [of our school] is the School of Science and Technology, we were not living up to our names because technology was not really in [right] places. … We started looking at data critically after we took the DW course. … When it comes to data, we used to have tons of data. But we were not organized. We didn't even know why we collected the data. Today, we have that data in one place, we know why we have it, who needs it, why we are using it, how we can benefit from the data. That data is utilized to communicate with parents. That data is utilized to have conferences with the students…for teachers to see themselves. That data is embedded in the goal setting at the beginning of the school year." [TAM Ellis Nov20]
She then showed a thick binder what she referred to as "my data binder." "Every single teacher has their own data binder. This is the data about the last progress report…We have, for example, [data] for English Language Arts… We took out all the different skills that were assessed in the tests. Now, the teachers will be able to see that, skill by skill, which one is the one [to work on]. They will be able to modify and have differentiated instructions that we learned in the DI course. [TAM Ellis Nov20]

Organizational Structure

One of most common difficulties cited by WIDE participants in their surveys has been the lack of time for full participation in our online professional development courses. It is difficult to keep up with ongoing self-reflection and group discussions, while fulfilling their full-time job requirements in school. Although the asynchronous features of online courses provide certain advantages, it is still difficult to find time and manage other competing priorities.

It is interesting to read the online-survey comments from teachers regarding this issue. "Our biggest constraint was the timing of each week's assignment was not in line with when we could meet as a [WIDE] team. So we were always a little behind. I also personally felt that I didn't have time to give enough feedback to other participants. It

was a challenge to just get our assignments done. Also this year NYC has us doing an inquiry [team] project and that distracted us." [End-of-course online survey, Fall07, ECE-DW, 10482]

Another teacher explained, 'Time' was always a factor for this team. We are coaches and data specialist, and have a very demanding schedule during the school day. We are therefore limited in our time to meet, collaborate and execute plans with the students who are chosen from different classes.

Times available for our team to meet and collaborate were not always in sync with assignment due dates (which we thought were a bit unrealistic). We tried our best to meet deadlines, however with breaks in the school semester and other work-related commitments, this was not always possible. [End-of-course online survey, Fall08, CNE-MI, 11582]

As mentioned earlier in this report, each school allocated a special time and space for their Harvard/WIDE team course work. Clearly this set-aside time was important to the participants. The CNE teachers, for example, expressed their appreciation for their Thursday after-school time , set aside to work exclusively on WIDE course activities. "We were given time only by our institution [school]. This was very helpful due to the intense workload of the course." [End-of-course online survey, Fall08, CNE-MI, 11585]

Another teacher explained, "The school Principal was very helpful and supportive of our group in working on our assignment. She allows us to use the resources that we need for the course. [End-of-course online survey, Fall08, CNE-MI, 15113]

Principal Jones noted that "We know the routine. We know it is on Thursdays, and we kind of look forward [to it]. So, I changed things [school schedule] around. So we [the Harvard Team] would be freed up on that Thursday." Principal Jones also coordinated the entire PD schedule so that "once a month, the 3-5th grade teachers meet together. At another time, the whole school meets together, and then I give them time once a month that we have an hour, almost two hours of professional development built into their schedules," where they often work with the student assessment data or other WIDE-inspired practices including DI.

For a staff member who develops professional development activities at CNE, for example, the DI theory helped differentiate his staff training. "When I did [staff] training this year, I made sure that my training was different for my staff, because they each had different levels of experience. One of the things we talked about was child development and I did a whole piece on different kids are in different places, what you do about, how you handle the class of twenty children when three of them are so far behind. … So, from the big picture standpoint, I'm using the [DI] concepts... so it's a little bit different." [CNE FG2_TSNT1]

Both ECE and TAM also applied the concept of DI in their professional development activities. One staff developer at ECE said that "I have been differentiating PD more. We gave menus such as the beginner's or advanced training on Smart Board, and did certain seminars that were basically self-selecting and based on differentiation." [ECE_FG] Principal Ellis at TAM also pointed out that "we also learned [from the DI course] that we need to differentiate in professional development… For example, we have a group of teachers that they only just become new teachers and they have different professional development from the rest of the other teachers, so new teachers have four periods of PD instead of three periods [for other teachers]. One of the [four] periods is just to teach them how to work with the class, how to set up the classroom, those basic things that the older teachers already know." [TAM Lopez1 Feb09]

According to Principal Ellis, their professional development time is "embedded in the teacher's schedule, so ... the number of instruction periods is being reduced so that they'll be able to have those periods mandated for professional development." [TAM Ellis1 Feb09]

Visionary and Distributed Leadership

Another key element of successful systemic educational improvement is to develop visionary and distributed leadership that will create and sustain common educational goals within a system. This means that all leadership competences should not be vested in one leader. Rather, with systemic leadership, all staff can identify the critical vision or mission of the system, can recognize necessary steps and resources required to meet the goals, and authority and responsibility is distributed across different levels of the system.

By being closely aligned with the school's key priority (improving the data collection and presentation for the 2007-08 Quality Review), one CNE teacher called the DW course "really really eye opening" because it not only used the school's own assessment data but offered ongoing opportunities for the school administrators and teachers to work collaboratively to "see how we can use what we've gathered and use it best to help the children." [CNE FG1_MI] Another teacher provided a concrete example of how the whole school started to change: "you do a little more [with the data], and then slowly, certain teachers who were very resistant and very vocal about not wanting to collect all this data and how it was a waste of time, were suddenly saying, "Oh! This kid, he really changed, and now I know I have to do this with him." To her, it was that turn when a majority of teachers in the school "really started looking at [the data] and said 'ok, what does that mean in the classroom, what exactly do we do with all this information?' "That was when the buy-in started happening, because people were able to see the reason, they could see the results."

Thanks to this school-wide systemic effort in improving the use of student data, CNE has accomplished its goal to move the school from "In Need of Improvement" in 2006-07 to "Proficient" status in the 2007-08 NYC Quality Review, as shown in the table below.

Review Category	2006-2007	2007 - 2008[17]
School Environment	0.812	A (11.2)
Student Performance	0.441	B (15.2)
Student Progress	0.546	A (42.6)
Additional credit	2.25	0.75
Overall Score	**In Need of Improvement – Year 1**	**A (69.8) Proficient**

[Table: CNE NYC Quality Review point/grade]

One of the key contributing factors in this remarkable improvement was the visionary and consistent support from the school leadership group, particularly from Principal Jones.

When asked to describe her leadership style, Principal Jones explained that, "It is important to be [a leader] but it is also more important to be a part of the group. Instead of saying I am appearing as a principal. I am different from all of you. .. For me, it is important to take ownership [as a leader] and being part of that team down here. And knowing and seeing things at their level." "There has to be a way that we mutually can share things because if I could not share, then I am not a good leader," added Principal Jones. Principal Jones sees herself as someone who "helps people and asks for their input." "It is not about me directing them. I act more as a facilitator," added Principal Jones. In fact, one teacher noted that "I think, like one of the teachers said to me, because you don't usually see Ms Jones in another light other than as principal. In that [WIDE] course, she is like one of the guys. So it was very good for the teachers to see her and to communicate with her on a level that they would not normally communicate with her."

Principal Jones's creative, energetic, and committed leadership was fully recognized by being one of the five recipients of the 2007 Sloan Public Service Awards, selected among more than 250,000 public service employees in the NYC government. According to a CNE teacher's description of Principal Jones, appeared in the published booklet for this award, she is "a tireless advocate for children, she also pushes teachers to excel in their professional and personal development; she gives us leeway to do our jobs creatively and creates a sense of unity, commitment and ownership in the programs she promotes."

Principal Miller vividly recalled his first arrival at ECE, which was a failing school. "When I got here, there was a lot of finger pointing: the teachers blame the parents, the parents blame the teachers. It was an ongoing cycle and it was easier to blame than to do. I set very high expectations. What was really frightening was that everyone told me

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[17] Please note that the NYC Quality Review implemented a grade system (A to F) in the school year of 2007-2008.

that it is 'such a great school.' That really scared me. During lunch, I went to a copy store and blew up our test scores into a six feet poster. I hung them all over the school and asked the teachers: 'would you send your child to this school?" Awakening… [I answered that] 'I would not send my child to this school.' I am not going to be satisfied until each one of your child, nephew, and best friend's child would want to come to this school.' That is basically how we get started [changing]."

Principal Miller described that "it really set the expectation high and let everyone know that this place is about moving children and working with children. … This was not a factory to punch in and punch out. I needed to make that change." One of his teachers explained that, at the beginning, "teachers would ask questions about parking permits, leaving early to go to a doctor" to Principal Miller. He intentionally ignored these requests and instead Assistant Principal talked to the teachers that "If you ever want to talk to Principal Miller, it needs to be around student outcomes and achievement." Principal Miller pointed out that "it was a defining moment, a statement."

As of the 2004-2005 Report Card, ECE's designation was changed from "Schools In Need of Improvement" to "School in Good Standing." Since then, as shown in the graph below, ECE has continued striving with significant academic growth, with percentages signifying the percent of students are or above standard (Levels 3 & 4) on NY State standardized exams. "This is where anyone that looks at the data will tell you with the wrong zip code, with the wrong color, with the wrong socio-economic status for children to be successful, and we break that mold here… This is a school where all children are successful," proudly said Principal Miller.

Review Category	2006-2007	2007 - 2008
School Environment	13	A (10.4)
Student Performance	25.9	A (23.1)
Student Progress	32.1	B (30.2)
Additional credit	1.5	0.8
Overall Score	**A (72.4)** **In Good Standing**	**A (64.5)** **Well-developed**

[Table: ECE NYC Quality Review point/grade]

When asked to describe his leadership style, Principal Miller said "Different! Very much out of the box! I don't consider myself as a leader. I spent most of my time in classrooms. The work of the teachers in classroom is my work. I see myself in the classroom and my philosophy has changed drastically in the last six years." [ECE_Miller]

As ECE's 2008-09 School Comprehensive Educational Plan (CEP) indicates, the school has gone through a dramatic improvement "through determination, newly developed collaborations, and a strong commitment from staff and parents." According to this plan, ECE is most proud of these two accomplishments: 1) "increased student achievement brought about by the improvement of the quality of assessment and instruction" and 2) "the creation of a truly collaborative teaching environment, as well as a comprehensive inclusive student environment."

The previous section described Principal Ellis and her leadership team's changes. After going through various steps to improve engagement and communication, Principal Ellis described the current meeting environment in this way: "Before the WIDE classes, it was unbelievable. At first we [the leadership team] were dictating. The leadership team would tell everything…this is what you [a teacher] do. No input. It just had to be done. … [if it doesn't happen] I used to think, why do the teachers don't do this? Why do they not do it even after we explained it? So we used to see it, "Okay, they don't want to do it." But after being in those classes—Leading for Understanding—we began to think, maybe they don't know how to do it, not that they don't want to do it. … Let them participate in the input in how to make changes. Part of it, they will get engaged… Now it's different. … For example, for the 6th grade, we have two teachers who are in charge of the whole 6th grade. They plan the PD and everything. We [the leadership team] just go and sit down and listen." [TAM Ellis1 Feb09] "It definitely changed me as an administrator and now it's changing my staff," continued Principal Ellis.

The following table shows how TAM improved its Quality Review results for the last two years by moving its status from "Planning for restructuring" to "Well-developed." Its 2007-08 Progress Report, reported that "the school met 100% of its improvement target from last year."

Review Category	2006-2007	2007 - 2008
School Environment	6/15	D (4.1/15)
Student Performance	9.8/30	B (14.0/25)
Student Progress	17.1/55	C (25.7/60)
Additional credit	0.8	0.8/15
Overall Score	**D (33.7)** **Planning for Restructuring**	**C (44.6/100)** **Well-developed**

[Table: TAM NYC Quality Review point/grade]

VII. Conclusion

"If it [WIDE World] works here, it works everywhere!" claimed Principal Miller.[18]

The three NYC schools in this study were not the best schools few years ago. Thanks to their visionary, coherent, and persistent efforts to improve student academic achievement, each school made significant progress in classroom teaching, student learning, and overall school performance. This research report used the WIDE's Systemic Educational Improvement Model to capture and analyze the ways in which each school faced its own challenges and accomplished important educational improvement over the last two years.

A majority of the NYC participants in this study reported that their WIDE experience helped them grow, not only as individual teachers or leaders, but as collaborative members of a whole school. As this paper illustrates, systemic educational improvement requires a thoughtful coordination of critical teaching and learning activities across all levels of personnel in a school.

In conclusion, we would like to recapitulate the five strongest areas of WIDE's impact on the three NYC schools.

1. Improved understanding and enactment of high-quality, effective teaching, learning, and leadership
Based on long-term participation in WIDE courses, the members of these schools have acquired improved understanding and enacted high-quality and effective teaching, learning, and leadership. Throughout the study, they demonstrated their capability to use common vocabulary (such as the TfU framework) and articulate shared norms for high-quality instructions and outcomes.
2. Improved engagement and collaboration among the school members
We collected abundant evidence of improved levels of engagement and collaboration among the school members, including examples related to self-esteem, professionalism, and collegiality. These changes indicate that the culture at the NYC schools has shifted from an autocratic to a more democratic learning and working environment.
3. Increased capacity of Inquiry process across levels
By establishing a professional learning community through the WIDE coursework, these teachers and leaders are now accustomed to ask more questions of one another and their students. By regularly reflecting on their knowledge and practices, these educators regard themselves as life-long learners and are eager to prepare their students to do the same.
4. Visionary and distributed leadership
The leaders in this study are extraordinary individuals. They have demonstrated their capacity to lead their schools with a clear vision, collective decision-making mechanisms, shared responsibilities, and untiring support to make the WIDE experience as successful as possible. These leaders also increased the leadership capacity in their schools by collaborating with teachers and, in the process, creating new leaders.

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[18] From a personal communication with Dr. Joo during her research visit in February 2009.

5. *Data-driven educational improvement*

In order to address the NYC's accountability requirements, these schools made tremendous progress using their student data for school-wide educational improvement. They worked strategically to understand, collect, analyze, and present their assessment data for the annual Quality Reviews.

At WIDE World, we are proud of our successful partnership with the NYC schools and grateful to the Harvard Club of New York Foundation for supporting the last two years of educational improvement.

"We are talking about the [WIDE] graduation, but it is a celebration!" Principal Ellis said excitedly. [TAM Ellis]

Exemplary Use of Technology in k-12 Education in Saudi Arabia:
Dar Al-Fikr Private School

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Introduction

Educational technologies are rapidly changing teaching and learning environments in developing countries (US Fed News Service, 2008). Saudi Arabia is an example of a developing country that has accelerated the implementation of educational technologies (Al-Abdulkareem, 2008; Al-Yousif, 2008). While Saudi Arabia pledged 26 percent of its budget since 2006 for building 2,600 K-12 schools (Al-Faisal, 2006), little has been written about K-12 education in Saudi Arabia outside of the Kingdom.

Research about K-12 education in Saudi Arabia has been limited. Only two dissertations were written on K-12 education years ago (Al-Hareky, 1983; Issa-Fullata, 1982). As a result, the present state of K-12 education in Saudi Arabia is largely unknown in the United States and the West, in general, since the Kingdom does not provide much information on the subject (Prokop, 2003). This presentation will discuss some of the barriers to improving the use of technology in K-12 education and show the reality of implementing educational technologies in Saudi Arabia through some initiatives that have been established by the Ministry of Education. It also demonstrates an exemplary use of educational technology at the Dar Al-Fikr private school in Jeddah. It is hoped that this presentation will provide a basis for understanding the many changes that are taking place in Education in Saudi Arabia, as a result.

Curriculum Development

In 2002, the Ministry of Education has established "The General Project for Curriculum Development" to reconstruct and improve curricula for different subjects. One of the project's aims emphasizes the importance of implementing technology in this reconstruction process.

> Providing effective methods accomplishes educational policy with integration. This is done by effectively interacting with new educational technologies, benefiting from experiences of others, specifying required skills to be learnt by students at every educational level, linking information with general life, developing critical thinking methods, and developing required skills and essentials for productive work (curriculum development in S.A, 2006, Para. 3).

The Ministry of Education's ten-year strategic plan was established in 2004. It stated that its Information and communication technology (ICT) goal is "to develop the infrastructure of information and communication technology and its employment in education and learning" (Computer and Information Center, 2008, Para. 1).

Dissertations on Saudi Arabian K-12 Education

A recent search of the ProQuest database of Dissertations and Theses on February 16th, 2009, found only few studies conducted on higher education e-learning in Saudi Arabia. Two studies were conducted on implementing educational technology in k-12 education. Al-Hareky(1983) studied the effectiveness of modern educational technology on the mathematics performance of elementary students in Saudi Arabia (instructional TV, computer based instruction). The study found that there was significant difference in the total mean of achievement scores was higher for the computer group than the control group. Also, the total mean of achievement scores of television group was significantly better than the control group. The study also concluded that there was a positive attitude among the majority of students and teachers toward computer-based instruction and instructional television. The study also found no significant difference between the total mean achievement scores for males and females in each group.

Issa-Fullata (1982) studied the impact of modernizing instruction through educational technology on students' achievement in Saudi Arabia. Four instructional treatments were used: a control group; a regular teaching method with a classroom teacher, an experimental group 1 with an assisted tape/slide instructional program with the classroom teacher, and experimental group 2 with a self-contained instructional tape/slide program without the classroom teacher participation. Two instruments were used to measure students' achievement: a paper-pencil and a visual/tape format. Analysis of Variance showed that only experimental group1, the paper-pencil subgroup showed a significant difference at $P < .05$. Teachers also showed positive attitudes toward educational technology and instructional design.

Barriers to Using Technology in Saudi Arabia

There are several barriers that need to be overcome to reach the desired implementation and spread the benefits of implementing educational technologies to touch all the Saudi students. These barriers include:
- Weakness of infrastructure especially communication infrastructure.
- Need for technology specialists.
- Lack of technological knowledge and skills among teachers and administrators.
- English language barrier (for example, most web 2.0 tools are in English).
- High coast of technology. (Al-Abdulkareem, 2008)

With this lack of information about the current reality of implementing educational technologies in Saudi Arabia educational system, as well as these barriers, more studies are needed to investigate the reality of implementing educational technologies and to help in overcoming these barriers.

New Educational Programs in Saudi Arabia

In order to fulfill the goal of implementing technologies in K-12 education, the Ministry of Education has started different projects. For example:
Obikan & Intel Project:

Obikan Research and Development Company (ORD), in cooperation with Intel, has developed an e-Learning portal using Intel's School Learning Software, called 'skoool' to support school curriculum in Saudi Arabia. Skoool concentrates on secondary Math and Science curricula. "It includes a wide range of interactive educational resources that aim to complement students' schoolwork and home study by showing them how to save time and improve their academic performance" (Saudi company Obeikan to develop e-learning portal utilizing Intel's school learning software, 2005. Para. 2). Abdullah Obikan, an engineer at ORD, said that "by adapting our interactive learning and supplementary material to the Arabic language, we hope to help increase technology literacy and academic achievement in the Kingdom" cited in ((Saudi company Obeikan to develop e-learning portal utilizing Intel's school learning software, 2005, Para. 4).
King Abdullah Project for Educational Development (KAPED):

The largest and the most recent program is "King Abdullah Project for Educational Development", which has a budget of about $ 2.4 billion and aimed to guarantee the availability of a highly skilled and motivated work force in the future. The project will "begin with creating a high-tech classroom environment in the Kingdom in six years. More than 400,000 teachers will be trained to handle classes in the high-tech style" (Ministry of Education in S.A, 2008).

Figure 1: (KAPED) logo, (Tatweer, 2008)

The project has started since the last academic year by assigning fifty high schools among the country (25 male and 25 female schools) as a pilot schools to implement the project. These schools have been equipped by the

required advanced technologies to facilitate what is called the smart classrooms. These facilities include smart white board, one-one laptop, data projector, digital video camera, and high speed internet (Tatweer, 2008). Each school is also equipped with access to virtual laboratories and museums, digital library, and the required facilities for the extra curricula activities (Tatweer, 2008). Also, the project adopts the project based learning (PBL) as a learning strategy to support the student-centered education (Tatweer, 2008). In addition, these changes in the learning strategies require change in the assessment tools to be used as "assessment for learning" instead of "assessment of learning". Therefore, the project adopts the authentic assessment tools such as performance assessment instead of the standardized tests (tatweer, 2008). Finally, the professional training for teachers and school principals (male and female) to prepare them for the skills that are required to implement the project properly plays important role in the aimed success for this project. Last year during the summer vacation 1700 teachers and principals were trained for the use of the new technology and the new learning and assessments strategies (Ministry of Education in S.A, 2008).

Figure 2: One to one laptop program (Tatweer, 2008)

Figure 3: PBL (Tatweer, 2008)

Dar Al-Fikr K-12 Private School

The K-12 Dar Al-Fikr Private School is considered to be an exemplary model of implementing educational technologies K-12 in Saudi Arabia. The school curriculum is based on IT-assisted interactive learning. All subject materials are computerized and loaded onto the school network. The school teaches additional subjects that are not taught at Saudi public schools, such as Life Skills, Design & Technology, Thinking Skills, and Community Service. One unusual aspect of Dar Al-Fikr's curriculum is that the teaching is done in both Arabic and English, which makes students benefit from technological resources and tools more easily, since many web tools are in English. Moreover, the school uses a full electronic administrative system. This is unusual for public schools in Saudi Arabia. (Dar Al-Fikr private school, 2008)

Figure 4: Inquiry Learning activity (Science class) at Dar-Al-fikr

Figure 5: Science lab

Figure 6: Art class at Dar Al-Fiker Girl School

Figure 7: Quran class

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Investigating Novice Instructional Designers' Experience and Challenges in a Game Design Course: An Activity Theory Approach

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Abstract

This study conducted to investigate novice instructional designers' learning experiences in a game design course where designers were involved in designing and developing educational games and to investigate the challenges and interaction that were taken place in a game development process. This study utilized Engeström's (1999) activity

theory as its main theoretical framework to better understand the interaction within the components of activity and revealing challenges and experiences. All components of activity theory were examined to how these components influence each other. From those interactions what outcomes are obtained by novice instructional designers and what challenges they have was obtained from this examination. Activity system approach also provide an evaluation method for this complex environment.

Introduction

Instructional designer's skill-set and knowledge that needs to be applied in educational contexts have changed and varied over time (Davidson-Shivers & Rasmussen, 2002). Project based and context dependent applications are some exemplary methods that have been used to educate instructional designers in the academia (Davidson-Shivers & Rasmussen, 2002). Considering wide range of methods in educating instructional designers,, evaluation criteria need to be developed to improve the curriculum of academic programs, the content of the courses and self-assessment of trainers (Bratton, 1990).Teaching ID in the context of educational game design has been gaining more interest and some models have been developed for teaching instructional design by means of designing instructional games (Akilli & Cagiltay, 2006). Game design for learning approach have been used in education, and this is supposed to more educative because it requires inquiry, research, analysis and synthesis which are desired issues in education.

The main purpose of this study was twofold: first, to investigate novice instructional designers' learning experiences in a game design course where designers were involved in designing and developing educational games , secondly to investigate the challenges and interaction that were taken place in a game development process.

Theoretical framework

This study utilized Engeström's (1999) activity theory as its main theoretical framework to better understand the interaction within the components of activity and revealing outcomes. Such inquiry requires deep understanding of the context itself and the participation into that context (Engeström, 1999; Eskola, 1999). This theory was selected due to its capability for analyzing "object-oriented, collective, culturally-mediated human activity or activity system" (Engeström, 1999, p. 9).

Activity theory includes subject, object, tools, rules, community and division of labor. In the context of this study, the components of activity theory were formed as shown on Figure 1. All of the components were dynamic and students were assigned several roles during the project.

Context and Participants

In this instructional game design case study 23 undergraduate students, facilitators, target group and people who are facilitated by students to reach resources related game design engaged in development of a game-like learning environment. To reveal the interaction between all components of the activity system, all the externalized tools such as texts, data and discourse of all interactions, observations and products in collaborative social environment were observed and analyzed using activity theory framework.
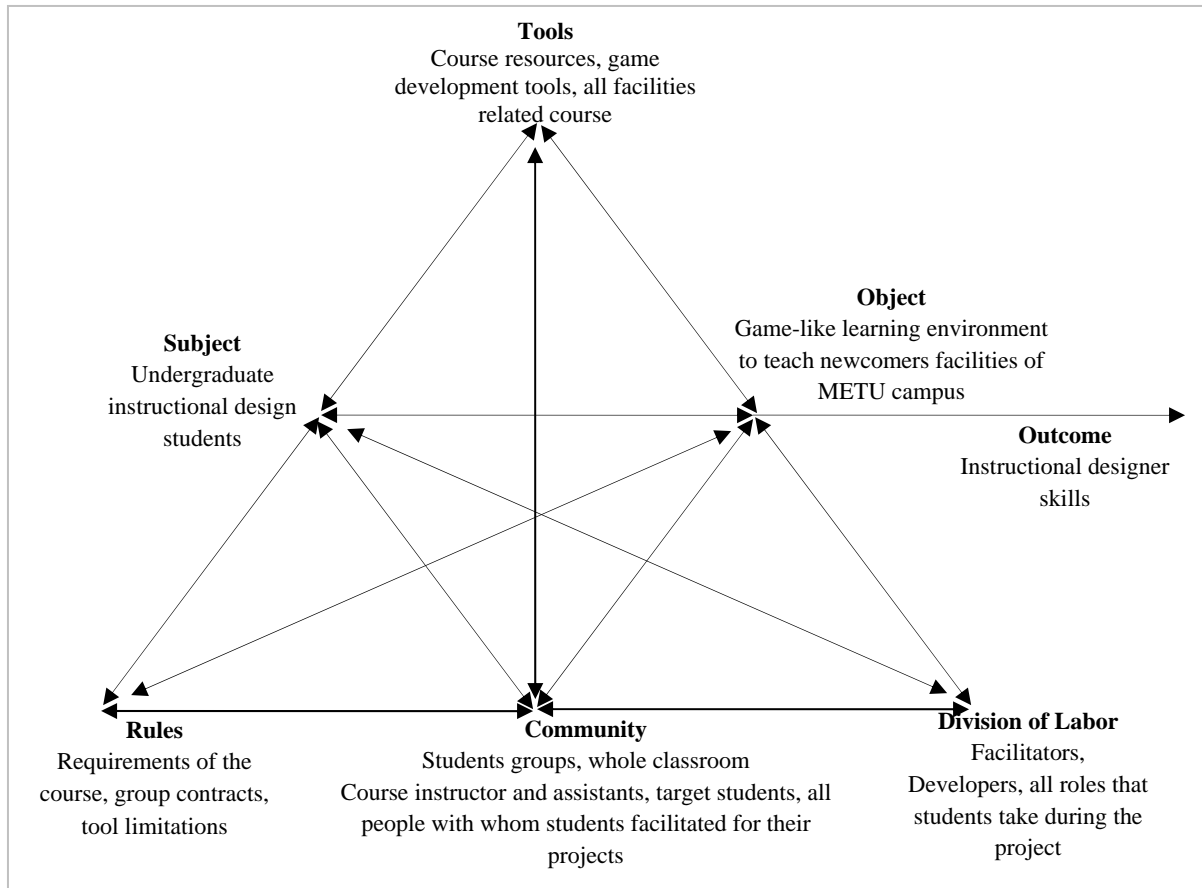
Figure 1: Components of activity theory in the case study

The course was designed using the FID2GE ID model (Akilli & Cagiltay, 2006) which was developed for game-like learning environments. FID2GE model promises a fuzzy logic dynamic design processes, designs are participatory design products, continuous formative evaluations, promotion in communication processes and time planning. Students in this course were engaged to development of a virtual university campus. All groups developed a game environment related to one part of a university campus (library, medical center, technopolis, etc) and each group prepared an instruction to help target learners who were newcomer students understand how to get benefit from the specific part of the campus teach that how target learners can facilitate with that part of the campus.

Sample of the main study was 23 undergraduate students who were in their senior year and enrolled in an undergraduate game development course. Researchers selected three groups (11 students) to make deep observations and interviews. Groups were selected based on instructors' insights from previous courses and students' performances during the projects. Groups used Active Worlds Virtual Environment (AWVE) as a development platform for their game-like learning environments. In this environment each group had a limited space to put their 3D environment. AWVE includes three parts. In 3D interface students put 3D objects and they could make them interactive. Also there is a web part that students put stories of characters in the game or story of environment. Lastly AWVE includes chat tool that provides communication with AWVE world community. Thus facilitators could trace groups work by means of this virtual world.

During students' weekly meetings, semi – structured interviews were conducted with the groups to explore their instructional design processes and the problems they encountered. At the end of the semester, six voluntary students were interviewed individually about their learning experiences in the course focusing on the challenges, strengths and weakenesses, and lessons that students learned in the course. Researchers also attended all classes for observation. The study took 15 weeks to be completed. Within these 15 weeks of study, students attended two-hour classroom sessions and participated in weekly meetings with researcher and other facilitators. Data analysis was divided into two parts: the first part focused on the challenges and interaction between all components of the activity system while the second part focused on the outcomes and experiences analyzed in the perspectives of the subject of the activity system.

Results

Challenges in Activity System

Tool limitations affected novices' motivation in design

In this activity system there are lots of tools like previous experience on group working, projects and games, lab hours, theoretical part of the course, reports, report templates, AWVE as development tool, resources to develop content and communication tools, etc. Results showed that especially AWVe environment played a big role in quality of projects and challenges. The limitation of the AWVE features decreased designer students' motivation to build interactive 3D game. Students had to create a 2D web based environment in the virtual network to make their target group play in 3D part. At the beginning of the course students were very motivated to develop an enjoyable and challenging 3D game. But because target group had to be dependent to web based part, designers thought that they could not provide an enjoyable game that provide a flow (Csikszentmihalyi, 1990) in that environment. One of student put into words this problem by saying "3D part is nothing without 2D part, player just walk around the virtual world if he is not engaged some operations by means of 2D part". Also students could not find all resources to design 3D part, and among 300 million 3D objects finding necessary one was very difficult for students. One of the students suggested that there should be a search engine to find necessary 3D objects. Most of students lost their time to just find one piece of 3D object.

Another challenge that affected students' motivation in designing 3D game was related to the issue of control of the game. We found that students could not use the AWVE to offer several challenged choices in the game while target group can just follow a sequence of instruction. Those problems caused reduce of motivation of students and increased communication in community.

Novices' tended to ignore tool limitations before development phase

Students had to prepare reports before they start to project. Some of students were not aware of instructional design processes and therefore they thought these reports are needless. When they pay less attention in design they had lots of difficulties while developing their projects. Students were found to be influenced by the desire to developed the 3D game that they did not realize the limitation of the AWVE in the analysis phase and they ignore some instructional and technical issues in design phase. Consequently, they had to modify their initial game design. As one student said "as an instructional designer we planned totally different things but because of the tool we had to develop a thing that is not like a game". This also showed that students tend to ignore instructional design rule of the course, because FID2GE model proposes that each step includes some experience for next step (Akilli & Cagiltay, 2006). For example students had to develop some prototypes while they were making their design and writing scenario.

Being relied on community to solve problems

In this project, community consisted of group members, users of Active Worlds Virtual Environment (AWVE), target group (newcomers to the university), instructors, facilitators, experts and peers. Students interacted with all of them during the game development project using participatory game design approach. The interaction within the community was supported by the Active Worlds Virtual Environment (AWVE). Students received support not only by their own learning community in the course, but also from users of the AWVE who shared their knowledge the construction of 3D world. Groups seek a solution for their problems by means of instructors and facilitators. If they could find an experienced user in AWVE environment they facilitated from them. For example one of students stated his experience by saying "Group member stated that "we met with a user who have … nickname, he had made lots of things with a basic account, he helped us, we took Roller Coaster idea from him….". Quality of object most of time changed because of tool and motivation of group members. It was observed that if students work with target group effectively their motivation increase but sometimes they did not communicate well and they could not reflected their findings to the game.

Facilitators had an effect to guide their projects and they also checked rules during the project. In addition, we found that facilitators played crucial role in helping to solve group-related problems such as risk management issues and consequently guaranteed the quality of object (game-like learning environment). Groups defined some rules at the beginning of the projects and they sign a contract which consisting of responsibilities of members, timetables, risk management and penalties. Students preferred instructor control for penalties. This can be interpreted as students need a more professional control mechanism to make them work on a project.

Communication with facilitators and other community members also highly involved with quality of work. For example the groups interacted with facilitators were more successful groups and in these groups all group members showed up in each weekly meeting. Researchers realized that some groups come to weekly meeting just because it is a rule of the course, but successful groups came additional meetings to ask some strategies and solve their problems. Successful groups also did their group meetings rigidly and reported it to facilitators.

The importance of rules

Despite of the course rules, we found the need to develop community rules to help novices produced quality work. For example in observations it was realized that one of the groups developed their project with a totally different instructional approach than the one suggested in the course rules. Not only this influenced the quality of their project, it also affected their knowledge on effective instructional approaches in game design. This case mainly caused because of students previous experience with a similar course. Students mainly used templates and knowledge coming from a multimedia development course which was given almost same structure. On the other hand facilitator also could realize this problem and if this problem was realized by their facilitator on time, quality of work could change.

Design of the course also influenced division of labor, which in this paper means "roles" because it requires group working, work with a real target group. On the other hand students preferred different division of labor; some groups preferred to work on each labor (i.e. role) equally, and others preferred to give each group members a labor (i.e. role). Groups that assigned one labor (i.e. role) for each group member encountered more problems because one member's work affected the entire group process However, we found that the course rules contributed to solving group problems. For instance, student designer of a group who was not completing his tasks would faced certain actions, thus other group members' rights were protected by rules. But still students hesitated to say these kind of problems to facilitators and they expected facilitators interpret the problem in group working. In this case facilitators need to know everything in group contract and understand problems by making in-depth observations to reveal problems.

Experiences and Outcomes

Experiences of Students

Students had to follow an instructional design process thus they conducted several analyses like learner, needs, content, context, and tool. For all stages of design they submit a report to summarize their work. In evaluation stage they conduct usability evaluations and evaluations related quality of instruction. In development stage they designed a 3D environment and web sites that were integrated to 3D part. For group working they also had some roles like leader, communication person, scenario write, and reporter.

Changes in roles

Data from interviews and observations revealed that during the game design project, students' roles changed between being a coder, designer, developer, task analyst, reporter, narrator, usability test designer, leader, coordinator, resource manager. In addition, we found that students were developing other soft skills such asconducting research, communication, conducting needs assessment, and analyzing target group while engaging in this project. For instance, they conducted usability testing for their designs which then affect their communication skills.

Online community

Another important finding was the role of Active Worlds as a venue to build online community among students while simultaneously functioned as tool to develop game. Using Active Worlds, students coordinated meeting with their target groups and continuously worked with group members in the process of selecting, modifying and developing instructional materials, evaluating development tools, and defining the technical issues of required resources. Therefore this project provides them a real world application opportunity in terms of labor. All labors provide students an insight about how that labors are conducted in real life. Also labors of other part of community provide them to work under a project leader, evaluating feedback. Rules that defined by groups also indicated labors of each group members as well as rules for risk management and work policy. Thus students experienced some skills related team work, time management and risk management. Shortly game development has lots of dynamics and each dynamics has a potential of some skills for novice instructional designers.

Conclusion

Game design process has several interaction and some challenges for novice instructional designers. This kind of projects can be used to educate instructional designers in an almost real-life experience. Students can acquire practical skills which they can use in real life because they faced with real life problems in this process. In ID field there are several instructional models have being developed, however there is a lack of comparative or evaluative studies for these models (Akilli & Cagiltay, 2006). Results of this study might provide an assessment system with by means of revealing interaction patterns between several factors in game design activity. These outcomes can provide a guide for developing new project based courses aiming development of educational games or other kind of multimedia products.

Observing the case in an activity approach provide an in-depth evaluation of processes. Especially in group work it is difficult to evaluate students individually. Limitations of activity system might reduce the quality of work. When the whole system observed, instructors can make fair evaluation. Also outcomes of activity should be observed to understand the objects of the course is not the unique outcomes of the system. Activity system might be a good approach for evaluation of students who are treated with constructivist approaches which have gaps in evaluation methods (Airasian & Walsh, 1997).

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Measuring College Students' Perceptions and Attitudes toward Anti-Plagiarism Detection Tools and Their Behaviors, Beliefs, and Moral Judgment regarding Plagiarism

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Abstract

The focus of this study is on measuring the impact of using anti-plagiarism tools (APT's) on students' behavior and attitudes toward plagiarism. A survey instrument was developed and validated in order to collect self-reported data on perceptions/attitudes, behavior, beliefs, and moral judgment with respect to plagiarism and the use of APT's. The survey was deployed with an undergraduate section at a southeastern research I university, yielding a response rate of 72.3% (n=133). Results found significant correlations between APT perception and plagiarism behavior, moral judgment, and neutralization (i.e. justification of unethical behavior). Findings also confirmed previous research with respect to correlations between attitudes, moral judgment, and plagiarism behavior. Details on survey development and validity, as well as suggestions for future research are provided.

Literature Review

It is fair to say that plagiarism may threaten the integrity of higher education in colleges and universities throughout the U.S. About one in two students have cheated on tests and 71% and 85% of college students who participated in a study reported plagiarism and cheating on assignments, respectively (Stephens et al, 2007). Although Stephens defines cheating and plagiarism rather widely, figures from other studies are also staggering. For example, 70% of 18,000 high school students admitted they had cheated; and 60% plagiarized (Villano, 2006).

Even more alarmingly, most of the students reported in Villano's article do not consider cheating as wrong and they feel justified in their behavior. "They don't understand why they should be held to a higher standard" said McCabe, who has studied the field of academic integrity for decades, in an interview with Slobogin from CNN (Slobogin 2002). The report is consistent with the findings from Stephens' study in which the students who reported cheating and plagiarizing showed a lower sense of moral responsibility and a higher tendency of neutralization or justification of their behaviors than non-cheating students (Stephens 2001). Students' behaviors and moral sense have been further investigated by Lovett-Hooper et al. They looked at the relationship between academic dishonesty and norm/rule-violating behaviors (Lovett-Hooper et al., 2007). The study found a positive relationship between all three Academic Dishonesty subscales (self-dishonest, social falsifying, and plagiarism) and an imagined norm/rule-violating future. In short, the study suggests academic dishonesty may lead to rule-violating behavior in the future.

In 2002, the Association of American Colleges and Universities (AAC&U) published a report on higher education of the 21st century to suggest comprehensive principles and models that improve learning for all undergraduate students entitled "Greater Expectations: A New Vision for Learning as a Nation Goes to College" (AAC&U, 2002). It envisions what society expects from college education and identifies three characteristics of learners as being empowered, informed, and responsible.

Among dishonest behaviors, plagiarism has become a focal point recently as information technology advances and the use of the Internet is commonplace. In surveys run from 2002 through 2005, 38% of 18,000 college-aged students said they had 'cut-and-pasted' from the Internet, 25% of graduate students also reported engaging in plagiarism, and 80% faculty observed plagiarism (McCabe, 2005).

In an effort to fight plagiarism, many institutions put in place anti- plagiarism tools (APT) such as an online plagiarism detection service. There exist several commercial services including EVE2 (Easy Verification Engine: http://www. canexus.com/eve/), Glatt Plagiarism Services (http://www. plagiarism.com/), SafeAssignment (http://www.mydropbox.com), and TurnItIn (htpp://www.turnitin.com). These tools are generally well received by students because of the convenience of online submission, and by instructors as an additional tool to address the plagiarism issue. But only few studies have evaluated such tools systematically. In a 2006 study, TurnItIn was evaluated in terms of how the system works, user experiences, and data generated by the system (Evans, 2006). The author suggests that the service detects problematic practices but it may not be practical to check every script thoroughly. The verdict was 'working' but 'impractical.'

The growing popularity of these tools is likely due to a variety of reasons. For one, there seems to be a general agreement among instructors that awareness of such a tool can be a deterring factor; students do not risk getting caught if such a tool is in place. As shown in a recent study by Dahl (Dahl, 2007) one of the main advantages of

APT's may be their psychological effect. Awareness of TurnItIn among the participants in the study increased awareness of academic integrity and plagiarism (e.g., what is considered plagiarism, honor code, etc). The awareness also clearly brought about some behavioral changes: More than half of the participants learned how to reference correctly after using TunrItIn, which tells us that such a tool can also have educational benefits for higher academic standard (Dahl, 2007).

Therefore, it is important to examine how using APTs can affect students' behaviors, attitudes, and perceptions with respect to ethical conduct. What psychological effects and educational benefits of using APT's can bring is an important question. Thus, in this current study we investigate the following questions:

1. What are college students' awareness, perceptions and attitudes, and beliefs with respect to anti-plagiarism tools?
2. What is the relationship between perceptions/attitudes toward plagiarism, plagiarism behavior, moral judgment and beliefs, and perceptions/attitudes toward anti-plagiarism tools?
3. What are the effects of using anti-plagiarism tools?
4. What is the relationship between effects of using APT's and other variables of interest?

To answer the research questions, a self-report questionnaire was developed and used to collect data. Correlational analysis was the main method used to examine the relationships among variables based on the students ratings on the corresponding statements. The questionnaire included statements related to specific effects and benefits of APT's suggested in the literature as an attempt to address the questions. The statements include 'After I learned my instructor was using an APT, I still plagiarized' and 'I decided not to plagiarize' (deterrence effect); 'I became more aware of plagiarism' (awareness effect); 'I tried to find out how to avoid committing plagiarism,' 'I tried to learn how I should reference something correctly because I experienced an APT' and 'I feel confident about quoting other people's work correctly' (educational benefit). Other variables' operational definitions are as follows.

Variables of interest

Plagiarism awareness is the level of students' awareness or knowledge about what constitutes plagiarism. *Plagiarism behavior* represents how many times a student engaged in plagiarism. *Perception/attitude on plagiarism* includes three subsets: moral judgment, belief (neutralization), and plagiarism perception. In a 1991 study, *moral judgment* was shown to have a strong relationship with college students' dishonest behavior (i.e., cheating on exam) and suggested a strong predictor of such behaviors (Beck & Ajzen, 1991). The study suggested that students with high moral judgment level are less likely to engage in dishonest acts. In another study, *neutralization* was also shown as a strong predictor of academic dishonesty (Diekoff et al., 1996). *Neutralization* means students' tendency to justify dishonest behaviors attributing external and internal factors. Thus, the study suggested that students with high neutralization level are more likely to engage in dishonest acts. *Perception/attitude of APT's* is about how students feel about APT's, whether they support the use of APT's, feel intimidated, see APT's as a reliable tool, and so forth.

Method

Participants

Participants were 184 students enrolled in a non-major course in southeastern public university. The researchers decided to use one course that is representative of the university population and work with the instructor of the course to ensure reasonable response rate. The instructor of the course gave extra credit to the students who completed the survey. The response rate was 72.3% (133 students participated). Since the survey should be anonymous, the researcher assured the students that the fact of their participation would be stored separately from the survey data and that their responses would not be associated with their identity.

The respondents consisted of 6 freshmen (4.5%), 55 sophomores (41.4%), 56 juniors (42.1%), and 15 seniors (11.3%). 64% of the respondents were female. The majority of the students major in Communications Studies (42%) and other majors included English, Marketing, Media Production, Business, Public Relations, Political Science, and International Affairs.

Procedures

The first announcement regarding the study and the procedure was made during the class in September 2009 and was followed by an email advertisement and announcement on the course website. All students enrolled in the course were emailed with a link to the online survey along with a brief summary about the study. Anonymity of

participation was emphasized in all announcements and individual inquiries regarding anonymity and procedures were answered during the class visit and via emails by the researchers and the instructor. Once the students opened the questionnaire, they needed to provide their informed consent in order to proceed.

The online questionnaire was available for one week. In addition to the announcements in class and on the course site, and the initial email invitation, a reminder email was sent out on the third day and another one on fifth day of the data collection.

Measures

A survey instrument was developed for this study, which included newly developed items and other items that were adapted from the existing instruments. It is a self-report questionnaire that consists of forty five statements, most of which are rated using 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), and eleven statements with slightly different scales. Please see Appendix A for a copy of the instrument. New statements were written in order to measure the variables of interest: the students' awareness, perceptions and attitudes, beliefs, and morality with respect to plagiarism and APT's. Subscales of moral judgment and beliefs were adapted from a moral responsibility scale (Beck & Ajzen, 1991) and a neutralization scale (Diekoff et al., 1996). Students' academic dishonesty was measured by items adapted from the Academic Dishonesty Student Survey (McCabe, 1992).

Structure of the measurement instrument

The measurement instrument consists of 5 sections measuring the variables of interest in addition to APT experience (section 4) and the demographic information (section 7). The following Table 1 summarizes the structure of the instrument with the different sections and associated variables.

Table 1. Structure of the Measurement Instrument

Section Variables	Subscale (if any)	Scale	Variable type
1. Plagiarism Awareness		Disagree, Not sure, and Agree.	Interval (Pretest total score)
2. Plagiarism Behavior		Never, 0, to More than three times, 5	Interval
3. Perception/Attitude toward Plagiarism	- Moral judgment - Neutralization - Plagiarism perception	5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).	Interval
4. Anti-Plagiarism Tool (APT) Experience	- APT Awareness - Experience	- Yes, No - Number of courses and instructors	- Categorical - Interval
5. Perception/attitude of Anti-Plagiarism Tool (APT)		5-point Likert scale ranging from 1 (strongly disagree) to	Interval
6. Effects of APT	- Educational Benefits	5 (strongly agree) with N/A option	Interval
7. Demographic Information			Categorical

Section 2 uses a modified version of McCabe's Academic Dishonesty Student Survey (1992). Most statements in the section 3 were developed in accordance with items in sections 5 and 6. Section 3, perception/attitude on plagiarism, contains subscales of moral judgment and beliefs that were adapted from a moral responsibility scale (Beck and Ajzen, 1991) and neutralization scale (Diekoff et al. 1996).

Development of the measurement instrument

Newly developed items were drawn from the literature and tested and revised through a panel review, an expert review, and formative evaluation. The instrument with the new items was reviewed by twelve doctoral students who are experienced in survey research and instrument development. The revised instrument then was reviewed by an expert who has been conducting and teaching survey research methods at a Research I University for more than 20 years.

Formative evaluation involved four representative students with different majors and years in school. During the formative evaluation session students engaged in open discussion and critique of the survey instrument (e.g., clarity of statements, overall structure, effective communication, etc). The instrument was once again revised based on the result of the formative evaluation.

Validity and reliability test

      Formative evaluation provided opportunities for assessing not only the quality of items but also content validity. Since there is no external criterion that can be compared to in terms of plagiarism behavior, perception, and morality, criterion validation is beyond the scope of this study. Establishing construct validity, however, may be possible for some items that were modified from the existing items. The authors made a judgment based on how the results of this study relate to the previous studies that used the same instrument. For example, the instrument measuring moral judgment and beliefs revealed that plagiarism is highly correlated with moral judgment and beliefs of students (Beck & Ajzen, 1991). Thus, construct validity of the modified items of moral judgment and belief subscales can be assessed in addition to the content validity.

      The reliability estimates for each section and subscales are summarized in Table 2.

Table 2. Reliability Estimates

Section Variables	N of Items	Cronbach's Alpha
1. Plagiarism Awareness	6	N/A – a test score
2. Plagiarism Behavior	9	.763
3. Perception/attitude on Plagiarism	11	.693
a. - Moral judgment	(4)*	(.660)
b. - Neutralization	(2)	(.440)
c. - Plagiarism perception	(5)	(.737)
4. Anti-Plagiarism Tool (APT) Experiences	5	N/A**
5. Perception/attitude of Anti-Plagiarism Tool (APT)	13	.701
6. Effects of APT	7	.727
7. Demographic Information	6	N/A

*subscales in parenthesis

**2 questions pertains to the number of courses and instructors the students counted as experiences with APT and plagiarism discussion.

Results

College students' awareness, perceptions and attitudes, and beliefs with respect to anti-plagiarism tools

      The awareness level was measured by six questions each asking whether a specific act was a type of plagiarism. The majority of the students scored 3 or less, which may indicate the lack of knowledge about plagiarism among the students. Moral judgment, plagiarism perception, neutralization, and APT perception are all quite high. APT effects showed high agreement that their experiences with APT affected their behaviors and perception. The following descriptive statistics table summarizes the results.

Table 3. Descriptive Statistics

	N	Range		Mean	Std. Deviation	Skewness	
		Min	Max			Statistic	Std. Error
Plagiarism Awareness	124	.00	6.00	2.137	.990	.383	.217
Moral Judgment	123	6.00	15.00	11.894	2.003	-.350	.218
Plagiarism Perception	123	9.00	25.00	20.667	2.748	-.750	.218
Neutralization	122	2.00	8.00	3.943	1.501	.412	.219
APT Perception	124	24.00	59.00	40.742	7.204	-.042	.217

Data Preparation for statistical analysis

      Preliminary data examination showed that there were some missing cases and undifferentiated responses. Further examination of such cases convinced the authors to drop the undifferentiated cases from the analysis. A total of 10 cases was removed from the data set because they either showed no variance in their answers to one or more sections of the questionnaire or provided answers that did not match when they were supposed to match such as reverse coded items.

      In order to address the issue of missing data, we calculated the percent score for some variables instead of raw score using only answered items. Since there were only a few missing values and the missing values should not affect the overall score, a raw score divided by the maximum possible score would best represent the measures.

Perception/attitude on plagiarism (moral judgment, belief (neutralization), APT effects, and plagiarism perception used percentage scores while plagiarism awareness and behavior used raw scores.

Correlation Analysis

This study examined the correlations among moral judgment, beliefs (in the neutralization subscale), plagiarism behaviors, and attitudes/perceptions toward anti-plagiarism tools (APT's). The following correlational analysis table summarizes the results of this study. It shows relationships among variables and the effects of APT use. Educational benefit is a subscale under APT effects that included items such as 'I became more aware of plagiarism'; 'I tried to find out how to avoid committing plagiarism'; 'I would prefer to get more guidance about what plagiarism is'; 'I tried to learn how I should reference something correctly because I experienced an APT.'

Table 3. Correlations

	Awrns	Plagiarism	Moral Judgment	Plagiarism Perception	Neutralization	APT Perception
Awareness	1	.036	.177	-.007	.011	.058
Plagiarism Behavior		1	-.339(**)	-.026	.305(**)	-.310(**)
Moral Judgment			1	.209(*)	-.429(**)	.307(**)
Plagiarism Perception				1	-.206(*)	.158
Neutralization					1	-.382(**)
APT Perception						1
APT Effects						
Ed. benefit						
Experience						

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Moral judgment and perception of APT are negatively correlated with plagiarism behavior while neutralization is positively correlated. Plagiarism behaviors represent the frequency of dishonest behaviors that the students reported. Thus, the study confirmed that the higher their moral judgment, the less likely it is for the students to involve in plagiarism activities. Likewise, the more the students have a positive perception of APT's, the less likely to plagiarize. On the other hand, the more students tend to justify their dishonest behavior, the more likely they are to plagiarize.

Perception of APT correlates positively with moral judgment and correlates negatively with neutralization, which could mean that those students who perceive plagiarism negatively tend to avoid plagiarism and perceive APT's positively. APT perception is also positively correlated with APT effects. In other words, those who see APT's positively tend to attribute their specific perception and behavioral changes to their experience with APT's, leading to a higher plagiarism awareness level or a decision not to plagiarize.

APT effects

Based on the students' responses, the majority of the students agreed that APT use affected their behavior and awareness with respect to plagiarism. Table 4 summarizes the students' responses to the APT effects statements and Table 5 summarizes the correlation between APT effects and other variables.

Table 4. APT Effects

	N/A	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Total
1	25	**64**	**28**	6			123
	20.3%	**52.0%**	**22.8%**	4.9%			
2	6	5	11	19	**68**	**12**	123
	4.9%	4.1%	8.9%	15.4%	**55.3%**	**9.8%**	
3	30	5	5	23	**43**	**16**	123
	24.4%	4.1%	4.1%	18.7%	**35.0%**	**13.0%**	
4	15	11	10	29	**50**	**8**	123

	12.2%	8.9%	8.1%	23.6%	**40.7%**	**6.5%**	
5	2	**16**	**41**	43	20	1	123
	1.6%	**13.0%**	**33.3%**	35.0%	16.3%	0.8%	
6	1	2	7	18	**80**	**15**	123
	0.8%	1.6%	5.7%	14.6%	**65.0%**	**12.2%**	
7	16	8	22	27	**42**	**6**	123
	13.0%	6.5%	17.9%	22.0%	**34.1%**	**4.9%**	

*1. I still plagiarized; 2. I became more aware of plagiarism; 3. I decided not to plagiarize; 4. I tried to find out how to avoid committing plagiarism; 5. I would prefer to get more guidance about what plagiarism is; 6. I feel confident about quoting other people's work correctly; 7.I tried to learn how I should reference something correctly because I experienced an APT. APT effects are deterrence effect (statement 1 and 3),
awareness effect (statement 2), and educational benefit (statement 4, 5, 6, and 7)

Table 5. Correlation Analysis with APT Effects

	Awareness	Plagiarism Behavior	Moral Judgment	Plagiarism Perception	Neutralization	APT Perception
Awareness	1	.036	.209(*)	-.007	.011	.081
Plagiarism Behavior	.036	1	-.278(**)	-.026	.305(**)	-.293(**)
Moral Judgment	.209(*)	-.278(**)	1	.151	-.372(**)	.313(**)
Plagiarism Perception	-.007	-.026	.151	1	-.206(*)	.128
Neutralization	.011	.305(**)	-.372(**)	-.206(*)	1	-.325(**)
APT Perception	.081	-.293(**)	.313(**)	.128	-.325(**)	1
APT Effect 1*	.036	.352(**)	-.132	-.071	.071	-.187
2	.183(*)	.050	.197(*)	.036	-.069	.070
3	.076	.049	.152	.173	-.078	.138
4	.033	.039	.167	-.018	-.065	.054
5	-.022	.108	.004	-.010	.010	.020
6	.045	-.236(**)	.212(*)	.097	-.411(**)	.377(**)
7	.162	-.089	.060	.092	-.118	.210(*)

*Analyzed APT effects that did not include n/a responses.

Students' plagiarism behavior was directly reflected on the first statement of APT effects and the correlation between plagiarism behavior and APT's deterrence effect was positive and significant. Likewise, students' awareness level was positively correlated with APT's awareness effect item. Other significant correlations were found between one of the APT's educational benefit item ('I feel confident about quoting other people's work correctly') and plagiarism behavior, moral judgment, neutralization, and APT perception/attitude, respectively.

Discussion

The research questions of this study were:

1. What are college students' awareness, perceptions and attitudes, and beliefs with respect to anti-plagiarism tools?
2. What is the relationship between perceptions/attitudes toward plagiarism, plagiarism behavior, moral judgment and beliefs, and perceptions/attitudes toward anti-plagiarism tools?
3. What are the effects of using anti-plagiarism tools?
4. What is the relationship between effects of using APT's and other variables of interest?

With the first two questions we aimed at gaining a better understanding of the factors that contribute to plagiarism behavior in students. As presented in the results section, there is positive relationship between moral judgment, and APT perception/attitude. On the other hand, neutralization and plagiarism behaviors have a negative relationship.

The third and forth questions, however, could not be answered as expected since there is not enough information available, even though some correlations turned out significant (i.e., moral judgment and overall APT effect score, $r = .184$, $p < .05$; APT perception and APT effect score, $r = .253$, $p < .01$). For example, educational and other benefits of using APT's was a main variable of interest in this study but could not be tested appropriately given the data since there were only 8 students who have never experienced an APT before whereas the rest of the students have experienced it. Although correlations are statistically significant, this may not be a meaningful result because the data set violates the normality and equal variance assumptions that need to be met to run a statistical test. Since most students already knew about APT's and have used at least one before, there must be other ways to differentiate their experience with APT's or a large enough number of non-experienced users should be surveyed.

College students' awareness, perceptions and attitudes, and APT perception/attitude

In discussing plagiarism awareness, perceptions and attitudes, and APT perception and the corresponding analysis, it is important to note that most of the students who participated in the study knew about APT's and had experienced APT's before. Only eight students indicated that they didn't know about APT's and had never taken a course that used APT's. Interestingly, the students' awareness level turned out low although their self-reported perception of plagiarism and moral judgment level were high. This may suggest that they don't know what constitutes plagiarism but they are aware that plagiarism is an issue and can have serious consequences. The absence of an association between behavior and awareness was confirmed by analysis of correlation. Also plagiarism awareness is not associated with moral judgment, plagiarism perception, neutralization, or APT perception, which makes sense because knowing about plagiarism does not necessarily mean high level of moral judgment and other variables.

APT perception/attitude was measured in this study along with other variables that were found in other academic dishonesty studies in order to examine the relationship with those variables (e.g., moral judgment and dishonest behaviors). APT perception/attitude was found to have a positive relationship with moral judgment while having a negative relationship with plagiarism behavior and neutralization. It seems valid and reasonable to include APT perception/attitude as a main variable in plagiarism research.

This study shows results that are consistent with previous studies in addition to presenting new findings from including additional variables such as APT perception/attitude. For example, the measure of moral judgment and beliefs confirmed that plagiarism behavior is highly correlated with moral judgment and beliefs of students (Beck & Ajzen, 1991). In terms of validity of the instrument developed for this study, consistent results and correlations among major variables strongly support the construct's validity with respect to the modified items as well as the newly written items.

In addition to confirming findings of prior research, the present study shows that the use of APT's is related to how students behave and how they perceive plagiarism. The fact that this study found significant relationships between the use of APT's and other major variables, such as moral judgment, suggests that APT's should be included as a major variable in future research on plagiarism.

APT effects

First, as to the deterrence effect (statement 1 and 3), none of the respondents stated that they plagiarized and about 50% of them indicated they decided not to plagiarize after they learned that APT's were used. It is particularly important to note that about 20% said that the deterrence effect was not applicable to them. During the formative evaluation, all of the students pointed out that the 'not applicable' option was needed because they did not plagiarize and decided not to do so regardless of APT use. It may not be reasonable to make a conclusive remark

about 'not applicable' but helpful to understand and the difference between 'agree' and 'disagree' responses. In other words, by excluding 'not applicable' responses, agreement with the deterrence effects of APT can become clearer.

The awareness effect (statement 2, 'I became more aware of plagiarism') was also clearly shown to be one of the main APT effects. Using an APT raised the level of plagiarism awareness, which was also consistent with students' high plagiarism perception score (mean = 20.67, sd = 2.75, max = 25). The APT awareness effect is also supported by the correlations with plagiarism awareness and moral judgment although the size of the correlations is quite small. On the other hand, plagiarism perception and APT awareness effect are not associated based on the correlation analysis. Plagiarism behavior and APT perception are not associated either with APT awareness effect as it is not associated with plagiarism awareness.

Most educational benefit items also did not produce significant correlations with the other variables. Only the responses to the statement 6 ('I feel confident about quoting other people's work correctly') turned out to have significant correlations with plagiarism behavior, moral judgment, neutralization, and APT perception. About 77% of the respondents agreed with the statement, which may indicate benefit of using APT's. In fact, many of the respondents agreed with other educational benefit statements except the statement 5, which was about whether they wanted more guidance or not. If they were already confident as indicated in their response to the statement 6, they would not seek more help. In their responses to statement 4 and 7, they indicated they tried to learn more about avoiding plagiarism (about 50% of the respondents agreed excluding 'n/a' responses). Despite the absence of significant correlation, educational benefits seemed to be clearly shown.

Limitation of the Study

This study involved the collection of sensitive information from students by means of an anonymous web-based survey. In order to encourage participation, the survey was deployed in the context of an undergraduate course and students were able to earn participation points toward their grade as a reward for participating in the study. Although the students' anonymity was guaranteed, it is possible that some students were reluctant to admit to any unethical behavior they may have engaged in, which might explain the comparatively low scores on that variable in contrast to other studies of undergraduate students. One might argue that self-reports should be considered with caution in general, because participants might have a distorted perspective of their own behavior; they might report how they think they should behave or how they would like to behave, rather than how they actually behave. Additionally, the vast majority of the participants had had some experience with ATP's in the past; this prevented us from effectively comparing the responses between experienced and inexperienced students and as a consequence it was not possible to establish any differences between the groups. A larger sample size would likely yield a better distribution and thus offer additional opportunities for analysis.

Recommendations for Future Research

Current study only surveyed 133 students, which is an intact group to ensure higher response rate and achieve good representativeness. Despite the high response rate, the intact group participation unexpectedly resulted in too small number of students who had not experienced APT prior to the data collection. It is crucial to have enough number of non-experienced participants to compare variables based on the student's experiences with APT. Thus, more participation would be desirable in a future research. Also it would be ideal to have any way to complement and support the findings from self-report questionnaire method. Observation (e.g., examining actual writing assignments) would provide invaluable insights and potential verification of students' responses.

Since it can be hypothesized that there are differences in the variables of interest depending on levels of awareness of and perception/attitude toward APT's, it may prove beneficial to employ MANOVA in order to investigate the effects of awareness and interactions among key variables (e.g., morality, awareness, and attitude).

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Appendix A. Survey Instrument

<div align="center">

Survey Instrument – FE Form #1 (v 2.5)

</div>

Date: _____

Please indicate your agreement with the following statements (Agree/ Disagree/ Not sure)

- Copying any part of source texts without crediting sources is considered plagiarism.
- Plagiarism includes paraphrasing source texts without crediting the source.
- As long as there is proper citation, you can copy someone else's words in your paper without quotation marks.
- Using someone else's idea in your paper without copying any words may not require proper citation.
- Submitting someone else's paper is acceptable if your friend exclusively wrote it for you.
- Completely paraphrasing source texts may not require proper citation.

How many times have you done the following in the past academic year (2008-2009)?
(never / once / twice / more than twice)

- working with others on an assignment when asked for individual work.
- copying a few sentences from an internet source without properly citing it.
- turning in work that I have partially copied from another person.
- turning in an assignment that I have partially copied from assignments I previously submitted.
- paraphrasing material from a written source without citing it.
- receiving unpermitted help from someone on an assignment.
- falsifying information on a bibliography.
- turning in a paper found/purchased on the internet as my own.
- submitting a paper someone else wrote for me as my own.

Please rate the following statements.
(Strongly disagree – 1, Disagree – 2, Neutral – 3, Agree – 4, Strongly agree – 5)

- Plagiarism is a serious offense.
- It would be morally wrong for me to cheat on an exam.
- Cheating is okay if everyone else seems to be cheating.
- Plagiarism is a moral issue.
- Plagiarism is a problem at FSU that needs to be addressed.
- I am aware of the consequences in regards to plagiarism.
- I have read FSU's Academic Honor Policy.
- FSU promotes academic integrity in every way possible.
- Cheating on exams goes against my moral principles.
- Cheating is okay if a friend asked me to help him/her cheat.
- I would face serious consequences if I were caught plagiarizing.
- I am familiar with the content of FSU's Academic Honor Policy.

Are you aware of the following?
1. software or online services that detect plagiarism (anti-plagiarism tools) exist. (Yes / No)
2. anti-plagiarism tools are currently available to FSU instructors. (Yes / No)
3. Some FSU instructors currently use plagiarism detection tools. (Yes / No)

Have you:
1. taken at least one course that has used an anti-plagiarism tool? **How many?**
2. had any instructors who talked about plagiarism and how to avoid it in class? **How many?**

(None,   1,   2,   3,   4,   5 or more.)

Anti-plagiarism tools (APT's) are commercial online services that check various sources including student paper databases to detect plagiarized papers. Currently, FSU has two successful commercial APT's available for use by the FSU faculty.

Please rate the following statements.
(Not applicable – 0, Strongly disagree – 1, Disagree – 2, Neutral – 3, Agree – 4, Strongly agree – 5)
- I support the use of APT's for undergraduates.
- I am concerned about writing due to APT's.
- Using APT's pose no risk to honest students.
- I am worried that I could get caught
- I feel offended by the use of APT's because it feels like I am being suspected of plagiarizing.
- I believe that trust between student and instructor diminishes as a result of using APT's.
- No APT's can detect all cases of plagiarism.
- APT's are deterrent to plagiarism.
- APT's are intimidating to me.
- I understand how APT's work.
- I feel uncomfortable with APT's because they may wrongfully accuse me of plagiarism.
- My experience with APT's has been a positive one.
- Overall, it seems that APT's are reliable tools.

After I learned my instructor was using an APT,
- I still plagiarized.
- I became more aware of plagiarism.
- I decided not to plagiarize.
- I tried to find out how to avoid committing plagiarism.
- I tried to find out how the system works.

Please rate the following statements.
- I would prefer to get more guidance about what plagiarism is.
- I feel confident about quoting other people's work correctly.
- My attitude towards plagiarism has changed after encountering APT's.
- I tried to learn how I should reference something correctly because I experienced an APT.
- I have used a specific technique to attempt to "trick" the tool.

(ALTERNATIVE sections for those who have never experienced APT's)
Anti-plagiarism tools (APT's) are commercial online services that check various sources including student paper databases to detect plagiarized papers. Such tools compare submitted text with millions of papers in various databases and billions of web pages to identify potential plagiarized text. A report (called originality report) is generated for each submitted paper. The report presents overall matching percentage, the submitted text with potentially plagiarized portions highlighted and original sources for further investigation. Currently, FSU has two successful commercial APT's available for use by the FSU faculty.

Please rate the following statements.
(Strongly disagree – 1, Disagree – 2, Neutral – 3, Agree – 4, Strongly agree – 5)

- I would support the use of APT's at FSU.
- I would be concerned about writing due to APT's.
- Using APT's would pose no risk to honest students.
- I would be worried that I could get caught.
- I would feel offended by the use APT's because it would feel like I was being suspected of plagiarizing.
- I believe that trust between student and instructor would diminish as a result of using APT's.
- No APT's could detect all cases of plagiarism.
- Using an APT's would be a deterrent to plagiarism.
- APT's would be intimidating to me.
- I would feel uncomfortable with APT's because they can wrongfully accuse me of plagiarism.

Please rate the following statements.
(Strongly disagree – 1, Disagree – 2, Neutral – 3, Agree – 4, Strongly agree – 5)

If I learned my instructor was using an APT,
- I would still plagiarize.
- I would become more aware of plagiarism.
- I would decide not to plagiarize.
- I would try to find out how to avoid committing plagiarism.
- I would try to find out how the system works.

Please rate the following statements.
If I experienced APT's for a while,
- I would prefer to get more guidance about what plagiarism is.
- I would feel confident about quoting other people's works correctly after learning about plagiarism and academic integrity.
- My attitude towards plagiarism would change.
- I would try to learn how I should reference something correctly.
- I would try to find specific techniques that could "trick" the tool.

Demographic Information

- What is your age: ___

- What is your gender?
    - o Male
    - o Female

- What is your race?
    - o African American/Black
    - o Asian
    - o Caucasian/White
    - o Hispanic
    - o Multi-racial
    - o Native American/American Indian
    - o I prefer not to answer
    - o Other:

- What is your major?
    - o Major list.

- What is your year in school
    - o Freshman
    - o Sophomore
    - o Junior
    - o Senior
    - o Graduate
    - o Other

- What is your overall cumulative GPA?
    - o 1.99 or less
    - o 2.0 – 2.49
    - o 2.5 – 2.99
    - o 3.0 – 3.49
    - o 3.5 – 4.0

Do teachers enrolled in an online Science course learn more when participating in discussion forums?

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Abstract

This study examined the impact of discussion forum groups on learning, both actual and perceived, course satisfaction, and sense of community between two groups participating in an identical online professional development Science course. Over 140 teachers were randomly assigned to either a discussion forum course or a non-discussion forum course (control). Between the two groups, results from this study show a significant difference in the sense of community and perceived learning of water conservation strategies. However, the results also find no significant difference in actual learning, course satisfaction, or perceived learning of Arizona geography and Arizona water systems. This paper provides a theoretical background of the use of discussion forums in online courses, elaborates on the participant pool and findings, and describes implications for future research.

Introduction

Professional development is an integral part of a teacher's training process. However, many professional opportunities fail because they are a "one-shot, one-size fits all" approach, which doesn't allow participants the time to practice or implement what they learn (Lock, 2006). The professional development sessions are either squeezed into a short time window before school or directly after school, when teachers have already completed a full day of work. Additionally, with lesson planning, conferences, and other professional duties, time is limited for teachers to explore what they have learned after they attend the professional development. Taking part in an online professional development course allows the teacher to participate during a time that is convenient for them, allowing access to the course materials at any time (Gonzalez & Morales, 2001). However, low completion rates of online courses have led many organizations to add a social interaction element that, if done correctly, can help provide a more authentic experience (Githens, 2007).

There have been numerous studies that have yielded two conclusions about online learning versus face-to-face learning: 1) online learning can be just as effective and 2) the lack of face-to-face contact does not negatively impact learning (Moore & Kearsley, 2005). But is there a difference in learning if two groups complete the same online course in which one group participates in a discussion forum while the other group does not? The goal of this study was to answer this question by comparing scores on a pre- and post-assessments as well as written assignments. Additionally, results from a course evaluation will help compare the learner's feelings of his/her sense of community in his/her course and to examine if this data has any impact on the assessment results.

Discussion forums and learning

Discussion forums are a typical component of online courses that provide participants with the ability to interact socially and academically with other distance learners in the course. Picciano (Piciano, 2002 as stated in Moore & Kearsley, 2005) studied the relationship between the amount of social interaction and the overall performance in an online course. He concluded that students who participated at a higher level typically scored better on written assignments but that there were no differences in how they performed on objective tests. However, if one were to categorize discussion forums as a form of online collaboration, one study has revealed that collaborative learning does not always lead to the desired outcomes of increased learning (Du, Zhang, Olinzock, & Adams, 2008).

Social interaction in discussion forums is hypothesized to provide a foundation for learning, meaning that the more the participants feel there is sense of social interaction, the greater the effort and the learning. Additionally, the critical thinking involved in discussion forum use is seen as directly related to learning (Wise, Chang, Duffy, & Del Valle, 2004). Mitchem (2008) states:

> The most valued aspects of online discussion groups are the flexibility and the convenience of asynchronous participation, and inclusion of diverse participants and perspectives from multiple locations.

Githens (2007) offers five reasons why people value online courses that include discussion forums. First, participants value reading experiences from other participants. Second, participants value the socialization with others in the field. Third, participants often provide complex and contradictory perspectives. Fourth, participants who do not engage in discussion forums are often still engaged with the forums. Fifth, learners feel online discussion forums are an "intellectually safe" place to post comments.

While social interaction may lead to more participation in discussion forums, the research is not clear as to the impact they have on learning, even though the assumption is that this interaction is a critical part to the learning experience (Dennen, 2008). Caspi and Blau (2008) suggest that it may only be a "socioemotional" source of perceived learning and that cognitive learning is unaffected.

Method

Participants

This study included 142 K-12 teachers (13 male, 129 female) from various locations throughout a state in the southwestern United States. The teachers were recruited through an advertisement posted within IDEAL, the state's educator portal. Any teacher who was interested in participating in the course and research study was exempt from paying the $50 course registration fee. Of the 142 participants, 74 participated in the intervention group and 68 participants were in the control group. Although the course was designed for intermediate level (grades 4-6), it was available to all teachers listed in the portal's database with the distribution including eight primary teachers, 58 intermediate teachers, 33 middle school teachers, and 43 high school teachers. The course was offered over a four-week period in the summer of 2009.

Course Design

The online Science course was developed in the SAKAI learning management system. The course layout included integrating materials taken from a pre-established curriculum used in face-to-face trainings. Digital videos and images were embedded in the learning management system to supplement the curriculum. Prior to the start of the study, a pilot study was conducted to test the course materials and data instruments.

Research Design and Instrumentation

This quasi-experimental study used comparative methods to analyze 1) learning between pre- and post-assessment scores, 2) scores on a culminating project, and 3) responses to a course evaluation. Each of the instruments below was tested in a pilot study conducted prior to the start of this study.

First, in order to analyze learning between groups, the participants were given a 25-question multiple-choice pre-assessment (0_1) of the course content, then randomly assigned to either the intervention or control group. Each group received identical content with the intervention group participating in discussion forum assignments (X). At the conclusion of the course, each participant was then asked to complete a post-assessment (0_2) that was identical to the pre-assessment.

Next, each participant was required to complete a final project at the conclusion of the course (X). The projects were scored using a rubric by two course facilitators. The scores on the final projects were compared between the intervention and control groups (0_1).

Finally, each participant was asked to submit a course evaluation to give their overall satisfaction with the course, their perceived learning, and their perceived sense of community at the conclusion of the course (X). The ratings of these areas were compared between groups (0_1).

Procedure

The teachers registered for the Arizona Water Story online course through IDEAL, Arizona educator portal. Initially, 176 teachers registered and started the course. Due to the high number of participants and enrollment limitations, six total sections were created: three intervention sections (discussion forum) and three control sections (no discussion forum). The participants were randomly assigned to one of the six sections using an online random generator.

Once the participants were assigned a section, each individual completed a 25 multiple-choice pre-assessment of the course information to determine a baseline set of data. At the conclusion of the course, an identical post-assessment would be administered to compare with the pre-assessment results to determine if learning occurred during the course.

Each section of the course received identical information and materials during the course. Each group was also expected to complete a post-assessment and final project as part of the final evaluation. The only difference between the two groups was that intervention group participated in discussion forum activities.

The four-week online course was self-paced, meaning that participants could work at their own pace to complete the post-assessment and final project by the end of the course, and divided into five units: 1) Introduction, 2) Arizona Geography and Water Sources, 3) The Hydrologic Cycle, 4) The Arizona Water Story, and 5) Arizona Water Use Today. However, the intervention group had five discussion forum assignments that were due at the end of each week. Each discussion forum assignment required the participants to individually respond to a prompt related to one of the course units. Additionally, the participants in the intervention group were asked to reply to other group members' posts.

At the conclusion of the course, all participants were required to complete the post-assessment and final project that would be evaluated and used to assess their understanding of the content and pedagogy. The participants were then asked to complete and evaluation of the online course.

Results

Full Intervention Effectiveness

The effectiveness of the intervention on participants completing the course was determined by comparing scores on pre- and post-assessment scores and final project scores for both the intervention and control groups.

Learning results on the pre- and post-assessment. A one-way analysis of variance (ANOVA) was conducted to evaluate the differences between the intervention and control groups on the pre- and post-assessment. The independent variable, group assignment, included two levels: 1) discussion forum and 2) no discussion forum. The dependent variable was the change in scores between the pre- and post-assessment. The ANOVA for the main effect, group assignment, was not significant: $F(1,140) = .031$, $p=.861$. The graph (Figure 1) shows the average change from pre- and post-assessment for both groups.

Learning results on the final projects. Next, a one-way analysis of variance (ANOVA) was conducted to evaluate the differences between the intervention and control groups on the final project. The independent variable, group assignment, included two levels: 1) discussion forum and 2) no discussion forum. The dependent variable was the score on the final project. The ANOVA for the main effect, group assignment, was again not significant: $F(1,140) = .629$, $p=.428$. The graph (Figure 1) shows the average score on the final project for both groups.
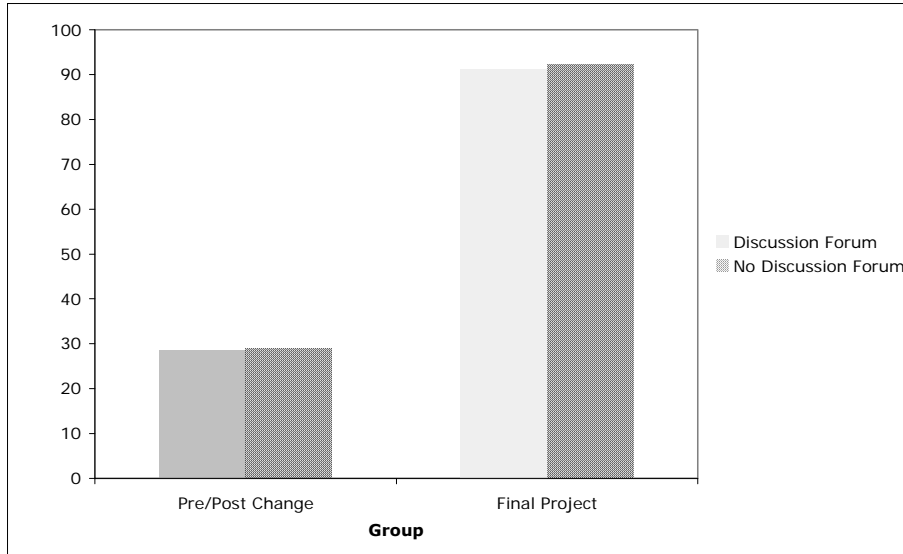
Figure 1. Bar graph displaying assessment scores by group

Satisfaction and Perceived Learning

All of the participants who initially registered for the course were asked to complete a course evaluation at the course's conclusion. Of the 176 participants who registered, 146 of those submitted the evaluation (72 from the intervention and 74 from the control group). The survey asked participants to rate their satisfaction with the course, their perceived learning, and their perceived sense of community during the course using a 5-point Likert-scale (1: strongly agree, 2: agree, 3: neither agree nor disagree, 4: disagree, and 5: strongly disagree). Example questions include: "I learned new ways to conserve water from the Arizona Water Story online course" and "I felt a sense of community in this online course".

Overall course satisfaction. The average course satisfaction for the intervention group was 1.41 out of five while the control group average was 1.38 out of five. A one-way analysis of variance (ANOVA) was conducted to evaluate the differences between the intervention and control groups on overall satisfaction of the course. The independent variable, group assignment, included two levels: 1) discussion forum and 2) no discussion forum. The dependent variable was average rating on overall satisfaction. The ANOVA for the main effect, group assignment, was again not significant: $F(1,142) = .041$, $p=.839$.

Perceived learning. A one-way analysis of variance (ANOVA) was conducted to evaluate the differences between the intervention and control groups on perceived learning of the course. The independent variable, group assignment, included two levels: 1) discussion forum and 2) no discussion forum. The dependent variable was average rating on three different areas of perceived learning: 1) Arizona geography, 2) The Arizona Water System, and 3) Water conservation strategies. The ANOVA for the main effect, group assignment, was not significant for either learned Arizona geography or Arizona water systems: $F(1,143) = 1.253$, $p=.265$ and $F(1,143) = .001$, $p=.980$, respectively. However, the ANOVA for the main effect, group assignment, for water conservation strategies, was significant: $F(1,143) = 4.224$, $p=.042$.

Sense of community. Lastly, a one-way analysis of variance (ANOVA) was conducted to evaluate the differences between the intervention and control groups on sense of community in the course. The independent variable, group assignment, included two levels: 1) discussion forum and 2) no discussion forum. The dependent variable was average rating a sense of community question taken from the course evaluation. The ANOVA for the main effect, group assignment, was significant: $F(1,143) = 29.950$, $p<.001$.

Table 1.
Course evaluation scores

Questions	DF	No DF
Overall, I am pleased with this online experience.	1.41	1.38
I learned about Arizona geography from this online course.	1.34	1.44
I learned about the Arizona water system from this online course.	1.28	1.28
I learned new ways to conserve water from this online course.	1.49	1.76
I felt a sense of community in this online course.	2.24	3.19

All scores are out of 5 with 1=strongly agree and 5=strongly disagree

Dropouts. The overall completion rate for the online course was 82% (142 of 174). The group that participated in discussion forums had a completion rate of 86% (74 of 86) while the group that did not participate in discussion forums had a completion rate of 77% (68 of 88). An anonymous survey was distributed to these participants so that they could provide feedback as to why they were unable to complete the course. Of the 32 dropouts, 14 responded to the survey. The largest contributor to not finishing the course was previous time commitments, as shown in Table 2.

Table 2.
Reasons for not completing the course

Reason	Number
Previous time commitments.	9
Content was not appropriate to my grade level.	0
Content was not interesting to me.	0
The course was too difficult to navigate.	1
The course objectives were unclear.	0
The course assignments were not relevant to my teaching position.	2
I wanted to participate in discussion forums but was not assigned to that group.	2
I did not want to participate in discussion forums but was assigned to that group.	0
I did not receive help when I asked for it.	0
Would you take the course if it were offered again?	11

N=14 dropouts responded to the survey

Discussion

The generalization that can be discerned from the pre- and post-assessment data collected in this study indicates that participating in an online discussion forum does not lead to higher gain in achievement scores between a pre- and post-assessment. Complimentary to this information is lack of difference in perceived learning between the two groups on Arizona geography and the Arizona water system, as shown in the course evaluation. However, there was a significant ($p<.05$) difference in perceived learning between the two groups when the participants were asked about water conservation strategies. One reason that the data shows no difference for a majority of the results is because all participants voluntarily enrolled in the online course. Lim and Kim's (2003) study shows that as motivation increases perceived learning also increases. One can then infer that all participants were inspired to study the information and therefore all participants were especially diligent in learning the information. Additionally, Lim and Kim's study concluded that female participants show a significantly higher degree of learning than male participants when motivation levels increase. This is important for the current study because of the larger percentage of female participants in the study (91%).

The results on the final project scores that evaluated pedagogical knowledge of teaching the content were also not affected by placement in either group. The discussion forum prompts were designed to allow participants to post ideas on how they would teach the main course objectives in their classrooms. One would assume that discussing pedagogical strategies with other classmates would help the participants learn new strategies for teaching the main course objectives. However, the results of the study do not substantiate this claim. Dennen (2008) mentions that while discussions are an important part of the online experience, the "act of writing" is not the only factor that contributes to learning.

Both groups responded that overall, they were pleased with the course. However, the group that participated in discussion forums reported a significantly higher sense of community (p<.001) than the group who did not participate in the discussion forum. An inference that can be made from this is that the participants in the discussion forum group were able to share thoughts and ideas with one another similar to the way participants would in a traditional setting. Dennen (2008) concurs that while discussions are considered a necessary component to online courses, they are typically added for no other reason that to provide a connection between participants.

It is also important to note that significantly more participants from the control group dropped out than did in the intervention group, 20 and 12 respectively. According to the survey, the major reason for participants not completing the course was a lack of time. However, since only 14 of the 32 dropouts responded to the survey, it is difficult to determine if this is the main reason for not completing the course.

Further research on online discussion forums and learning is important to determine if the data collected in this study can be generalized across other populations. Additionally, the there is a need for more rigorous and objective standards in terms of grading discussion forums. Finally, although the course facilitator was not an integral part of this study, studies need to be conducted to determine if an instructor's role in the discussion forum increases learning, and if so, how that role should be clearly defined.

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A Systems Analysis & Design for an
Out of School Suspension Distance Education System

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Abstract

This article will document the design of a distance education Out of School Suspension Program and will map out the purpose of learning organizations (systems approach). It discusses primary objectives, inputs, processes and outputs of the systems. In addition, the article focuses on supported learning theories and explains how mega, macro, and micro communities are integrated into the system.

In addition, it describes the system in its entirety, including elements and relationships, interdependency, vision and learning paths. Following the description of the system is the mega, macro and micro communities' makeup.

Finally, an assessment is presented of the system's particular blueprint and efficacy, including the impact of special education on the school and society.

Introduction

Anyone visiting our schools of today may notice that frequently, special education students demonstrated continuous disruptive behaviors. As well as causing continuous disruptive behavior, visitors may notice acts of violence, such as a student throwing a chair at another student. Under both the No Child Left Behind Act and the Individuals with Disabilities Education Act and

> According to federal and state regulations, the removal of a student for more than ten (10) days because of a violation of a code of student conduct is regarded as a change in educational placement. Because of this change in placement, the action of removal triggers the need for an IEP meeting where the IEP team must determine whether the behavior(s) that led to the suspension is related to or is because of the student's disability. Additionally, the team must meet to consider whether the conduct in question was because of some type of failure by the LEA to implement the IEP of the student. If so, then the IEP team must either 1) conduct a FBA (functional behavioral assessment) or implement a BIP (behavioral intervention plan) for the child; or 2) if a BIP is already in place, review and revise it to address the behavior AND reinstate the child to the educational placement from which the child was removed. (34 C.F.R. §300.530(e)) (Gibson, 2007, N.P. ¶ 7)

This article will introduce a distance education system, titled Virtual Out of School Suspension Program, designed to deliver a professional learning environment within a K-12 public school system. Distance education is on the rise and rapidly developing approaches to deliver instruction across the world. (Smaldino, Lowther & Russell, 2008). The system is designed to afford the school's principal the opportunity to send students home for a period longer than ten days within a flexible learning environment, as an extension of a low socio-economic elementary school.

Methodology

Setting

The writer is a student at a large non-profit university in the Southeastern United States with a nationally recognized program providing leadership and scholarship in the systematic application of instructional technology to the research-based, best-practices delivery of instruction in virtual schools, higher education distance education, and e-learning in business, industry, and government (Nova, 2009).

One of the mandated courses for doctoral students with a concentration in instructional technology distance education is a 3-credit course in system analysis and design. This course provided the writer with skills for the analysis and design of an educational and instructional system. The key focus was on critical elements in the structure of a distance education delivery system; analysis of educational and instructional systems; relationships of subsystems within an educational system; design of an educational system; design of instructional systems; and evaluation and continuous improvement of a system.

The writer analyzed a low socio economic status elementary school located in Southeastern United States, identified steps in designing a system, created a valid distance education system and identified subsystems that may impact the student`s performance within the system. Since the writer worked closely with special education students` she chose to develop a virtual out of school suspension program.

Purpose

The purpose of this article is to introduce to the reader a distance education system, titled Virtual Out of School Suspension Program (V.O.S.S.P.) that will enable students to continue their coursework while not physically in attendance at their current school.

The writer believes that requirements in the current No Child Left Behind (NCLB) law may have affected student`s safety. Currently, NCLB asks the individual states and schools to develop standards for safety, apply research-based programs, gather and evaluate data, and improve on safety problems identified by schools and states in order to make "Adequate Yearly Progress" (U.S. Department of Education Website, 2002, pg 31).

According to the U.S. Department of Education Website's the U.S. Department of Education is required to conduct an evaluation on the impact of schools funded under Safe and Drug Free Schools (SDFS). It states that programs must demonstrate a reduction in school violence. Both the NCLB and the Individuals with Disabilities Education Act (IDEA) (2004) question the long existing practice of school suspensions. Under NCLB, it is difficult to place special education students in out of school suspension for any time greater than ten days per school year. Furthermore, a concern is that out of school suspension does not allow students to continue with their necessary coursework. Thus, the writer has designed a distance education, Out of School Suspension Program which enables students the opportunity to continue their education while fulfilling the requirements of their suspension and allowing school administrators' the chance to assign out of school suspensions for a period longer than the maximum ten days. In the near future, an actual operation within our schools would lead to a calmer, safer, and more productive school climate.

The Development of the Virtual Out of School Suspension Program

Resources

The budget of the V.O.S.S.P., supported through federal, state, and local, funds, based on a forecasted plan for the program and created each fiscal year. The budget is based on predicted student enrollment. The budget will incorporate faculty trainings, salaries, distance education materials, a local area network (LAN), laptops, and other miscellaneous technological items.

Community

The V. O. S. S. P`s office is housed in a low socio-economic urban community comprised of government subsidized housing and private homes located in the Southeastern United States.

History

According to Gibson (2007), "A limited amount of recourse is available to the student through federal, state and district regulations" (Gibson, 2007). Thus, after a special education student is removed for more than ten days from school they are regarded as a change of placement. This action triggers the need for an Individualized Education Plan (IEP) meeting where the IEP team determines whether the behaviors that led to the suspension was a result of the student`s disability. Then, the team decides if this behavior was due to improper implementation of the IEP. If so, the IEP team must conduct a functional behavioral assessment and implement a behavior intervention plan (BIP). If the student already has a behavior intervention plan. the need is to review and revise it and reinstate the child to their home school.

Unfortunately, the schools climate survey report for the 2007-08 administration form at the district level states 35% of the teachers at the low socio economic elementary school felt that adequate disciplinary measures are not being used to deal with disruptive behavior (district, 2008, P. 4, ¶ 1).

So, the questions are, would a virtual out of school suspension program afford the principal a viable alternative to having students involved in disruptive behaviors at their school? Would V. O. S. S. P. enable students to continue their education and learn conflict resolution skills while in suspension? Would a program such as this be valuable to schools across America?

Description of the System

Elements and Relationships

The V.O.S.S.P. design is made up of administrative leadership, technical, and curriculum support teams. The administrative team will decide which students will attend the V.O.S.S.P and for how long. The leadership team will provide programs that empower teachers and students with technology. Professional development and distance learning opportunities highlight the V. O. S. S. P. and will set the stage for teachers, students, and administrators to create, experience, and advance 21st century learning. The technical support team provides students, teachers, administrators and parents with the tools they need to integrate technology into their daily work through reliable technology resources, such as laptops, internet connections. The learning and teaching aspect will include information skills standards and curriculum, instructional models, program integration with flexible scheduling, assessment rubrics, information skills lesson plans, subject area lesson plans, technology that will benefit all stakeholders. The curriculum support and assessment team will work to ensure appropriate online curriculum is accessible and used to assure the students' goals and benchmarks are met.

There will be a continuous flow of equal interdependence between the inputs and outputs of the communities (mega, macro, micro). The V.O.S.S.P will operate under the district systems policies and procedures. The operating budget of the virtual out of school suspension program will be dependent on the district and the Elementary school`s funding as well as funding obtained from mini grants written. Interactions between the Elementary and the V.O.S.S.P will be ongoing and expected to occur at least weekly. The decisive output of the Macro Community is the proposed V. O. S. S. P. The Micro Communities outputs (resources) flow into the Macro Community. Inputs from the Mega Community (school district) will be outputs for the Macro Community. All levels are interdependent and evidenced through open boundaries. Communications and resources will allow the system to function efficiently.

Vision

The vision of the V. O. O. S. P. is to educate special education students who disrupt the traditional school classroom. It provides a focused learning environment and a thorough education that meets The student`s educational state standards.

Learning Paths

The V.O.S.S.P. is designed to improve a student`s education through online instruction while incorporating diversified instruction, individual learning styles and personalized instruction. The learning paths are synchronous, occurring simultaneously with A. B. Elementary` students learning paths. The curriculum and materials, supplied by the school district and carried out in an "Elluminate" online setting. The Elluminate live software enables instructors and students to interact and collaborate in real time to add synchronous content to asynchronous distance learning or combine blended online/onsite learning activities. The designers of Elluminate believe it will engage teachers to promote active learning and improve student performance.

The curriculum support team will refer to the state and district instructional pacing guide, broken down into nine-week segments. The curriculum support team, home school and the district will devise a calendar, which contains weekly or bi-weekly benchmarks, to assess student mastery and determine which skills and content need to be reassessed.

The V. O. S. S. P. will use a pacing plan and the student`s most recent school work to drive their instruction. Additional curriculum in the area of conflict resolution will be added to the student`s current curriculum and must be mastered before the student returns to their home school. Faculty development, instructional design, and student success rates will maintain ongoing data to document success and/or areas in need of improvement. Ongoing professional development trainings and revisions will occur throughout the school year. Student`s assessments will be ongoing and computer generated scores will be entered in a database each Friday. Student's ability and completion of assigned (weekly) curriculum will be determined through assessments. Generated synchronous with the home school systems grading periods is a nine- week progress report.

Supported Learning Theory

The three theories most frequently encompassed are Bruner`s constructionist Skinner`s behavior conditioning theories, Piaget and Vgotsky. The constructivist theory is used foremost in supporting the students' learning. Bruner's constructivist theory is an overall framework for the V. O. S. S. P. `s instruction because it is based upon the study of cognition. Much of Bruner`s theory is linked to child development research (including Piaget & Vgotsky). This new distance education program will utilize Bruner`s learning theories to individualize student`s instruction and assure success and ease of success in returning to A. B. Elementary.

Another learning theory applied in the proposed V. O. S. S. P. is often observed in classrooms for students with emotional/behavioral disabilities. This learning theory, known as behavioral or operant conditioning (learning) occurs when a response to a stimulus is reinforced (Skinner, 1938). Essentially, operant conditioning is a simple reaction system: If a reward or reinforcement trails the response to an incentive, then the response becomes more likely in the future. The students will be awarded daily points and receive a "prize" is received after a total of 50 points is achieved. Prizes will consist of one choice between a shortened assignment (student doing even number problems only), throw away one low grade, or a coupon requesting parents/guardian take student to lunch (value of $5.00 or less).

Communities

"While no level of the IEM (Mega, Macro, Micro, Process, or Input) is more important than the others, it is critical that we begin with the Mega level when we plan for educational success by defining outcomes as the results at that level" (Kaufman, et al, 2001, p. 59). Successful planning within the Mega community (state, district, and communities) which is considered an "open system" will ensure a focus on future-oriented initiatives. First, there is the immediate community consisting of students in grades K-5, parents, faculty, administrators, and support staff. Next, are MDCPS and federal guidelines concerning school suspensions? Last, is The Florida Department of Education and the United States Department of Education who have the ability to revise IDEA and oversee school`s compliance with IDEA`s procedures.

The mega level (Figure 1) consists of the state, district, society (communities) and policies/procedures involved in the development of the V. O.S.S.P. This system shares missions and visions with the Macro and Micro communities. It consists of inputs and outputs that nourish each other. The output of the mega level will feed as an input to the macro level (V. O. S. S. P.).

Kaufman, et al (2001) explain, "if we begin at the Mega level and identify the outcomes we are committed to achieving, then we can "roll-down' from Mega to define the data rather than relying on conjecture" (p.59, ¶2). They also explain how stakeholders (internal and external) of an educational institution want students to be successful in school and society. Thus, the discernable outcome within the Mega systems community will be to have each student believe in his/her ability to achieve and become a future leader.

At the Mega level, the inputs consist of revenue awarded from the state, U.S. Department of Education, and private grants. Inputs also include the laws, regulations and policies set by these agencies and societal needs. Another input would be community partners and their assistance with coursework planning.

Processes will include the systems needs, policy implementation, procedures, and generating jobs.

Last, come the outputs that will lead into the Macro Community inputs. The outputs consist of the budget, education, employment and necessary technologies to meet the state`s requirements.

The boundaries would be the open lines of communication between all the communities (Mega, Macro, and Micro). Emails, and phone conversations will be ongoing and Elluminate sessions will enhance the open line of communications. Elluminate`s voice system will assure instructors and administrators that it is the actual student participating in the assignments.

According to Kauffman, et al (2001), "Effective Macro planning flows from Mega planning and is derived from the results it defines"(p.91). The Macro level represents the V. O. S. S. P., which flows from the Mega community. Lauritsen (2001), Sampson, Raudenbush, & Earls (1997) agree, communities are complex systems that can be explained in numerous ways. Thus, the largest structure solely devoted to the Macro community is the V. O. S. S. P. and all of its components.

The V. O. S. S. P. is comprised of one classroom, within a low socio economic elementary school. The virtual learning is web based using a LAN network, Website, Elluminate, online resources, and emails. Students participating in the V. O. S. S. P. are issued a lap top computer for use while participating in the program. The laptop will be designed to have limited accessibility to the internet which directs the students to the V. O. S. S. P. Students who choose not to check out a laptop due to liability or other issues may access the V. O. S. S. P through their local library`s computer systems or their own personal home computers/ laptops. The student`s special education needs such as Speech, Language, Physical Therapy and/or Occupational Therapy will be accessible to the

student via their home school. However, it will be the parent's responsibility to provide transportation, possibly, requiring an interim IEP to clearly state the change in transportation.

The V. O. S.S. P. department`s faculty (instructional and non-instructional) are under the supervision of the three program support (curriculum, technical and leadership) teams who are guided by the school's assistant principal. The assistant principal is under the authority of the Principal.

There is a constant flow of communication between the communities. The Mega Community will interpret federal laws and establish the procedures for the Micro Community to operate within compliance issues. The Micro Community will be responsible for implementing these policies and procedures which in turn will assure the student`s IEP and benchmarks are being met.

The Macro level`s inputs would pertain to curriculum, technical and leadership team, faculty who will be teaching and the systems policies/procedures. Processes would be the purchasing and implementation of curriculum, reviewing goals, objectives, assessments, and training development necessary based on staff, parent, and student inputs. Outputs include resources needed, modification of programs and staff development and workshops.

The boundaries would be the open lines of communication between all the communities through emails, phone conversations, and Elluminate sessions. This will enhance the open line of communications.

Consider next, the micro communities whose direct stakeholders would be the administrators, parents, teachers, community groups, faculty, and students. The indirect stakeholders consist of the Parent Teacher Association (PTA), Excellence School Advisory Committee (EESAC), and community leaders. The role of the stakeholders (indirect and direct) is that of active participants and reviewers.

The school is under the supervision of the principal and assistant principal which support the leadership team. The leadership team gives input and helps make decisions concerning recommendations for school improvement. The three support persons (curriculum, technical, and leadership) for V. O. S. S. P. are responsible for program functions. The Micro level is the "workers" (teachers), for example, producing lesson plans that equal a product.

Communications flow between the communities. The micro level inputs would consist of instructional technologies, course policies, and procedures. The process would consist of planning, evaluating needs, and learning styles. This process also encourages learning and provides resources and the student transfer of knowledge. The outputs would be to have student gains, meet the NCLB and the return of students to A. B. Elementary.

Evidenced through daily emails is the open communications between communities, specifically the Micro, Macro Communities, and weekly staffing.

Assessment Systems

Since the V. O. S. S. P. is considered a temporary placement assessment will be designed similar but on a smaller scale as A. B. Elementary and its traditional assessments. Student participation in the Florida Comprehensive Assessment Test, biweekly assessments, student, teacher, and parent surveys assures quality for the macro community is being achieved.

Quantitative and qualitative data, used to corroborate the V. O. S. S. P. Administrators and the three support positions, develop an overall program evaluation for the instructors to implement. Thus, ensuring that reliable progress is made throughout the students time spent in the V. O. S. S. P. Administrators review all surveys and make suggestions for program and/or teacher improvements. The assessments will demonstrate the need for the V. O. S. S. P.

The Virtual Out of School Suspension Program
View of Macro Community in Relation to Mega and Micro Communities

State Level

Administration

District Level

Curriculum Support Team

All the stakeholders within the entire school systems community

Mega → **Macro** → **Micro**

Leadership Team

Communities

Teachers

SPED Department

Students

Parents
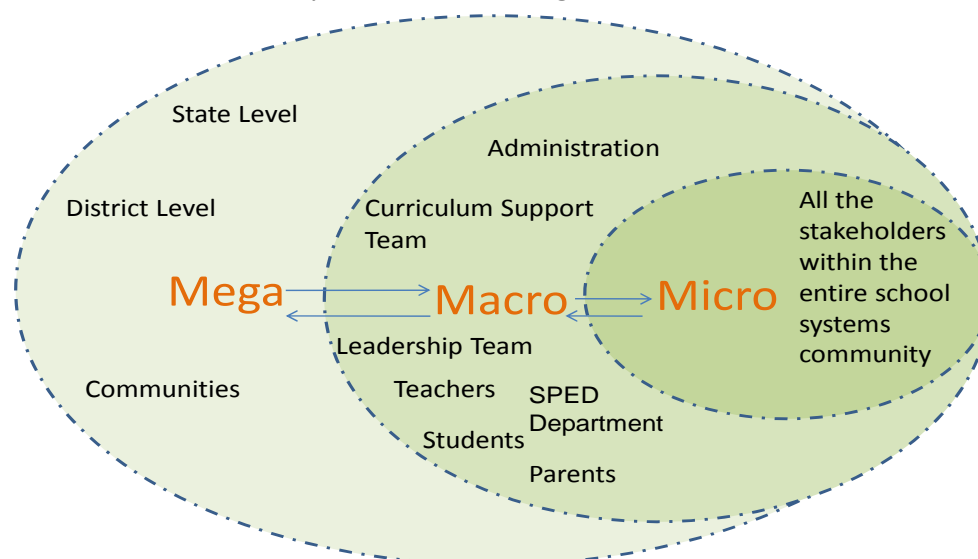
Educational System Graphic_Doris K. Koenig

Conclusion

The student`s continuous disruptive behaviors in their school seems to be a problem prevalent today. The evident frustration of the principal while required to follow the No Child Left Behind Act demonstrates the need to create an alternative to traditional Out of School Suspension programs. The Virtual Out of School Suspension Program was developed to fill such a need.

The virtual out of school suspension program, based on a systematic process, constructs knowledge through building on what they know in an attempt to improve instruction. It focuses on the student and uses theories (Bruner, Piaget & Vgotsky) to determine which is appropriate for learning, and uses that framework to drive their instructional decisions. The Mega, Macro and Micro communities are interdependent with each others' systems inputs leading to another`s outputs and vice versa. They conduct ongoing assessments. Surveys from students, teachers, and parents highlight necessary changes in the system. While attending the V. O. S. S. P, the disruptive student receives conflict resolution skills, participates in a professional learning environment, and returns to school with no gaps in education.

In conclusion, working as a team, the elementary school, special education department and the virtual out of school suspension program create a level of success for the stakeholders; students, parents, guardians, faculty, administration and the community.

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An Analysis of Educational Technology Related Doctoral Programs in the United States

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Descriptors: Educational Technology; Doctoral Programs

Abstract

This descriptive study seeks to understand the differing requirements of doctoral programs in educational technology related fields in the United States. Using a document analysis approach with five data sources, we found 59 different institutions (55 campus-based and 4 online) offered doctoral degrees with 33 different degree titles that satisfied a foundational set of curriculum criteria. Among these 59 institutions, total credit hours requirements ranged from 42 credit hours to 113 credit hours and total dissertation credit hours spanned from 1 to 45 credit hours to complete a doctoral degree. Among the nine universities who offered both Ph.D. and Ed.D. degrees, the requirements of the total credit hours were varied, but the same or higher total dissertation hours were required for the Ph.D. program than for the Ed.D. program.

Introduction

Potential graduate students face a plethora of challenges when trying to find and decide upon a doctoral studies program in educational technology. What exactly is educational technology? According to the Definition and Terminology Committee of the Association for Educational Communications and Technology (2007), "Educational technology is the study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources" (p. 1). However, the definition of the field of practice continues to evolve and change in tandem with changes in education and technology. Reiser (2007) believes that it is unlikely that professionals will ever reach a consensus through thoughts or actions on a single definition.

Coupled with the elusive definition of the field, prospective doctoral students and potential employers often are confounded by the myriad of naming conventions for higher educational programs in our field. When searching for doctoral programs, students typically find the names of educational technology, learning sciences, instructional technology, curriculum and instruction, or instructional design and technology (IDT). According to Persichitte (2007), these titles represent responses to the changes in the field, and it is perhaps impossible to separate the application of the field from the systemic changes that are intrinsic to it. Nonetheless, individuals seeking doctoral degrees in the field of educational technology face challenges.

One of the challenges is that students must try to wade through differing program and degree titles to find the curriculum within an educational technology doctoral degree program. They evaluate the core requirements as well as investigate the extent of the research curriculum and the intensity of the dissertation. One way to consider a meaningful educational technology curriculum is to place it in a professional competency-based framework, such as those offered by the International Board of Standards for Training, Performance and Instruction (IBSPTI), International Society for Performance Improvement (ISPI), the American Society for Training and Development (ASTD), and the Association for Educational Communications and Technology (AECT). Davidson-Shiver and Rasmussen (2007) suggest,

> Competencies for IDT can be used as follows: …To provide academic programs with information to develop and evaluate curriculum, courses, internships, and program requirements. To provide academic programs with a basis for program evaluation and planning. …To provide IDT academicians with a direction for forming a research agenda (p. 279).

However, they also pointed out that the lack of common titles for programs at colleges and universities make it difficult for potential students to match their goals with a specific professional competency framework. Caffarella (1999) reported that universities offered doctoral degrees with a variety of titles encompassing the field of educational technology. The titles of degrees vary from educational technology to instructional design to information and learning sciences, and there is considerable debate over which terms are more appropriate to use in

identifying the field (Carr-Chellman, 2006). For example, in a debate with Merrill about the future of the field, Wilson argued that the growth of graduate programs in the field is in both instructional design and technology, and in learning sciences (Merrill & Wilson, 2007).

Another challenge faced by those seeking advanced degrees in the field is deciding which type of degree to pursue; the Ph.D. or the Ed.D. and understanding the differences. Some institutions offer both doctoral degrees (Ph.D. – Doctor of Philosophy and Ed.D. – Doctor of Education) while most offer one or the other. In their Carnegie Initiative on the Doctorate study, Shulman, Golde, Bueschel, and Grabedian (2006) explained that the goal of the Ed.D. is to train leaders, managers, and evaluators in education as differentiated from the Ph.D., which trains researchers in the academic field. They argue that even though overlap between the degrees is expected and necessary, the distinction between the degrees has blurred, and the Ed.D. is widely considered a "Ph.D. – Lite" (p. 27).

Over the past ten years, the number of institutions offering doctoral degree programs in educational technology related fields has fluctuated. Lowenthal and Wilson (2008) evaluated the field by looking at the titles of programs and degrees, job titles, and professional organizations, concluding that the variety of different labels impact the confusion of identity in the field. Davidson-Shiver and Rasmussen (2007) claimed, "A lack of easily identified, common titles makes the field difficult to distinguish from other professions in education and training. The lack of common titles for IDT programs at college and universities makes it difficult for prospective students to match professional goals to programs." (p. 283).

The effort to define the field of educational technology is not new. Gentry (1995) wrote, "Regardless of how well this collection of interpretations of educational technology clarifies or confuses matters, it is safe to assume that some time will pass before precise meanings are accepted across the field" (p. 8). Reiser (2007) added that the definition of the field changed over the years and there are no universally accepted answers to questions about the nature of the field and its definition. Persichitte (2007) further reiterated that the lack of consensus extends to the name used to identify the field.

While there are sources to find listings of doctoral programs in educational technology and related fields, there is a lack of comprehensive studies to categorize and evaluate the requirements for those programs. This study provided an analysis of those programs and their curriculum. By taking an in-depth look at the similarities and differences among the programs, this study benefits potential doctoral students seeking appropriate doctoral degree programs that best fit their needs. It also helps current doctoral students identify potential universities with doctoral degree programs in educational technology related fields for their future employment. In addition, the study also sought to shed light on the growth in doctoral education in the field of educational technology while at the same time evaluating the focus of the programs.

The purpose of this study was to analyze the doctoral programs in educational technology related fields in the United States. The research addressed the following questions:

1. What was the growth of educational technology doctoral programs over the last 30 years?
2. How many institutions (both campus-based and online programs) offer doctoral degrees in educational technology?
3. What is the variation of doctoral program degree titles?
4. What is the range of credit hours required to earn a doctoral degree?
5. What are the varying dissertation requirements?
6. How do the requirements for the Ed.D. differ from those for the Ph.D. among universities who offer both degrees?

Method

Data Sources

A document analysis method was implemented for this study, which provided key information about the universities, their program requirements, and curricula central to addressing the research questions. By collecting data from five different data sources, a group of prospective doctoral programs at varying universities were identified, including campus-based and online programs.

The initial data source included the *Educational Media and Technology Yearbook* (Branch, 2008), which identified instructional technology related organizations and graduate programs across North America. The second source was the *Curricula Data of Degree Programs in Educational Communications and Technology*, an online database provided by the Association for Educational Communications and Technology (n.d.). This source

contained self-reported curricula data of degree programs in the educational communications and technology field offered by universities around the world. Information provided in the database included program and degree titles, degrees offered, program requirements, lists of faculty, and contact information for the programs.

In addition to these two educational technology graduate program related resources, a third data source, *GradSchools.com* (2009) was utilized. This online resource provided a search engine that allowed us to discover educational technology graduate programs from universities in the United States. A fourth data source consulted for the selection of potential programs was the online version of *The College Blue Book* (2007). This electronic resource included lists of degrees offered by universities in the United States. The online version of *The College Blue Book* provided summaries and general information including contact information, entrance requirements, and website addresses of each college and university around the country. The doctoral programs that had educational technology related titles were selected and added to the master list for further analysis. Finally, to evaluate each doctoral program more completely, we consulted a fifth data source – the university's website for each of the doctoral programs offered.

Procedures

We paired into three groups for the first step in the data gathering process, which was to identify which universities in the United States offered a Ph.D. or Ed.D. program in educational technology related fields. One team focused on the *Educational Media and Technology Yearbook*, the second team reviewed the AECT's *Curricula Data of Degree Programs in Educational Communications and Technology* database, and the third team collected data from *Gradschools.com* and *The College Blue Book*. Once collected, we combined this data into a matrix that listed all the universities offering doctoral programs in educational technology and related fields. For each listed program, we compiled program names and degree titles along with website addresses and contact information.

The goal of using multiple sources was to triangulate the program data. Once we collected the data, we compiled a master list and removed duplications to ensure accuracy. We then summarized and created an updated master university list that included 93 school names, program website addresses, degree titles, doctoral curriculum website addresses, type of degrees (Ed.D. or Ph.D.), degree completion requirements (total credit hours and dissertation hours), and contact information from all four different sources. Next, we alphabetized the university list by state.

Following this step, we divided the list so each pair of team members researched 31 universities in greater detail. For each university, we identified the website addresses of the curriculum for each program or its doctoral program handbook for later referencing and cross checking. To insure validity and accuracy of this data, we again paired up to validate the collected data. Following this step, we compiled the curriculum data for each program. At this point, we evaluated each program to determine if the curricula offered supported educational technology related programs.

To conduct this evaluation we compared the course names and curriculum requirements from five well-known educational technology related doctoral programs in the United States: Arizona State University, Florida State University, Indiana University, Pennsylvania State University, and University of Georgia (Ku, in press). We analyzed the curricula from these five universities and developed a set of curriculum criteria. The curriculum criteria included (a) foundational courses in instructional or educational technology (e.g., Introduction to Instructional Systems or Instructional Design and Technology), (b) educational practice and design courses (e.g., Instructional Media Design or Design of Distance Educational Environments), (c) cognitive learning and instructional theory courses (e.g., Theories of Learning and Instruction or Theoretical Views of Learning), (d) instructional systems research methods or research design applied to education type courses (e.g., Research in Technology, Quantitative Data Analysis, Qualitative Data Analysis, or Mixed Methods), and (e) the dissertation. We then used these criteria to evaluate and categorize the universities' curricula with respect to educational technology. We engaged in many conversations to come to a consensus regarding which universities had educational technology or closely related programs. The range of disciplines from instructional design to the trends towards learning sciences perplexed us as we assessed each individual program.

Once we created a list of potential university programs, we evaluated each program's curriculum for the required core courses and content to assess if the university's Ph.D. or Ed.D. curriculum was substantially educational technology focused. We repeated this process three times, as we developed a common understanding of the scope of the field. After a final comparison of the degree titles, course names, and curriculum requirements from the principle universities, we discussed and decided on which of the 93 universities that offered doctoral programs in educational technology related fields met the curriculum criteria and should be included in the study.

Data Analysis

In order to explore the growth of educational technology doctoral programs over the last 30 years, the records of educational technology programs offered by universities in the United States from five issues of the *Educational Media and Technology Yearbooks* (Witt, 1980; Logan, 1985; Branyan-Broadbent & Ward, 1990; Ely & Minor, 1995/1996; Branch, 2000; McClendon, 2005) were analyzed. A descriptive analysis of all degree titles (Ph.D. and Ed.D.) for both campus-based and online programs was conducted with the goal of examining the variation and frequency of the different degree titles. We used the degree titles exactly as they appeared on the universities' website for greater accuracy in the variation and frequency analysis.

Additionally, the range of credit hours required for the degree and the varying dissertation hours required were clarified by examining the specific curricula from each university. For programs using the quarter hour system, quarter credit hours were converted to semester hours assuming every three quarter hours is equivalent to two semester hours. We used the semester hour equivalents for the comparison of both course and dissertation requirements. Lastly, we compared and evaluated the total credit hour and dissertation hour requirements among ten universities that offered both Ph.D. and Ed.D. degree programs in the educational technology related fields.

Results

The Growth of the Educational Technology Doctoral Programs

According to the data regarding the growth of educational technology doctoral programs, the number of universities and institutions that offer doctoral degree programs has expanded over the past 30 years. The findings show that the number of doctoral programs in educational technology related fields fluctuated from 1980 to 2009.

A total of 42 universities offered doctoral programs in educational technology related fields in 1980, 62 in 1985, 64 in 1990, 47 in 1995, 49 in 2000, 54 in 2005, and 59 in 2009, respectively. After an initial increase of over 52% (from 42 to 64) between 1980 and 1990, the number decreased by 23% (from 64 to 49) in 2000. Then, the number of institutions offering relevant degrees rose over 20% (from 49 to 59) between 2000 and 2009.

Numbers of Institutions Offer Doctoral Degrees

The results from the study show that 59 institutions in the Unites States offer doctoral programs in educational technology and related fields in 2009. Among those institutions, 55 offer campus–based degree programs and 4 offer online degree programs in educational technology and related fields. Among the 55 campus-based degree programs, 30 institutions offer only Ph.D. degree programs, 16 institutions offer only Ed.D. degree programs, and 9 institutions offer both Ph.D. and Ed.D. degree programs. In terms of the four online degree programs, two institutions offer Ph.D. degree programs (Capella University and Walden University), one institution (University of Phoenix) offers an Ed.D. degree program, and one institution (Northcentral University) offers both Ph.D. and Ed.D. degrees in educational technology. The states with the most institutions offering educational technology related doctoral programs are Florida (6 institutions), Pennsylvania (4 institutions), Texas (4 institutions), and Virginia (4 institutions).

The Variation and Frequency of Doctoral Program Degree Titles

The results show that there are 29 different degree titles across 55 campus-based universities, resulting in 53% of the universities examined offering different degree titles in the field of study called educational technology. The three most common degree titles are Instructional Technology, Educational Technology, and Instructional Design and Technology.

Results for the four online university doctoral degree programs were also investigated and the names of the degree titles are Instructional Design for Online Learning, Educational Leadership/Educational Technology, Educational Technology and e-Learning, and Educational Technology. No common program degree titles were found among the four online educational technology doctoral degree programs reviewed. However, the title "Educational Technology" is included in three (75%) of the four titles. As a result, 33 different degree titles represented 59 campus-based and online institutions who offered doctoral degrees.

Furthermore, a keyword analysis of both campus-based and online university degree titles revealed five most commonly occurring words or word pairs. These terms by rank order are Instructional Technology, Educational Technology, Instructional Systems, Curriculum & Instruction, and Instructional Design.

The Range of Total Credit Hours Required

For the 55 campus-based universities, the total credit hours for the Ph.D. programs range from a minimum of 48 credit hours (Lehigh University and University of Northern Texas) to a maximum of 113 credit hours (Wayne

State University). For Ed.D. programs, the total credit hours range from 42 credit hours (University of Kentucky and West Virginia University) to 113 credit hours (Wayne State University). Two campus-based programs did not publish their total credit hour requirements. For the four online programs, the total credit hours range from 62 (University of Phoenix) to 89 credit hours (Walden University). Overall, the most common requirements for total credit hours ranged from 56 to 65 among 59 institutions.

The Range of Dissertation Hours Required

Dissertation hours for the Ph.D. programs range from a minimum of one credit hour (University of Hawaii at Manoa) to a maximum of 30 credit hours (University of South Florida, Kansas State University, Wayne State University, Kent State University, and Virginia Tech University) with 15 credit hours being the most common. For Ed.D. programs, dissertation hours range from 4 credit hours (Boston University) to 45 credit hours (University of Cincinnati). Six campus-based programs did not publish their requirements on dissertation hours. The range of required dissertation hours for the four online programs ranged from 11 to 30 credit hours. Overall, the most common requirements for dissertation hours ranged from 7 to 12 among 59 institutions.

Differences in Degree Requirements between Ed.D. and Ph.D.

Of the 59 institutions, 10 institutions (17%) offered both the Ph.D. and Ed.D. degrees in educational technology related programs. Nine are campus-based (University of Central Florida, University of Florida, Kansas State University, Wayne State University, Pennsylvania State University, University of North Texas, The College of William & Mary, University of Virginia, and Virginia Tech University) while one is an online-based university (Northcentral University).

However, only nine universities were compared due to unavailable data from Pennsylvania State University regarding the requirements of the total credit hour and dissertation hours. Of these nine universities, three (33%) require their Ph.D. students to complete more total credit hours than Ed.D. students. These three universities are University of North Texas (72 vs. 69), The College of William & Mary (69 vs. 48), and Virginia Tech University (96 vs. 90). In contrast, three universities (33%) require their Ed.D. students to complete more total credit hours than Ph.D. students. These three universities are University of Central Florida (108 vs. 99), Kansas State University (94 vs. 90), and University of Virginia (84 vs. 72). Another three universities (33%) require both the Ph.D. and Ed.D. students to take the same amount of total credit hours. These three universities are University of Florida (90 vs. 90), Wayne State University (113 vs. 113), and Northcentral University (51 vs. 51).

Furthermore, the comparison of dissertation hours revealed that five out of nine universities (56%) require more dissertation hours for the Ph.D. program than for the Ed.D. program. These five universities are University of Central Florida (24 vs. 21), Kansas State University (30 vs. 16), Wayne State University (30 vs. 20), The College of William & Mary (9 vs. 6), and Virginia Tech University (30 vs. 24). Four universities (44%) require the same dissertation hours for both degrees. These four universities are University of Florida (12 vs. 12), University of North Texas (12 vs. 12), University of Virginia (12 vs. 12), and Northcentral University (9 vs. 9).

Discussion

According to our findings, educational technology doctoral programs increased from 42 in 1980 to 64 in 1990. This increase parallels the development of advanced technologies in the United States after 1980. As Senese (1983) stated, the beginning of the technological revolution in 1980 affected both worlds of work and education. Technology became a significant component for improving the educational system. Many teachers and instructors were encouraged to include technology within their instruction to facilitate student learning. Teachers and instructors were required to have basic skills in technology usage. Therefore, the increasing need for combining teaching and technology in education became a major influence on the number of educational technology related programs offered from 1980 to 1990. However, the number of institutions offering educational technology doctoral degrees declined from 64 in 1990 to 49 in 2000. This phenomenon may have paralleled a significant economic downturn in the United States where budgets for improving and expanding programs were limited in both public and private universities in the 1990s. Therefore, several programs within institutions were closed, which led to a decreasing number of programs in the field.

As the economy improved and significant advances were made in technology, within a few years, the number of institutions offering educational technology and related degrees increased from 49 in 2000 to 59 in 2009. One major impetus to support this increase may be the rising numbers of distance learning courses offered by various institutions. Leonard and Guha (2001) shared that online courses presented flexible options allowing students to access classes anytime and anywhere, which responded to the needs of students with busy lifestyles and

second-career college students who previously faced a barrier to attending regular classes on campus. Dobbs, Waid, and Carman (2009) also pointed out that the affordability and accessibility of technology for students, especially computer and Internet accessibility, led to an exponentially growing demand for online courses.

There is a dramatic difference between the number of campus-based degree programs and online degree programs. Fifty-five institutions (93%) are campus-based programs while four (7%) institutions offer online doctoral degrees. This may indicate that the demand for online doctoral degree programs is not as strong as for campus-based programs. It may also point to issues around meeting residency doctoral degree requirements and the challenges of pursuing a doctoral degree with limited face to face instructor contact and cohort contact. Furthermore, students and faculty may perceive the quality of learning found in campus-based programs to be better than online-based degree programs. In addition, Adams and DeFleur (2006) indicated that employers prefer traditional degree programs to online degree programs. This may also have an impact on the demand for online programs.

The variance and frequency of the 33 different degree titles serve to underpin the lack of a clear definition and consistency within the field of educational or instructional technology. However, it seems logical that as the field has varied definitions and interpretations, so do the programs and degree titles that prepare professionals for entry into the field. The fact that the degree title *Instructional Technology* occurs 12 times among the 59 doctoral programs supports what Reiser (2007) claimed to be the term used most frequently to describe our field.

One explanation for the variety of program titles in our field is that the program degree titles may be driven by a university's marketing initiatives. In an effort to attract students, universities need to differentiate themselves to make themselves stand out and appear unique in the eyes of prospective students. One way to do that is to create a program name that is different, catchy, or sounds innovative, such as learning sciences or learning design and technology. Conversely, the absence of the words instructional design from a program title may mean that a key component of our field, instructional design, is not as heavily emphasized by that particular curriculum. As Merrill pointed out in his debate with Wilson (Merrill & Wilson, 2007), down the broad road of instructional technology, it may be more and more difficult to determine if there is an academic field of instructional design (p. 349). Either way, how a university positions and markets its educational or instructional technology doctoral program may influence the degree title and program curricula.

This study provided an overall view of the credit hour range for completing a Ph.D. or Ed.D. degree in educational technology related fields in the United States. According to Wellman (2005), institutions have a high degree of flexibility to vary credit hour requirements to meet internal institutional standards. The variation of the credit hours for the Ph.D. (48-113 semester hours) and Ed.D. programs (42-113 semester hours) in the educational technology field is extensive. In terms of dissertation hours, the range and variability for the number of dissertation hours required by various programs reflects the range and variability found in degree titles. One reason for this variability could be due to the challenges faced by doctoral education in the United States in general. According to Nerad (2008), one of the challenges faced by U.S. doctoral education includes managing the intricate link between doctoral education and the institutional research mission of the university. Similar to the total credit hours, the range of the total dissertation hours varies depending on the program's goals and mission.

Finally, this study addressed the different requirements for the Ph.D. and Ed.D. programs in the educational technology related fields. Several sources indicated that both the Ph.D. and Ed.D. programs were designed for different purposes and, therefore, prepared students differently (Shulman, Golde, Bueschel, & Garabedian, 2006; Deering, 1998.) Of the nine programs that offer both Ph.D. and Ed.D. degrees, three programs require more total credit hours for the Ph.D. than the Ed.D. degrees, three universities require the same number of total credit hours for both degrees, and three programs require less total credit hours for the Ph.D. than the Ed.D. degrees. Therefore, there is no significant relationship between total credit hours required of the Ph.D. and the Ed.D. programs. Although Shulman et al. (2006) declared that the Ed.D. is often viewed as a Ph.D. Lite, "with fewer requirements than the Ph.D., much less emphasis on fulltime study and residency…" (p. 27), our findings did not demonstrate a disparity of effort between degree types.

Even though the Ph.D. and the Ed.D. programs serve different theoretical goals, they are "similar in programmatic requirements, knowledge bases, competency standards, and in employment expectancies" (Andersen, 1983, p. 5). In terms of dissertation hours, the results revealed that the Ph.D. degree required more dissertation hours than the Ed.D. degree. Deering (1998) stated that the Ph.D. dissertation illustrated scholarly and high quality research and the Ed.D. dissertation was more applied but not theoretical in nature. Redden (2007) also implied that a Ph.D. dissertation is more research-oriented while an Ed.D. dissertation is more applied and practitioner-oriented. Therefore, institutions who offer both Ph.D. and Ed.D. degrees in the same field might demand more dissertation hours for Ph.D. than Ed.D. degrees.

As with many studies, there are limitations as well as areas for future investigation. This study does not explain or detail what the degree program fluctuations represented beyond the growth or decline of numbers. Further

investigation may shed light about which degree titles have remained stable, which are in decline and which are new. In addition, future research can focus on in-depth curriculum analysis among these doctoral programs to help clarify the core competencies in the field of educational technology.

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Designing for Geospatial Information Technologies

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Geospatial information technologies such as geographic information systems (GIS), global positioning systems (GPS), and global visualization tools (for example, Google Earth, and WorldWind) are increasingly being incorporated in the classrooms to promote student problem solving, data analysis, and critical thinking. These tools allow for visualizing, mapping, organizing, and analyzing multiple layers of geographically referenced information (Broda & Baxter, 2002; DeMers, 2005; ESRI, 1993). Baker and Case (2000) suggested GIS may be a promising educational technology for developing contextually rich student learning and Kerski (2008) noted the use of GIS in education is increasingly viewed as facilitating active learning to engage students in critical thinking (see also Bull & Mason, 1998; Ramirez, 1995; Sanders, Kajs & Crawford, 2002). Bednarz and Audet (1999) agreed, suggesting a GIS may provide an authentic, inquiry-based learning environment for the K-12 classroom. In fact, K-12 educators are harnessing the power of GIS technology to support standards-based math, science, geography, and social studies curricula (Holzberg, 2006). There is, however, a paucity of research on implementing GIS in science classrooms.

Keiper (1998) identified as barriers to implementing a GIS in the classroom lack of a specific relevant curriculum that includes a GIS, student frustration with the technology, and teachers' lack of a pedagogical style conducive to using a GIS (see also Sanders et al., 2002). According to Baker and Case (2000), many teachers find time a limiting factor in using a GIS because they need time on their own to learn and practice using the GIS and then need quite a bit of time to teach students to use the software. It appears using a GIS in the classroom may make some unusual cognitive demands on the learners and demands on teachers' limited instructional time.

Purpose of the Study

Given the paucity of research on implementing GIS in science classrooms and the promising nature of GIS to foster science inquiry, our goal was to determine how a Web-based module might best be designed and developed to enhance science inquiry supported by GIS with classes of eighth-grade students.

Design Conditions and Limitations

There were five conditions and limitations that shaped how we designed our materials and what instructional approaches we are able to employ.

1. The students in our study were of diverse ethnic backgrounds with 19% of them being non-native English speakers. Eighty-three students (41%) received lower scores on the 2008 state standardized reading skills test. Thus, a large portion of our sample would be classified as low-level readers.
2. One hundred and ninety-eight students (78%) received lower scores on the 2008 state standardized test of science knowledge. Thus, more than three quarters of these students would be classified as low-level science learners.
3. The school had adopted the Understanding by Design instructional development process model for its new science curriculum. We needed, therefore, to make sure that whatever we designed also conformed to the requirements of this model.
4. The science content was developed by science education experts and earth and environmental science experts who were part of the larger design team. As with all design projects, the instructional designer's role was to organize, sequence, and design science instruction, not the content. The instruction was to be completed in eight weeks and all developed materials had to be reviewed and approved by the design team.
5. The instructional unit was to be supported by My World GIS. The students and the teacher did not have experience using this particular GIS software. They were going to use My World GIS for the first time.

Selected Instructional Design Theories

The theories that guided us in the design process include behaviorism, constructivism, and inquiry teaching. We chose the behaviorist theory because the population of students with which the study was to be conducted is one that research suggests is likely to benefit from direct instruction and extensive practice, two behaviorist approaches (Gersten, Keating, & Becker, 1988). In addition, behaviorists tend to emphasize correct responses and we were concerned that the students in our study would be measured against state standardized tests that employ behaviorist assessment techniques almost exclusively. We employed many instructional practices classified as behaviorist (for syntheses of such practices, see Bugelski, 1971 and Snelbecker, 1974). We chose the constructivist theory because we wanted students to modify and refine what they already know and collaborate on performing tasks as they learned from one another. We used many instructional practices deriving from constructivism (for syntheses, see Bednar, Cunningham, Duffy & Perry, 1992; Duffy & Jonassen, 1992; Honebein, 1996; Knuth & Cunningham, 1993; and Savery & Duffy, 1996). We chose Collins and Stevens' (1983) expression of the theory of inquiry teaching because we wanted students to engage with hands-on activities and use evidence to justify their explanations just like scientists do. Further, scientific inquiry is the central tenet of science education reform.

Selected Instructional Models

We used four instructional development process models and three instructional design models to design instruction. Instructional development process models describe the phases/stages of designing and developing instruction, while instructional design models provide steps to guide designers organize, structure, and sequence instruction. Designers use instructional design models to make decisions about how content should be sequenced, how to use overviews and examples, how to practice, and how to assess learning.

Instructional Development Process Models

The first instructional development model we chose was the generic ADDIE model. ADDIE is an acronym for Analyze, Design, Develop, Implement, and Evaluate (Learning Theories Knowledgebase, 2008). We classified the other three models according to how they mapped to the ADDIE model. The second model was the Dick, Carey, and Carey (2005) model which breaks ADDIE's basic five phases into nine stages. A phase may contain one or more stages and stages break down phases into more specific actions and provide more guidance on how to design. Further, the Dick, Carey and Carey model makes clear that the process is iterative; that is, a designer goes back to any of the stages of design or development to make revisions. Although the model specifies sequenced stages, it recognizes explicitly that many design processes are complementary and may occur near simultaneously. The third model we used was Wiggins and McTighe's (1998) Understanding by Design model that focuses on a topic's enduring understandings. Enduring understandings refer to the big and important ideas that the teacher wants the students to comprehend and retain. The authors contended that "by having students encounter big ideas in ways that provoke and connect to students' interests, we increase the likelihood of student engagement and sustained inquiry" (p. 11). Our fourth model was Keller's (1983) ARCS motivation model that focuses on enhancing student motivation. ARCS is an acronym for Attention, Relevance, Confidence, and Satisfaction. Given that the learners were low-level science learners, sustaining their motivation was crucial for their success in this unit.

Instructional Design Models

We chose three instructional design models to match the theories that we used. For the behaviorist instructional model, we selected Gagné's (1977) Nine Significant Events model because it represents a sequence many effective teachers use in direct instruction. A constructivist model seemed well suited to this project because of the open-ended nature of the learning tasks and activities. We chose two constructivist design models: Jonassen's (1999) model for designing constructivist learning environments and Black and McClintock's (1996) interpretation construction (ICON) model. These two models appeared well matched to the content and target audience. Under inquiry teaching, we used three inquiry models: Bybee et al's (1989) 5E model that has been used over the years to design instruction; Eisenkraft's (2003) 7E model that adds two steps to the 5E model; and the National Research Council's ([NRC], 2000) Five Essential Features model that specifically applies to science.

Derived Instructional Model

As a result of our analyses of the various design models, we derived an instructional model and three sub-models for teachers to follow and we developed materials that fit our derived model and its sub-models. The larger instructional model has four major steps, the second of which represents presentation of all types of instructional content and incorporates our three sub-models. The three sub-models are unified under the larger model and they

present models for the presentation of content, for computer-supported activities, and for laboratory activities. The steps of our instructional model (and sub-models) are listed below and explained in the paragraphs that follow.

1. Confirm learners have necessary background.
    1.1 Administer content knowledge pretest.
    1.2 Administer attitude towards science and technology pretest.
    1.3 Elicit and discuss prior understandings of unit concepts aloud.
    1.4 Elicit additions to the concept map independently.
    1.5 Identify misconceptions from student responses.
2. Present instruction using the appropriate model.
    2.1 Instructional model for content presentation
        2.1.1 Elicit prior understandings of lesson concepts.
        2.1.2 Gain and sustain learners' attention.
        2.1.3 Tell learners the objectives.
        2.1.4 Stimulate recall of prerequisite learning.
        2.1.5 Explain content.
        2.1.6 Illustrate content.
        2.1.7 Elicit answers to specific questions on students' worksheets.
        2.1.8 Solicit some responses from students' worksheets and provide feedback aloud.
        2.1.9 Review content.
    2.2 Instructional model for computer-supported activities
        2.2.1 Elicit prior understandings of lesson concepts.
        2.2.2 Present authentic task.
        2.2.3 Model task.
        2.2.4 Provide worked example.
        2.2.5 Ask learners to perform task.
        2.2.6 Scaffold task.
        2.2.7 Ask learners additional questions to elaborate task.
        2.2.8 Review activity concepts.
    2.3 Instructional model for laboratory activities
        2.3.1 Elicit prior understandings of lesson concepts.
        2.3.2 Present authentic task.
        2.3.3 Form student groups.
        2.3.4 Model task.
        2.3.5 Ask students to make predictions.
        2.3.6 Ask group members to collaborate on task.
        2.3.7 Have students make observations.
        2.3.8 Have students use evidence to form explanations.
        2.3.9 Have students evaluate explanations and draw conclusions.
        2.3.10 Have students share and justify results.
        2.3.11 Address misconceptions.
        2.3.12 Ask learners to perform extension tasks.
        2.3.13 Review activity concepts.
3. Confirm instruction is meeting goals and objectives.
    3.1 Ask questions aloud and respond to student answers.
    3.2 Solicit and respond to student questions.
    3.3 Check students' worksheet responses aloud.
    3.4 Provide feedback aloud.
    3.5 Have students add new ideas to their concept maps.
    3.6 Adjust instruction to meet learners' needs.
4. Confirm learners have acquired desired knowledge, skills, and attitudes.
    4.1 Assess culminating activity.
    4.2 Assess concept map.
    4.3 Administer and analyze content knowledge posttest.
    4.4 Administer and analyze attitude towards science and technology posttest.

Step 1 is based on Dick, Carey and Carey's "identifying and analyzing entry behaviors and learner characteristics," Eisenkraft's first E, elicit, and Jonassen's constructivist step of providing knowledge representation tools.

In Steps 1.1 and 1.2, the teacher administers a content knowledge and attitude and behavior pretests to determine what knowledge, skills, and behaviors students bring to the learning task.

In Step 1.3, the teacher uses oral questions to identify what students know about energy (for example, "What is energy?" or "Where does energy come from?"). The teacher then discusses learners' responses.

In Step 1.4, the teacher asks students to brainstorm on their own, listing everything they know about energy and then to add to their individual concept maps. Students add ideas to their concept maps periodically as they complete the unit. The goal is for learners to construct their own relationships among concepts as they learn them.

In Step 1.5, the teacher addresses misconceptions learners may have about unit concepts. It is likely the teacher will examine student responses to the pretests outside of class to check for students' misconceptions and decide which areas to address and clarify when teaching.

As noted earlier, Step 2 encompasses three sub-models; the first for presenting content, the second for doing computer-supported activities, and the third for doing laboratory activities. The instructional sub-model for content presentation comes first because students need to acquire and understand science content before they can practice. The instructional sub-model for the computer-supported activities is presented second because the unit is primarily based on using GIS to support science teaching and learning. Computer-supported activities include using the GIS software, Google Earth, and spreadsheets to perform tasks. The content and activities are organized around Wiggins and McTighe's (2005) framework of focusing on big ideas. Laboratory activities augment GIS activities. Teachers employ the appropriate sub-model –or a combination of sub-models– depending on the nature of the activity for a class. The three instructional sub-models are discussed below.

Instructional model for presenting content

Step 2.1.1 matches Dick, Carey and Carey's "identifying and analyzing entry behaviors and learner characteristics," and Eisenkraft's first E, elicit. The teacher asks students questions about the specific lesson concepts and, in this way, identifies what knowledge and skills learners bring to the learning task. For example, a teacher might ask, "What is solar energy?" when introducing students to solar energy.

Step 2.1.2 combines Bybee et al.'s first E, engage, Gagné's gain attention, and Keller's attention. In the unit, we use brief videos, animations, demonstrations, oral stories, and objects to capture attention. For example, the teacher begins the lesson on geothermal energy by showing students a brief video of geothermal areas in Iceland. Throughout lessons, this sub-model uses such ARCS (Keller, 1983) attention-sustaining strategies as posing questions, engaging learners with tasks, and balancing content presentation with interactive sessions.

Step 2.1.3 matches Gagné's "inform the learner of objectives" with Keller's relevance by presenting objectives in a way that conveys the usefulness of the instruction (for example, by telling teachers such things as, "Inform students that they will investigate ways of conserving energy."

Step 2.1.4 is drawn verbatim from Gagné's Nine Significant Events model. The teacher reminds students of important prerequisite knowledge or skills they have learned previously. This also helps prepare learners for the new content.

Step 2.1.5: Using direct instruction, demonstrations, and videos, the teacher explains the new content or students access new content on the unit's student resources Web page. This step integrates Bybee et al.'s third E (explain) and Gagné's "present stimuli." The teacher uses small cycles of events to present the content and images are used in the materials to reduce the reading load and provide some content redundancy.

Step 2.1.6 interweaves Collins and Stevens' inquiry teaching strategies, Gagné's "provide guidance," and Keller's relevance. Examples, illustrations, and answers to student questions are used to help learners understand new content. The teacher relates examples to the learner's experience and values and uses positive and negative examples and counterexamples as well. For example, students receive teacher guidance on how to complete the personal energy audit in which they note their daily and weekly energy consumption.

Step 2.1.7 is an adaptation of Gagné's "elicit performance" event. Teachers ask learners to respond on their worksheets to specific questions as the content is presented.

Step 2.1.8: This is Gagné's event seven, "provide feedback," although we have the teacher provide such feedback aloud. The teacher asks students to share their worksheet responses with the class and he or she then discusses some of those responses with the class. In this way, the teacher reinforces correct responses, clarifies misunderstandings, and summarizes the content. This step also addresses Keller's satisfaction. Teacher-provided feedback should help to sustain desired behavior.

In Step 2.1.9, lesson concepts are reviewed by the teacher in order to reinforce student learning and to clarify any concepts students did not understand. This is a variation of Gagné's "enhance retention and transfer."

Instructional model for computer-supported activities

Step 2.2.1 combines Eisenkraft's first E, elicit and Dick, Carey and Carey's "identifying and analyzing entry behaviors and learner characteristics." The teacher asks questions about lesson concepts to determine what knowledge and skills students bring to the learning task.

In Step 2.2.2, the students become aware of their authentic task when the teacher presents it. This is a modification of Jonassen's "select an appropriate task for learners to do." Instructional materials present tasks in different ways. In some tasks, students analyze regional or worldwide cases first and then move to local cases. In other tasks, students analyze in the opposite direction. Regardless, this step obeys Collins and Stevens' strategy to vary cases systematically.

Step 2.2.3: Teachers model for learners how to do the task, for example, how to obtain data about solar power plants using the My World GIS Get Information tool. This is an instance of both Jonassen's and Black and McClintock's steps in which the teacher models the task.

Step 2.2.4 implements Jonassen's "provide worked examples." Either the teacher or the materials (or both) provides a worked example to help guide students in performing the task. For example, in our energy unit, the materials provide a worked example of how students should complete the solar power plants data chart. As noted earlier, the materials also provide positive and negative examples, and counterexamples (Collins & Stevens, 1983) to highlight important things that should help learners complete the task. For instance, the materials provide screenshots of what students would see when they perform a task either correctly or incorrectly.

Step 2.2.5: Learners perform the task. This step integrates the NRC's first essential feature ("learners engage with a scientifically oriented question"), Keller's satisfaction, and Bybee et al.'s second E, explore. Learners construct their own understandings by engaging actively with the task. To address Keller's satisfaction, teachers have learners use their newly acquired knowledge and skills to manipulate data in a simulated setting. For instance, the culminating task has students apply the unit's knowledge and skills to recommend the best combination of energy sources for a fictional island.

In Step 2.2.6, the materials and the teacher provide guidance to the learners as they complete GIS tasks. This honors Jonassen's steps where the teacher coaches the learners and provides cognitive tools to support the learners' performance. In our instructional unit, learners only use the GIS when they need it to accomplish a learning task. An orientation to the GIS is given by the teacher and he or she models how to use it to visualize, manipulate, and analyze data. Students learn to use the GIS through completion of a series of authentic tasks. We have scaffolded the handouts for using GIS heavily: They use screenshots, hints, and a consistent sequence to help enable students to use them to complete tasks independently outside the classroom. GIS activities are integrated with non-GIS activities that learners already know how to do so that students do not become overwhelmed as they begin working with the GIS software with which they have no prior experience.

Step 2.2.7 addresses Bybee et al.'s fourth E, elaborate. The teacher and materials ask students to answer higher-order questions, draw conclusions, and reflect on how concepts relate to each other. All this is done in hopes of fostering greater student understanding.

Step 2.2.8 is a variation on Gagné's "enhance retention and transfer." To reinforce student learning, the teacher reviews the concepts learned in the activity. This review should also allow the teacher to clarify any concepts students did not understand.

Instructional model for laboratory activities

Step 2.3.1 combines Eisenkraft's first E, elicit and Dick, Carey and Carey's "identifying and analyzing entry behaviors and learner characteristics." Just before beginning the activity, students are asked questions about lesson concepts in order to identify what knowledge and skills they bring to the learning task.

Step 2.3.2: The teacher presents the task to the learners. This is a modification of Jonassen's "select an appropriate task for learners to do."

In Step 2.3.3, the teacher assigns students to groups in which they will perform laboratory experiments.

Step 2.3.4: The teacher demonstrates the task. This represents both Jonassen's and Black and McClintock's teacher modeling of the task.

Step 2.3.5 implements Collins and Stevens' "make predictions" by having the teacher ask students to make predictions before they begin the laboratory experiment.

Learners conduct laboratory experiments in Step 2.3.6. This step integrates the NRC's first essential feature ("learners engage with a scientifically oriented question") with Bybee et al.'s second E, explore, and having students work collaboratively on tasks (Black & McClintock, 1996; Jonassen, 1999).

In Step 2.3.7, learners make observations of their laboratory experiments, thus implementing Black and McClintock's student observations of authentic artifacts.

Step 2.3.8: Obeying the NRC's third essential feature ("learners to give priority to evidence") and Collins and Stevens' "consider alternative predictions," students focus on evidence, think about alternative predictions, and formulate explanations from evidence. In keeping with Bybee et al.'s third E, explain, students discuss explanations and alternatives and expand their understanding of concepts.

In Step 2.3.9 learners evaluate their explanations in light of alternative explanations, and think their way towards solutions. This step integrates Bybee et al.'s fifth E, evaluate, the NRC's fourth essential feature ("ask learners to evaluate their explanations in light of alternative explanations"), particularly those reflecting scientific understanding, and Collins and Stevens' "question authority" (modified here to "draw own conclusions").

Step 2.3.10 is based on the NRC's fifth essential feature ("learners communicate and justify their proposed explanations") and Black and McClintock's steps. Learners share results and present and defend their explanations. We anticipate that this should enhance their motivation to be well prepared and may help to give them a sense of ownership of the content. This step is also designed to address Keller's confidence. In formulating an energy policy for a fictional island, students are provided with performance requirements and evaluative criteria to support them as they complete the task.

Step 2.3.11 represents Collins and Stevens' "trace consequences to a contradiction" and in this step the teacher corrects student misconceptions evinced in students' explanations.

Step 2.3.12 is based on Eisenkraft's seventh E, extend. Teachers ask learners to use the skills they have acquired to perform additional tasks. The intent is to enhance the transfer of student learning.

Step 2.3.13 reflects Gagné's ninth event ("enhance retention and transfer"). To reinforce student learning and clarify any concepts about which students seem confused, the teacher reviews the concepts covered.

This brings us to step 3 of the larger instructional model. This step is a variation of Dick, Carey and Carey's formative evaluation and also addresses Jonassen's constructivist model in which teachers adjust task difficulty or redesign the task to accommodate learners who are experiencing difficulties in completing it. The teacher asks questions and responds to student answers in Step 3.1, while in Steps 3.2, 3.3, and 3.4, the teacher reverses the process, soliciting student questions and responding to them and then providing feedback on students' worksheet responses. The goal here is to determine if the instruction was effective, to identify any weaknesses, and to determine where and how instruction should be revised and improved. Formative evaluation occurs while the instruction is in progress, so the teacher can adjust upcoming instruction to meet better the needs of students. Students add new ideas to their individual concept maps at various times during the unit in Step 3.5, while in Step 3.6 the teacher considers how best to improve classroom instruction and student performance.

Lastly, Step 4 is summative evaluation (Dick, Cary & Carey, 2005). In Steps 4.1 and 4.2, the teacher examines the culminating activity and concept maps to identify how well students learned in the unit. In Steps 4.3 and 4.4, learners complete content knowledge and attitude and behaviors posttests. The teacher considers student responses to these assessments as part of evaluating the effectiveness of the unit and deciding what revisions should be made for future.

Meta-Design Principles

We also derived five meta-principles that apply to the design of the unit as a whole. These meta-principles tell us when to apply a rule and how to apply it.

Meta-principle 1: Use multiple ways of learning to address learner differences.

The brain processes information in different ways; learners may see different connections between concepts if information is presented in multiple ways. Gardner (1993) proposed seven intelligences initially and argued that everyone is born with potential in all seven. He contended, however, that cultural and personal contacts determine which intelligences develop. The seven intelligences include linguistic, logical-mathematical, bodily-kinesthetic, spatial, musical, interpersonal, and intrapersonal. Gardner later added naturalistic intelligence. We applied this meta-principle by conveying the core concepts of the unit using as many modalities as possible to reach the various students. Examples include having students investigate optimal areas for building different energy-generating facilities (logical-mathematical intelligence); having students read about different energy sources (linguistic intelligence); having students manipulate GIS data and recognize patterns (spatial intelligence); and having students collaborate on group activities (interpersonal intelligence). We used different entry points, such as telling a story (linguistic intelligence); asking questions (logical-mathematical intelligence), displaying real objects in class (bodily-kinesthetic intelligence), and doing hands-on activities (bodily-kinesthetic intelligence) to help engage learners with the topic.

Meta-principle 2: Facilitate the process of modifying instructional materials to meet the needs of different learners.

According to Kinnaman (1993), teachers play a major role in effective implementations because they can identify how to modify materials to address the needs of the students in their classes. Cates and Kulo (2009) argued that designers should provide adequate scaffolds for teachers to help them become more effective in supporting their students. In this way, a good design for teaching and learning is also a professional development program. We developed two sets of handouts, a simplified one for the students that includes scaffolds for the task, and a detailed one for the teacher that not only includes scaffolds for the task but also scaffolds for what students are supposed to learn and the thought processes involved. We provided handouts in both PDF and Word format. The teacher can choose to modify the activity and/or materials based on how learners perform the task, including adjusting task difficulty. The teacher can also enrich the student handout by adding detailed explanations of the activity copied from the teacher's handout.

Meta-principle 3: Use icons consistently to enhance and reinforce student learning and use illustrations to reduce learner dependence on text.

According to Paivio (1971) images act as mediators in learning and memory tasks and can serve as highly effective memory aids. To take advantage of the power of images, we used icons throughout, in materials for both teachers and students and we illustrated all materials extensively. Our use of icons and images was not simply to make the materials more attractive but also clearer. The image on the left in Figure 1 shows the student resources Web page. Since learners use this page almost every day, we used images that depict each energy source to facilitate navigation and also to enhance and reinforce student learning. For example, we used an image of a volcano for geothermal energy and an image of a water wheel with flowing water for hydroelectric energy. We also used illustrations with arrows to connect the text with the task and to illustrate the task (see image on the right).

Figure 1. Examples showing the use of icons and illustrations
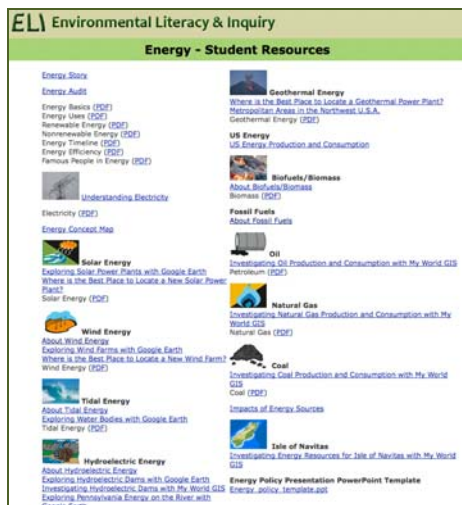
Meta-principle 4: Use procedural facilitators to guide learners' responses.

Scardamalia and Bereiter (1986) defined procedural facilitators as questions, prompts, and simple outlines of important learning elements that teachers use to scaffold learning. According to Rosenshine and Meister (1992), such scaffolds provide the support students need to do higher-level thinking. Tasks in the energy unit have steps that must be done in sequence to get the desired results. Our procedural facilitators are designed to increase learner comprehension and ensure students do not skip steps. For example, the image on the left in Figure 2 outlines the steps for doing a task, while the image on the right shows results students should get when they follow those steps.

Figure 2. Illustrations of the use of procedural facilitators
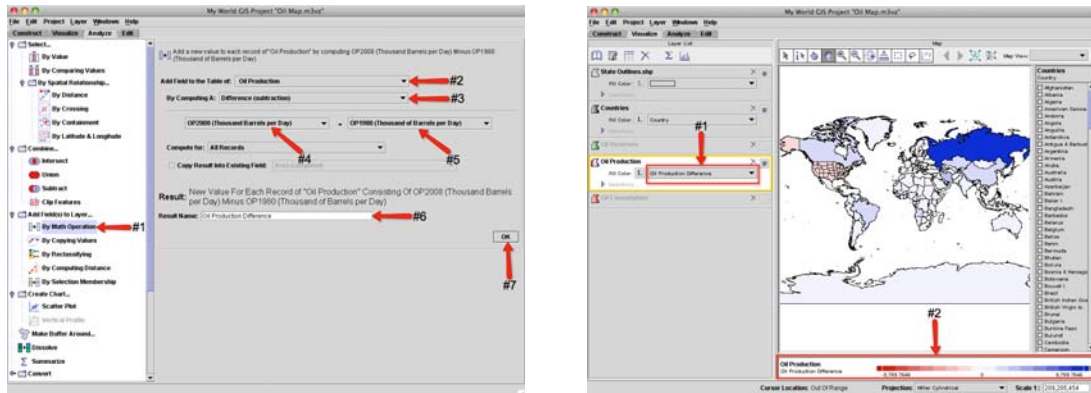
Meta-principle 5: Use Contrast, Repetition, Alignment, and Proximity (CRAP) design.

       According to Williams and Tollett (2000) there are four basic design principles one should apply in designing both print materials and Web pages. These are contrast, repetition, alignment, and proximity. Figure 3 illustrates how we applied these principles. We employed contrast in the form of larger san serif font in bold to emphasize key words and by using a background color that contrasts well with the text and images. We employed repetition by using the same shades of green and white colors, consistent fonts, the Environmental Literacy and Inquiry (ELI) logo at the top, and light bulb navigation buttons. We used a larger san serif font for the rest of the body text and used left alignment for items on the Web pages. We employed proximity by placing headings and subheadings closer to their related text or graphic than to the text or graphics above them. The Web pages also have lots of white space to help reduce cognitive load on the learners. Our intent throughout was to enhance readability.

Figure 3. Illustration of CRAP design
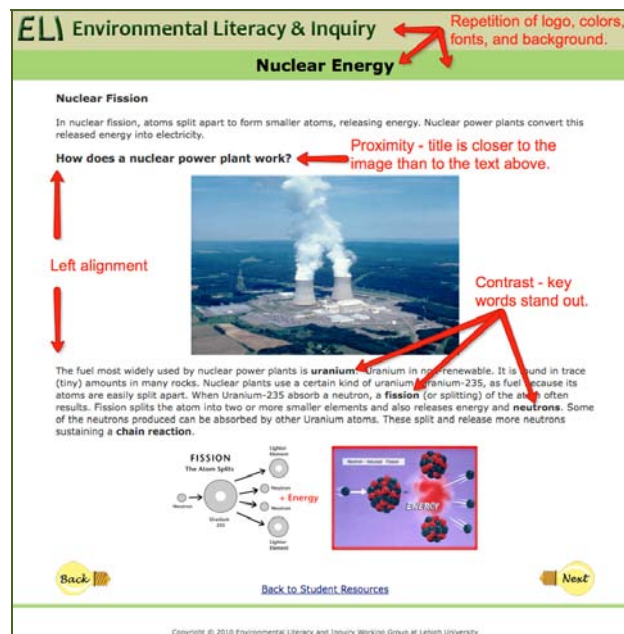
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A Design Case:
Creating an Enhanced Version of the Diffusion Simulation Game

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In this paper, we describe the design case for creating a new online version of the Diffusion Simulation Game (DSG). Originally a board game (Molenda & Rice, 1979) and then an online version (Frick, Ludwig, Kim, & Huang, 2003), the new DSG was rapidly prototyped first on paper and then in Flex Builder, ActionScript, PHP and MySQL. We also report results of play-tests, usability evaluations, and how the design and implementation of the DSG has been improved.

Overview

The purpose of the Diffusion Simulation Game (DSG) is to learn change management strategies which are consistent with Roger's (1995, 2003) diffusion of innovation theory and related research in this area. The goal of the DSG is to promote acquisition of strategies that result in adoption of an innovation (peer tutoring) by the principal, teachers and support staff at a fictional junior high school. The DSG models: progressive stages of awareness, interest, appraisal and trial of the innovation that precede adoption by individuals; people who are innovators, early adopters, early majority, late majority, and laggards; and those who are opinion leaders and gatekeepers. Game activities include gathering information on potential adopters; viewing diagrams of networks portraying school committees, lunch mates, and socializing outside of school; talking to individual staff members; asking help; making site visits; providing a demonstration of the innovation; conducting workshops; use of mass media; confrontation; and compulsion.

The challenge to the DSG player, who takes the role of a change agent, is to get as many individuals as possible to adopt the innovation. Each diffusion activity takes from 1 to 5 weeks of virtual time, and the game ends when either 72 weeks elapse or all teachers and the principal become adopters. By repeated play of the DSG, a user is expected to learn which diffusion strategies are effective with whom and when, depending on the adopter type and each person's changing stages of adoption when appropriate strategies are chosen that work with that person. It takes about two hours to play the DSG the first time, and about an hour for each successive play. The DSG also models stochastically the probabilities of success for various diffusion activities. Sometimes an activity succeeds and other times it does not, depending on the current game state, probabilities of success of the activity for various adopter types and stages of adoption, and chance. If used as part of a course—after students have played the DSG multiple times outside of class—the DSG includes a printed summary of key ideas from Roger's theory and change management for discussion during a debriefing session.

The DSG has been successfully used in a board game format for several decades in the Instructional Systems Technology master's program at Indiana University Bloomington. In 2002, the third author led a team of graduate students to build the first online version of the DSG, which has been used regularly in the distance master's program (cf. Frick et al., 2003).

Requests for DSG licenses for use outside of our university have been growing. Starting in the fall 2008, we have been designing and developing an enhanced version of the DSG that will: 1) store logs for successive game plays, reviewable by students and their instructors; 2) make it easy to insert new content for different settings (e.g., in business, other languages); 3) make it easier to maintain, grant licenses and collect license fees; 4) link game play to a new record keeping system to facilitate research on strategies players use and how well they learn; 5) add levels of difficulty to the game; and 6) improve the interface to increase ease of use. In addition to applying van Merriënboer's (2007) 4C/ID model for design, we are creating the new DSG in Flex Builder, ActionScript and MySQL so that it will run over the Web but feel like a desktop application.

The Importance of Diffusion of Innovation Theory

Innovation is the process of transforming an opportunity into new ideas with the goal to improve existing products, practices, or services (dal Zotto & Van Kranenburg, 2008). Notwithstanding the overall positive impact

that an innovation might have within a specific context, there will invariably be people reluctant to adopt it (Burkman, 1987). This is mainly due to the fact that most innovations do not diffuse by themselves but require change agents and the willingness of potential users to change their preexisting mental models and behaviors.

"Diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system" (Rogers, 2003, p.11). Diffusion of innovation theory explains the process by which new ideas and practices spread between and within social systems (Valente & Davis, 1999). Nowadays, multiple disciplines offer courses related to change management and diffusion of innovations as part of their curriculum to provide students the knowledge and skills needed when dealing with the implementation of new concepts and practices as part of their profession.

Purpose

The purpose of this paper is to describe the process of designing a new online version of the DSG to overcome several limitations of the previous version; among the new version improvements are: storing interaction sequences in order to assess improvement in gaining adopters across repeated play; storing game logs reviewable by students and their instructors; making it easier to insert new content for different settings (e.g., in business, other languages); making it easier to maintain, grant licenses and collect license fees; adding levels of difficulty to the game; and improving the interface to increase ease and speed of use.

Methods

Participants

A team of five graduate students in the Instructional Systems Technology (IST) graduate program at a large midwestern university led by the third author collaborated in the design and development process of the DSG enhanced version. The third author had previously led another research group in the design and development of the first DSG online version (Frick et al., 2003).

Design Procedure

Weekly meetings were held during a semester. Besides the meetings, the team members used emails and a listserv for communication. A Google site was eventually created to keep track of all of the decisions made during the design process.

The first meetings were entirely devoted to becoming familiar with the previous DSG versions. One session consisted of playing the board version; this session was led by Dr. Molenda, one of the original creators of the game, who also answered questions about the original design.

In subsequent meetings, the team members use brainstorming to identify a list of limitations of the previous online version and desired enhancements. This list was then used to define goals for the new enhanced DSG version. The goals were classified in two different categories:

1) Front-end (user interface):
   - Improve the interface to increase ease of use, reducing the amount of scrolling and mouse clicks needed to play the game and eliminating the need to refresh the page.
   - Improve the feel and look, making it more visually appealing.
   - Add licensing interface.
2) Back-end
   - Store logs for successive game plays, reviewable by students and their instructors.
   - Make it easy to insert new content for different settings (e.g., in business, other
   - languages).
   - Link game play to a new record keeping system to facilitate research on strategies players use and how well they learn.
   - Add levels of difficulty to the game.

Once the expectations were identified, in the subsequent sessions the team dealt with two issues simultaneously, each of them taking approximately half of each session: the software to be used for the entire project and the user interface (UI) prototype.

Regarding the software to be used, the team decided that the front-end would consist of SWF files created in the Adobe open source program called Flex 3; for the back-end it was decided to use a combination of PHP (a server-based scripting language) and MySQL (a relational database management system).

The reason for using Flex 3 was that most Web browsers nowadays support Adobe Flash player which can play SWF movies. An alternate solution was to use AJAX (asynchronous JavaScript and XML), a group of technologies that can be used to create Web applications that do not require the browser to refresh the page; however, the team realized that there are some issues related to browser and platform compatibility with AJAX. Moreover, the learning curve to configure and start using Flex was perceived to be smaller than AJAX, allowing a faster pace in the development of the application.

Concerning the UI design, several paper and digital prototypes were first created. Based on those prototypes, the team decided to use the concept of an "Activity Area" (Figure 1) in which the player would drag and drop a specific diffusion activity along with the staff members selected. Feedback about the player's actions would also be displayed in this area. This prototype helped us to visualize all the different sections needed in the game and assisted us in determining the best way to integrate all of them. The team quickly decided that a drag-and-drop interface was less efficient than simply clicking desired components to select them.

Comparing the paper prototype to the first online version of the DSG (Figure 2) it can be noticed that the prototype followed a similar layout, using three different tabs to contain each of the three different main sections of the game, which are:

1) Game Rules, which includes the directions and objectives of the game;
2) Play Game, which includes the simulation game itself;
3) Game Logs, which includes the list of diffusion activities and staff members selected by the player during each turn.

The paper prototype (Figure 1) shows the content of the "Play Game" tab. This tab also kept a similar layout as the first online version: the calendar section remained at the top and the staff member list on the left, while the activity list was moved to the bottom. The main difference between the prototypes and the DSG first online version was the introduction of the "Activity Area" section.
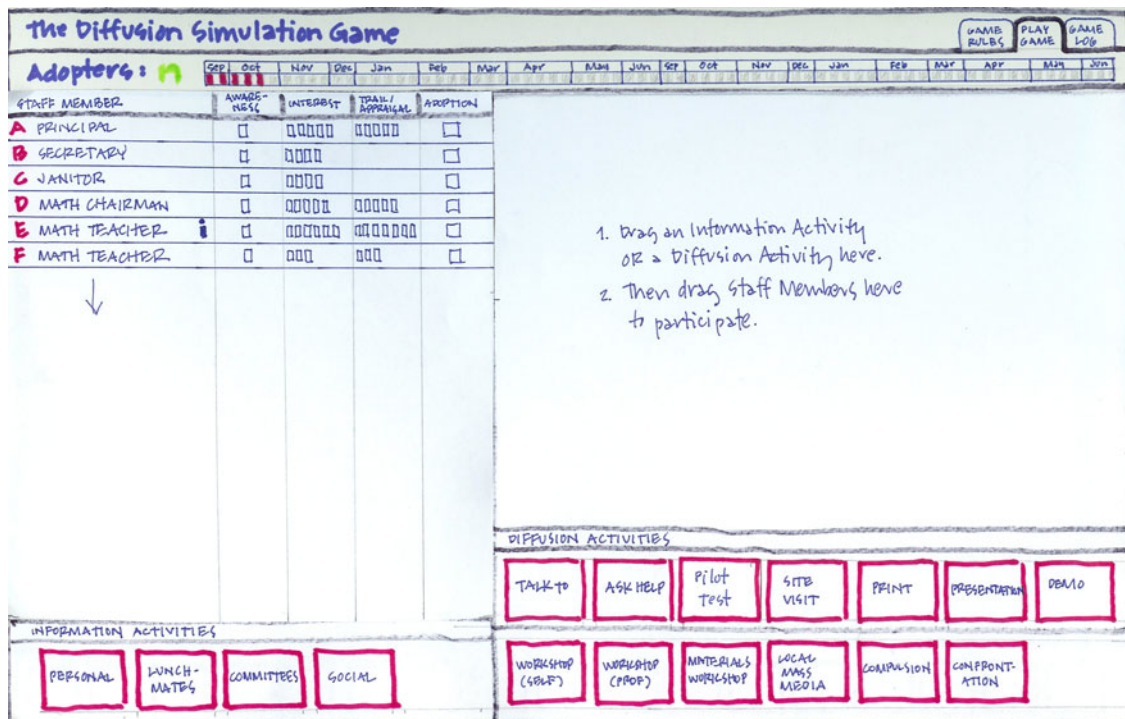
Figure 1. Example of DSG paper prototype.
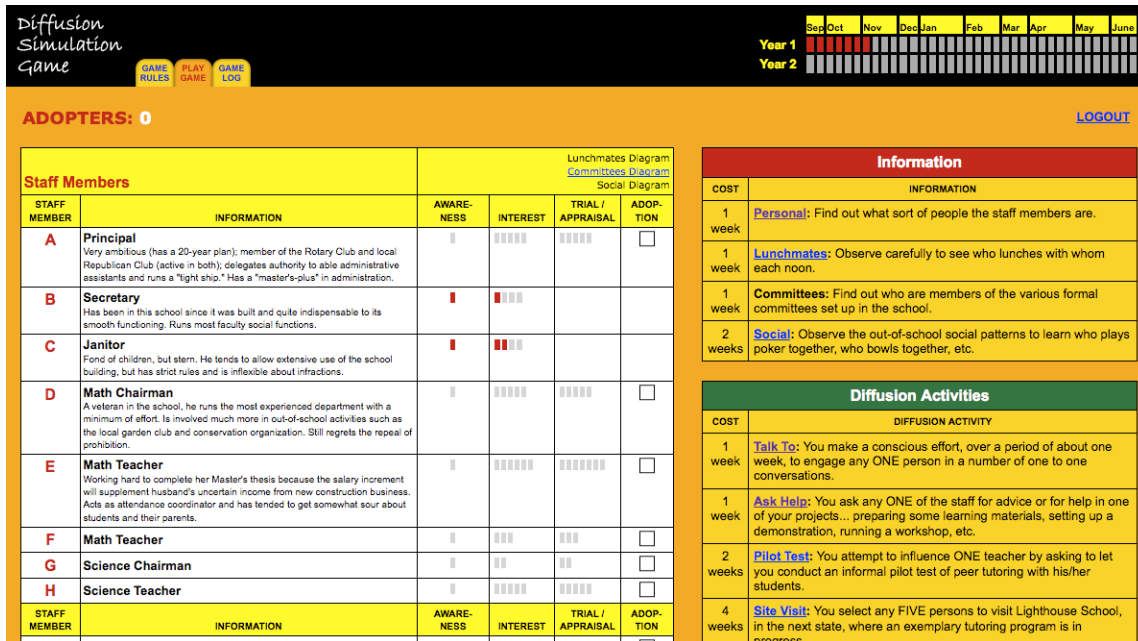
Figure 2. DSG first online version.

Figure 3. First digital prototype.

Corry, Frick and Hansen (1997) highlight the importance of focusing on the user throughout the design and development processes. An essential objective in the design of the enhanced online version of the DSG was to provide a better user experience. After a deeper analysis of the paper prototype, the team realized that placing the diffusion activities near the bottom of the screen created the potential disadvantage of players having to scroll down every time they needed to select an activity. For this reason, the team decided to have all the activities listed one below the other, on the right side of the activity area.

At this point, the team had already made the decision to use Flex for the User Interface. Since Flex facilitates rapid prototyping (Tripp & Bichelmeyer, 1990), the team decided to use it to create the first digital prototype that would include the modifications suggested from the paper prototype (Figure 3).

The first digital prototype helped the team to have a clearer idea about the monitor resolution that would be needed to fit as many of the game elements as possible in a single screen. A monitor resolution of 1024 x 768 was the most appropriate to diminish the amount of vertical scrolling while preventing horizontal scrolling at the same time.

Even though the first digital prototype was not fully functional, designers were able to emulate playing the game by selecting diffusion activities and staff members. Through this interaction, designers noticed that players would need to move the mouse from one side of the monitor to the other for every single turn in the game. Designers also realized that the natural order of the "Activity" and "Staff members" sections were inverted because players need to first select an Information or Diffusion Activity and then select up to five staff members.

Based on these observations, the designers switched these sections and placed them next to each other to match the sequence of decision making. Furthermore, since players of the first online version would continue playing in the new version, the designers decided to keep a similar background color as the first version. All these changes are shown in Figure 4.

The UI design process was very iterative; as soon as a change was done, all designers accessed the prototype and analyzed the revisions (even though the game was not functional yet). During team meetings, the designers commented about their observations and new changes were decided based on a team consensus.

After several weeks of work on the UI, the team agreed upon the design shown in Figure 5. In this final design the diffusion activity section is located at the left, followed by the staff member section, following the natural left-to-right reading process (as mentioned above, players need to first select a diffusion activity and then the desired staff members).
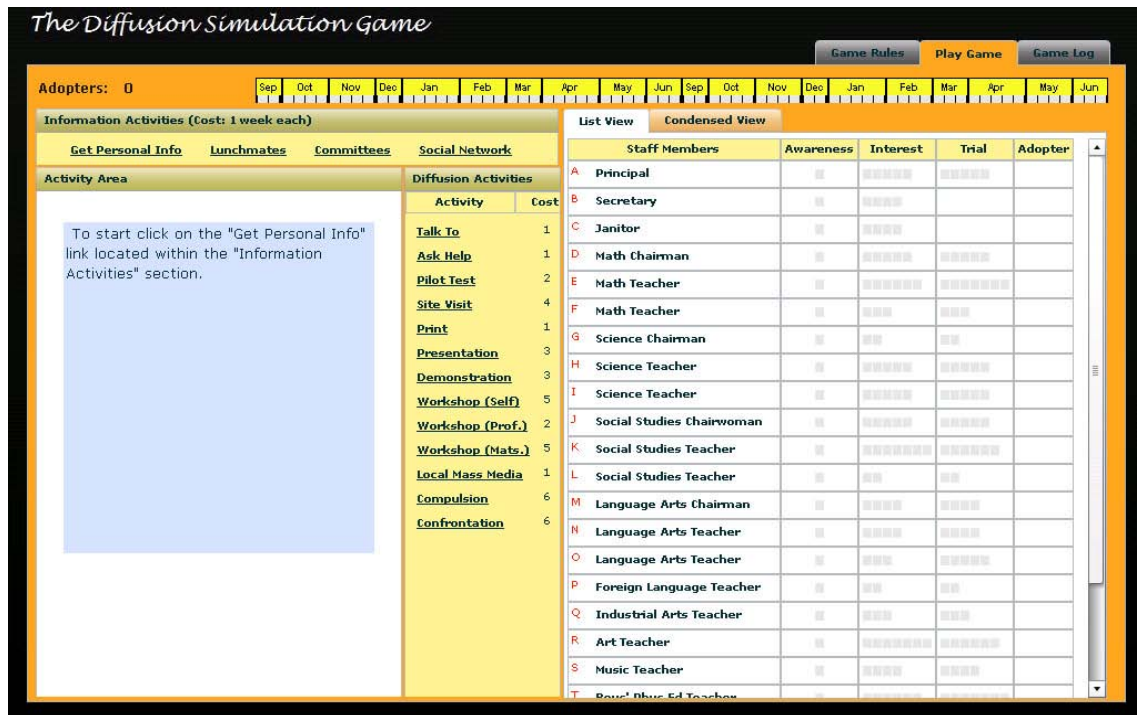
Figure 4. Second digital prototype.

The designers recognized the importance of reducing the short-term memory load as a golden rule of interface design (Shneiderman & Plaisant, 2005). However, this golden rule defied the rule about minimizing the amount of scrolling as much as possible. For purposes of the game, a player has to get the personal information of each staff member. Displaying all this information all of the time results in excessive vertical scrolling. The solution we proposed was to have two views: 1) a *list* view showing only staff member job titles along with a "tooltip" (call out) containing each staff member's description whenever the mouse hovers over the job title; and 2) a *detailed* view, that shows each staff member's complete description (only if "Get Personal Info" is true for him or her).
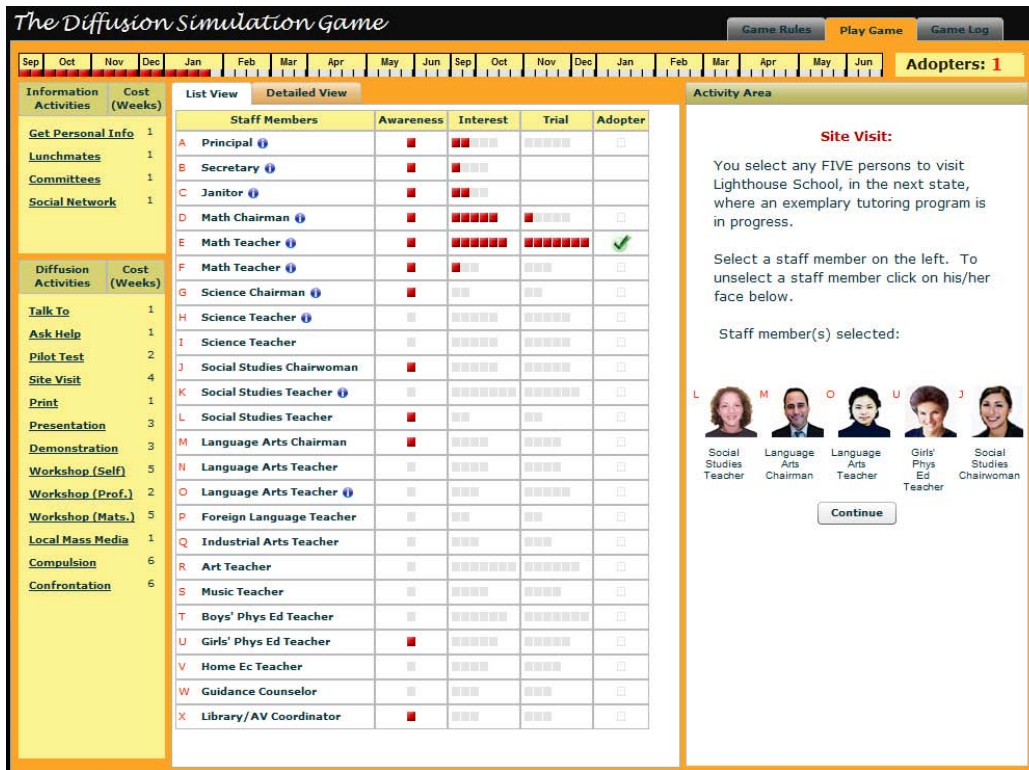
Figure 5. Final digital prototype: List View.
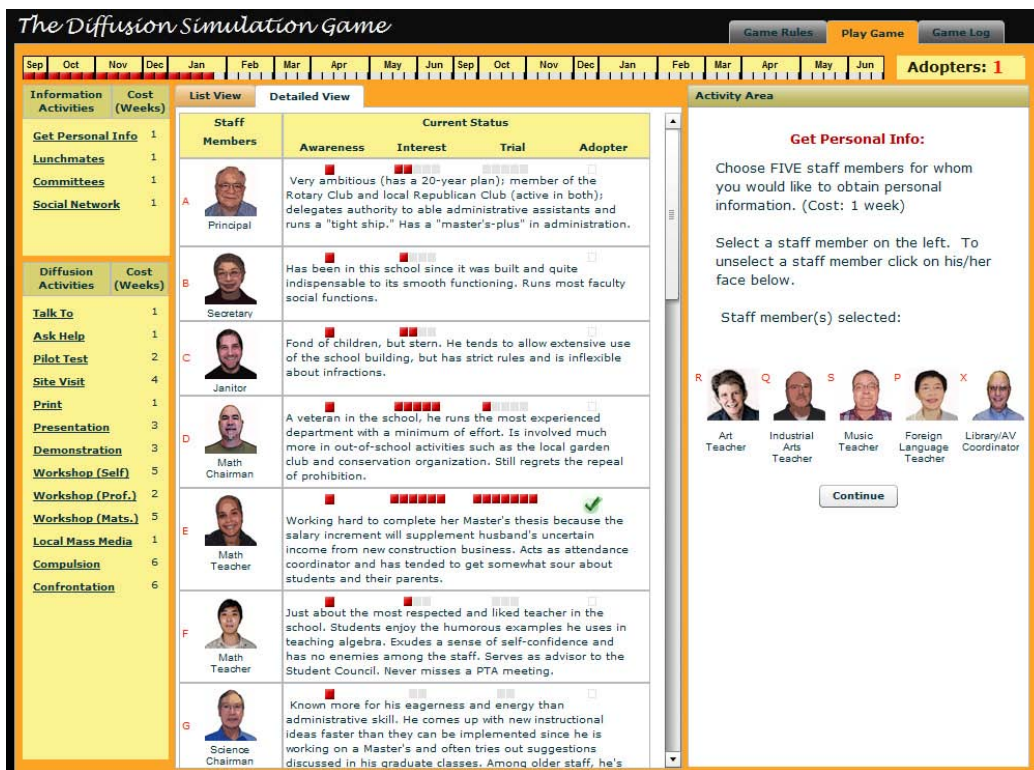
Figure 6. Final digital prototype: Detailed View

Moreover, the designers also decided to add more graphics, including the face of each of the staff members for the players to associate with a person's title, to make the game more appealing. The first set of faces was created

using an online commercial product called SitePal which specializes in the design of virtual avatars. However, for the release version of the new online game, the designers have decided to use cartoon (posterized) versions of pictures from real faculty, staff and students. The faces of the staff members along with their personal description are included under the "Detailed View" (Figure 6).

In conjunction with the UI design of the "Play Game" tab contents, a designer started working on the design of the "Game Rules" tab. Simultaneous work on the UI of both tabs was possible thanks to the use of Flex components, which are modular and easily combined into the final application.

In the first online version, the "Game Rules" tab consists of a single page. Given the goal of reducing scrolling, the designers decided to divide the content into five different subsections, each being displayed after clicking on the corresponding button on the left side of the screen (Figure 7).
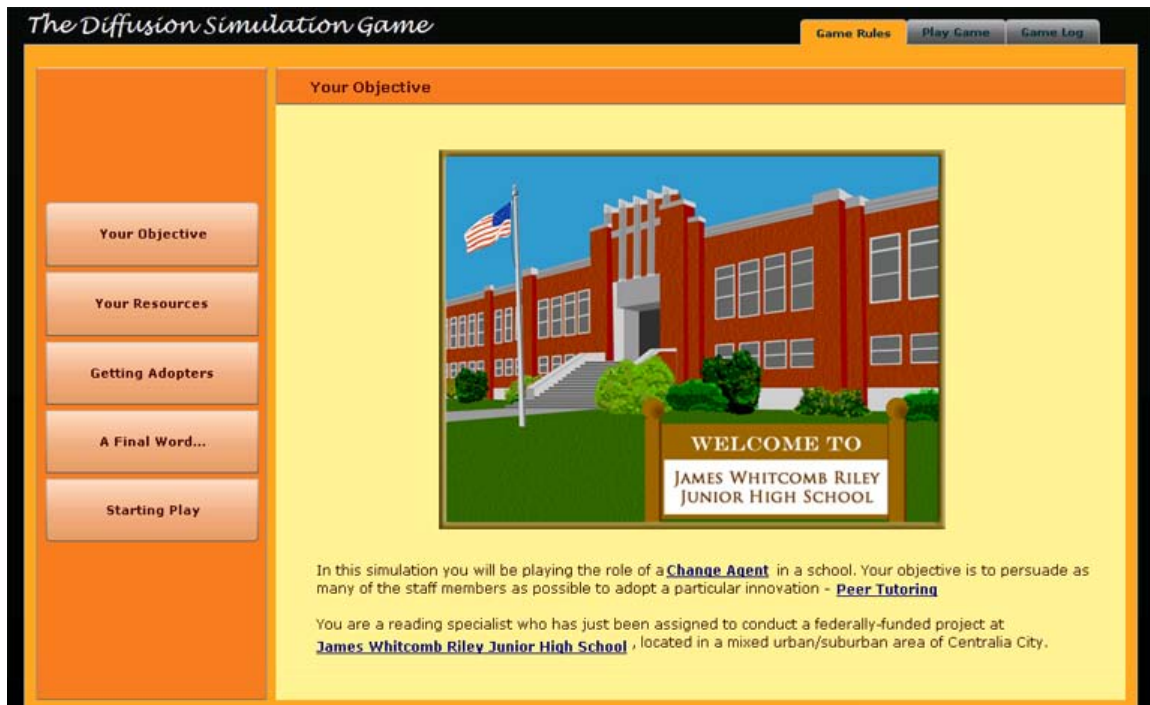
Figure 7. Final digital prototype: Game Rules tab

Back-end Development

Once the UI design was completed, the designers created the database structure using an Entity-Relationship approach that would allow to: 1) store logs for successive game plays 2) make it easy to insert new content for different settings and languages 3) make it easier to maintain, grant licenses and collect license fees; and 4) add levels of difficulty to the game. The database used was the open-source DBMS MySQL. It was chosen mainly because most designers were already familiar with it and they were certain that it was going to handle the data to be stored without any issues. Furthermore, this database was already being used for other projects within the department and there was no need to install a new database server.

The designers used the Model-View-Controller architecture for the development of the DSG. The model consisted of model objects using PHP, the view consisted of the Flex user interface, and the controller consisted of the ActionScript programs and their corresponding calls to PHP programs which ultimately communicated with the database to retrieve and store data.

In order to be able to determine if learning is promoted by playing the game, the designers analyzed the player-game interactions that needed to be collected as evidence for assessment. This process of identifying relevant interactions and creating mechanisms to collect and store data is similar to the "information trail" suggested by Loh (2008). The designers then plan to use MAPSAT methods (Frick, Myers, Thompson, & York., 2008) to analyze the data gathered to determine the presence of patterns in the strategies used that result in either gaining many adopters (expert play) or few adopters (novice play).

Usability Testing

       Testers. The designers used convenience sampling to recruit the testers for the usability testing. A total of seven persons were recruited: six of them were female and one male. Three of the females were doctoral students in different areas in the School of Education. Most of the participants were Americans except for two who were from Turkey.

       Requirements in recruiting testers were:

1) They should not have played any version of the DSG before.
2) They should not be familiar with diffusion of innovation theories.

       The usability tests were conducted on an individual basis, with each designer taking the role of observer while a tester was playing the game. Testers were encouraged to use their own computers or laptops to avoid any disadvantages resulting from using unfamiliar technology (one-button mouse, operating system, etc.). They were informed that the usability test could take up to two hours and that they could take as many breaks as they needed during that time. They were also asked to think aloud (Preece et al., 1994) while playing the game. They were not helped during the game unless it was absolutely necessary.

       There were no specific questions or tasks that testers had to complete during the usability test. They were only asked to play the game and to think aloud as they interacted with the game. The observer took notes and occasionally prompted the tester to think aloud while playing.

       After completing the game, the testers were asked the following questions:

- Was it difficult for you to play the game?
- Was it difficult for you to navigate in the game?
- What would you do differently if you were to play the game again?
- Is there anything you would suggest to improve your game experience?

       Usability test results. After completing all usability tests, the designers met and discussed their findings. Each designer described the issues or problems that the testers had as they were playing the game. For each issue or problem identified, the rest of the designers confirmed if they had experienced something similar. A list of the issues along with the number of times it was observed across multiple tests was created. The list of issues was then grouped into two categories: game mechanics and user interface.

       Game mechanics:

- Testers needed to invest five to ten minutes to understand the rules of the game.
- Testers were uncertain about which staff members had become adopters.
- Testers assumed that they would be allowed to select personal information for only five staff members during the entire game instead of during a single turn.

       User interface:

- Some game sections were unnoticed by the testers such as "Detailed View" and "Game Logs."
- Testers were not always sure which staff received points (did not see red boxes get filled when points were awarded after reading feedback).
- Testers wondered if it cost one week each time they clicked on the link to see a diagram.
- Feedback contains letters to refer to staff members, but users were not sure what their role is without looking to the left and possibly scrolling.
- Some testers did not know what a "Home Ec Teacher" is.
- Testers wanted to display more than one diagram at a time but could not.

       Regarding the game mechanics issues identified, it is worth mentioning that usability testers were not given any information about the diffusion of innovation theory before playing the game. This might be unrealistic in real game play because some of the players who will access the game most likely would have already studied the theory. Nevertheless, these findings clearly expose a strong weakness in the game: it takes too long for players to understand the directions and objectives of the game. Potential players could be easily discouraged from playing the game if this issue is not addressed. Alternative solutions consist of revising the Game Rules section to provide a clearer and more streamlined version of the directions; adding just-in-time information in the game interface; providing hints on an as-needed basis, based on the player's interaction; creating a concise video tutorial.

       The user interface issues detected made the designers realize the usefulness of usability testing as an ongoing part of the design process. Addressing the issues detected by the testers will help to improve the game's usability.

Future Work

So far, the designers have completed the front-end and back-end design of the DSG v. 2.0. The usability testing conducted was mainly to test the front-end—i.e., the interactions of the players with the UI. The back-end stores information about all of these interactions, allowing players to resume their games.

The next task is to recruit more testers to play multiple games and to analyze the data collected using MAPSAT (Map & Analyze Patterns & Structures Across Time) to verify if learning about the implementation of effective diffusion strategies is actually occurring. Version 2 of the DSG will allow us to conduct further research about student learning while playing the game. Measuring whether or not learning is occurring through playing educational games or simulations can be challenging (Bredemeier & Greenblatt, 1982; Dempsey, Rasmussen, & Lucassen, 1996; Hays, 2006; cf. Thiagarajan, 2003). In the case of the DSG, if the total number of adopters obtained by the same student across multiple game plays has increased, we are assuming that some kind of learning has occurred. Whether this learning is consistent with Roger's theory of diffusion of innovations is something that we plan to investigate. We intend to do this by use of MAPSAT to study patterns of diffusion activities chosen by players who are highly successful ("experts" who get everyone or nearly everyone to adopt) compared with players who only get some of the adopters ("non-experts").

Given the flexibility in the new back-end design, future DSG versions will include different levels of difficulty and multiple language support; we are also exploring the possibility of creating a version using a business context.

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Time-Saving Online Course Tools and Features that Promote Self-Regulation, Minimize Extraneous Cognitive Load, and Support Learning Community

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This paper describes content-independent online course communication tools and features designed to minimize extraneous cognitive load (ECL), support self-regulation (SR) and promote the learning community. Online course communication tools and features can enable an instructor to help learners more efficiently; they allow learners to spend less time and effort locating, organizing, accessing, distributing, and retrieving course information. Job aids and procedure templates to easily incorporate online tools and features designed to mitigate ECL and facilitate SR allow instructors into their existing online courses. Furthermore, online features and tools consistent with CL and SR design principles passively promote the course learning community in small but significant ways. Example job aids and templates designed and developed during an iterative, formative evaluation of instructor training (Ley, 2009) which applied an instructional development methodology (Richey & Klein, 2007) are included and discussed. The training development process study confirmed that faculty online communication problems may be addressed by job aids and procedure templates derived from CL and SR theory. Instructors may use job aids and templates to structure SR support, to minimize ECL, and to promote learning community.

Extraneous Cognitive Load, Self-Regulation, Learning Communities and Learning

SR, ECL and learning community research and theory have important implications for online learning. Research results are consistent with the instructional implications of the corresponding theory and associated corroborating research. The three phenomena synergistically interact to contribute to online learning. ECL impedes learning and can obstruct learning community participation; instructional features and tools that support SR and minimize ECL also may contribute to learning community participation. Three Online Learning Influences CL, a learner's mental effort and cognitive resources expended when learning (Paas, Renkl, & Sweller, 2004; van Merriënboer & Ayres, 2005) is inherently greater in online courses than in on-ground courses because the online interface imposes ECL not required in face-to-face (f2f) instruction; computer-mediated communications require more skill and effort than do f2f interactions. Of the three CL categories associated with learning; germane, intrinsic, or ECL (Gerjets, Scheiter, & Catrambone, 2004); ECL is most problematic for instruction and especially online instruction. Whereas germane CL engages learners in creating new schemas and intrinsic CL is a function of the number of elements a learner must understand (Gerjets, Scheiter, & Catrambone), only ECL undermines rather than contributes to learning (DeLeeuw & Mayer, 2008) and only ECL increases with less than optimal design (van Gog, Paas, & van Merriënboer, 2004). On the other hand, minimizing ECL associated with online information and communications simultaneously encourages SR and learner participation in the online learning community.

Learner SR may be defined as the self-generated thoughts, feelings, and actions for attaining educational goals and "includes. . .planning and managing time; attending to and concentrating on instruction; organizing, rehearsing and coding information; establishing productive work environment and using social resources effectively. . . it involves self-efficacy, outcome expectations, task interest or valuing, a learning goal orientation, and self-satisfaction with one's learning and performance" (Zimmerman, 2004, p. 139-140). SR foments academic success and differentiates the more effective learner from the less effective one. Instructional SR support has increased learner SR activities (Butler, 1998) and improved their learning (Lan, 1996). Learners can become self-regulated through teaching and instructional activities (Osman & Hannafin, 1992; Zimmerman, 2002). Several studies have "provided concrete evidence that [self]-regulation strategies may be embedded within instruction" (Osman & Hannafin, 1992, p. 88) and "each self-regulatory process or belief such as goal-setting, strategy use, and self-evaluation can be learned from instruction and modeling" (Zimmerman, p. 69). Thus the instructor who models SR and provides SR support within an online course encourages learning. Minimizing ECL and encouraging SR contributes to efficient online communications, an essential attribute of an online learning community.

Learner communications, the cornerstone of an online learning community, are the quintessential form of online participation. Online learning communities depend upon each learner's ability to participate. Two conditions affect an online learner's participation ability, his or her web-based self-efficacy and online course design. Web-based self-efficacy "refers to a learner's beliefs about his or her capabilities in using the functions of the [virtual learning community] website" (Chen, Chen, & Kinshuk, 2009, p. 135). Web-specific self-efficacy positively and significantly affected 400 college students' intentions to share knowledge within a learning community. Therefore

"cultivating learners' capabilities . . . in a virtual learning community can help them not only learn more efficiently, but also learn 'how to learn' . . . [and] prerequisite training for using the [learning community] website functions . . . is also required" (Chen, p.144). Although online learning communities may arise spontaneously, they may also be shaped by design (Ke & Hoadley, 2009). Qualitative data from more than 400 online graduate students indicated "structural dimensions of the course were perceived as the responsibility of a thoughtful instructor who understood learning" and who provided a "clear course structure" that engaged learners and supported them with a coherent course framework (LaPointe & Reisetter, 2008, p. 649). Design that promotes online learning community values will maintain consistency and predictability (Snyder, 2009); "the learning environment should be consistent and predictable so that the learner can focus on the content and not the delivery environment" (p. 56). ECL-reducing and SR-supporting online tools and features unavoidably introduce consistency and predictability because they codify communication and information exchange, retrieval, and access.

Barriers to Instructor Online Participation

Online course features and tools promoting SR and minimizing ECL necessarily save time, a special benefit to online faculty. Faculty who teach online and those who demur to do so often lament the time demands associated with online teaching (Mupinga & Maughan, 2008; Rockwell, Schauer, Fritz, & Marx, 1999; Visser, 2000; Zuckweiler, Schniederjans, & Ball, 2004). When asked, faculty ranked time demands as the top online teaching challenge (Vaughan, 2007). Some online communications time requirements stem from unavoidable sources. Human physiology explains some of the intuitively justifiable discrepancy between online and face-to-face teaching time requirements. Audio interactions communicate more quickly then text given approximately 180 spoken words per minute (WPM; Colbert, 1988), 50 typed WPM; 350-450 heard WPM versus 185-300 read WPM (Fulmer, 1976); therefore, face-to-face instructor-student listening-speaking interactions take about half to one-third as much time as typical online reading-typing interactions.

Studies investigating online learning have revealed online instruction can take more time than face-to-face instruction. Online communication usually requires more time than does comparable f2f communication although the extra time grows exponentially when instructors and learners unwittingly introduce ECL. Online email communications took substantial online instructor teaching time (Zuckweiler, Schniederjans, & Ball, 2004). Online interactions demanded both faculty and learner time although, as faculty gained online experience, they adapted ways to organize and decrease email. Email may be the preferred online communications method for private, one-to-one, instructor-learner interactions because email appropriately preserves privacy for assignment feedback and sensitive discussions concerning the student's grades or other personal circumstances. On the other hand email perpetuates information exclusivity, foments redundant communications, and impedes information retrieval especially when employed for instructor-student communications devoted to enabling learners to understand, interpret, comprehend, and complete instructional activities and assignments. Email used to disseminate course instructional communications that every learner should have unnecessarily creates undesirable ECL. On the other hand, many features, tools, and procedures that decrease learner ECL simultaneously support both instructor and learner SR; instructors benefit from the same features and tools that help their learners.

Course Design and ECL, SR, and Participation

The ways in which instructors and learners display and exchange assignment and course content information either support or undermine learning and learning communities. Less than optimal course logistics and navigational design become a significant source of ECL. Features, tools, and procedures that organize information, structure communications, cue instructional relevance, time frames, and course events reduce ECL, support SR, and facilitate participation (Figure 1).
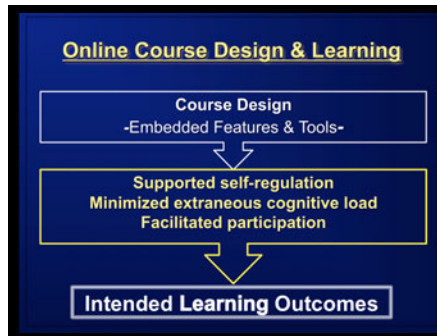
Figure 1. Online course design and learning

SR and CL instructional principles (Clark, Nguyen, & Sweller, 2006; Ley & Young, 2001) offer a framework for online course design that facilitates immediate, timely course instruction and information access, retrieval, and dissemination. Instructors using such a framework can replace unnecessarily redundant or private communications with more efficient and effective interactions. These SR and CL course features, tools, and procedures increase the ratio germane and intrinsic CL time and effort to ECL time and effort; in other words, they spend more time on teaching and learning and less time on locating, confirming, clarifying, and disseminating instructional communications and information. Communications grounded in CL and SR theory reduces online teaching and learning effort devoted to ECL and to self-regulating because they reduce the former and facilitate the latter.

SR-Supporting, ECL-Minimizing Communication Features, Tools, and Procedures

Three dedicated locations can organize most of the course communications about course content or completing assignments. The first location, a dedicated instructor message discussion board, disseminates and organizes a searchable permanent archive of instructor communications accessible to every participant. Students and the instructor have one primary place to find important instructor communications initiated during the course. A dedicated board promotes equity since everyone has continual and simultaneous access to all the instructor information. An instructor can maintain the organization and avoid ECL (Figure 2) in several ways: (a) posting all his or her text communications on the board and avoiding email or other locations for important text instructions for the class, (b) removing any student messages posted on the instructor board, and (c) including a syllabus policy about the procedures for the first two items. This eliminates most ECL incurred when students have several places to look for current instructor course communications.

Figure 2. Instructor board messages preferable to email.

One of the most effective ways for organizing and equitably answering student's assignment or content questions is to dedicate a single message board for all written student questions and comments. The instructor can maintain organization and equitable access in several ways. First, reposting every student's email question that violates your syllabus policy in a discussion board message beginning by thanking the anonymous asker and introducing the question with a comment such as "Here is a great example of a question that should be post on the dedicated students questions board since everyone should see my response." To avoid embarrassing the emailing question poser, an instructor would be wise to delete any student identifier in the email message before publishing the question on the students' questions discussion board message and responding to the private email by telling the

student, he/she will find the answer on student discussion board dedicated to their questions. To encourage course participation, students should also be able to talk with the instructor by telephone, in person, or other synchronous audio communication tools; codifying the procedure in the syllabus provides predictability and structure required for building a learning community.

A third discussion board dedicated to students helping each other allows them to ask and answer each other's questions. As with the dedicated instructor board and the student questions board, establishing the procedure for when and how students use the board in the syllabus provides predictability and structure required for building a learning community. Three dedicated discussion boards organize communications from the students, among the students, and from the instructor (Figure 3). Dedicated discussion boards organize instructional communications and thus support instructor and student SR; the instructor has all student text questions chronologically listed in one location.

Self-regulating online faculty and students monitor their progress, a critical SR process effectively supported online with two easily-embedded course features, an assignment table (Figure 4) and course home-page or announcement page reminders (Figure 5).
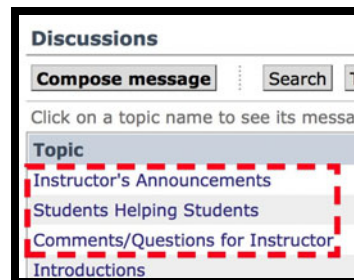
Figure 3. Three discussion boards organize communications from the students, among the students, and from the instructor.

Figure 4. Assignment Table with due dates, submission location codes & legend, points

Figure 5. Assignment Reminders preceded by month_due date

An assignment table feature displays every assignment chronologically by due date in one location accessible in the course and included in the syllabus. The first three columns, course week, assignment due month and date precede the assignment name column, coded submission location column, and total possible points column. A legend below the six-column table translates the fifth column submission codes. The assignment reminders announce the next few assignments chronologically by due date. The table and message reminders duplicate at least the next few assignments due which temporarily violates an SR principle – avoid duplicating information which potentially increases ECL for learners who take time to verify and confirm redundancy or seek to resolve conflict. On the other hand, the ephemeral messages conveniently remind online students what is next and the instructor's progress evaluating the assignment status after due date, such as, evaluation pending, points posted, feedback available, etc.

Assignment filenames, another organizing feature, label files with student and assignment idetnifiers. A syllabus policy or assignment instructions which require students to name any assignment files beginning with the student's last and first initial or last name and first initial followed by the month underscore due date organizes files (Figure 6). Intuitively named files enable an instructor to quickly locate a specific assignment for a specific student or to order all assignments with one click by the student's last name as listed in a grade book or database. The instructor

who downloads and names assignments posted in message boards can use the same convention; for an entire class's collated assignment, the filename would substitute all for student identifier, e.g., a July 21st assignment = 7_21all (Figure 6, first file listed).

The online features described in this article work in conjunction with common online tools; together they facilitate instructor SR and student SR while minimizing ECL and promoting learning community. The features described here, by no means a definitive list, promote course communications while encouraging student progress monitoring, all important for building a learning community of self-regulating students.
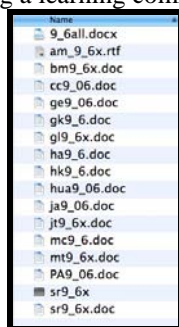
Figure 6. Assignment files named with student last-first initial and assignment due date

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Successful Desk-side Training:
A P.R.I.M.E.R. for designing effective synchronous online professional development for faculty

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Abstract: Online professional development offers faculty opportunities to keep abreast with evolving technology developments in times of tightening budgets and hectic schedules. The College of Education at the University of Hawaii has been offering synchronous online webinars utilizing ElluminateLive!, a voice-over-IP (VOIP) conferencing tool, which enables faculty to participate in workshop sessions from any location with an Internet connection. Data collected from these sessions has resulted in a collection of lessons learned or a PRIMER for designing effective synchronous online professional development for faculty.

Introduction

As technology increasingly becomes an integral part of every day life, universities and their faculty strive to keep abreast with evolving technological developments. Traditionally, face-to-face (F2F) workshops are a common and familiar form of professional development (PD) to help faculty learn about new technology. However, F2F workshops are inconvenient and often do not happen as intended. Most faculty already feel overwhelmed with the pressures of having competing demands on their time for teaching, research and service activities. Additionally, F2F workshops take many personnel hours to plan and staffing to deliver. The other problem is that of locating physical facilities to conduct these workshops. In these times of budgetary crunch, both personnel and physical facilities required to organize F2F workshops have become scarce resources.

In response to these challenges the College of Education at the University of Hawaii at Manoa (COE) has been offering online faculty PD sessions or "webinars" utilizing the voice-over-IP (VOIP) web conferencing tool, ElluminateLive!. In June 2005, the COE purchased annual licensing for the use of the ElluminateLive! web conferencing system which essentially allowed it to extend its classrooms into a system of virtual classrooms. ElluminateLive! also allowed the COE to port its PD training to a distributed audience via webinars (web seminar). These synchronous online webinars allow faculty the ability to participate in workshop sessions from any location with an Internet connection. The webinars attracted a wider audience because faculty could participate from the comfort of their offices or homes.

Background

Traditionally, most online courses are delivered predominantly via asynchronous technologies (Waits & Lewis, 2003). This could be due to the high cost of as well as the challenges involved with implementing synchronous technologies. However, Repman, Zinskie, and Carlson (2005) contend that the use of synchronous technologies can increase meaningful interactions in online courses.

In addition, Collis (1996) presented four major benefits of using synchronous systems for instruction – motivation, good feedback, telepresence and pacing. According to Collis, synchronous systems motivate learners to keep up with their peers and provide quick feedback as well as facilitate group decision-making activities. Additionally, the real-time interactions provided by synchronous systems encourage online community building and discipline in learning as well as help students prioritize their learning.

While F2F delivery has been a traditional method for faculty PD workshops, in times of tightening budgets and over-extended schedules new strategies are needed to encourage faculty to participate in voluntary PD sessions.

The compelling advantages of a synchronous system make it an ideal mode of delivery for faculty PD workshops. Recognizing this, the COE has been offering online synchronous PD session for its faculty utilizing the voice-over-IP (VOIP) web conferencing tool, ElluminateLive!

Method

From Fall 2005 to Spring 2007, the COE organized fifteen webinars which were attended by a total of 224 participants. Example titles from the webinar series include "Podcasting for Educators, "Open Source Software: Introducing OpenOffice.org", "The Changing Landscape of Library Resources," and "Making the Shift to Online Education – Panel Discussion" among others. Webinars typically lasted an hour and took place on weekday mornings when faculty were more often available. While expressly advertised to the COE faculty, COE students or faculty expressing interest from other colleges were allowed to participate.

The delivery tool ElluminateLive! uses VOIP technology to create a synchronous "classroom" in which participants hear and speak to each other in real time and can view and interact on a whiteboard. The tool also features a text chat window. When using ElluminateLive!, COE webinars typically feature a presenter introducing a new technology or technique through a mix of web tours, PowerPoint slides displayed on the whiteboard, and sharing of their own desktop for demonstration. Each webinar is recorded, archived and made available online for access or review at a later date through an online archive.

Webinars were organized by the College's instructional designer responsible for faculty professional development. In preparation for each webinar, the designer was responsible for a number of organizational tasks including identifying and inviting guest presenters, advertising the webinars through the COE website and faculty email list, handling email registrations, and doing a practice run with the presenters. During the webinar, the designer acts as a host and moderator by facilitating introductions, describing the session's protocol, relaying participants' questions from the chat window to the presenter and keeping the session on time. After the webinar the designer points participants to an online post-webinar survey evaluation and sends the link to the session's archived recording to the College via email.

Results

Webinar evaluation survey data revealed that faculty highly rated items referring to ease of use, interface and interactivity when evaluating ElluminateLive!. As shown in Table 1, one hundred percent of participants reported that overall they like using the Elluminate Live! system.

Table 1. Percentages of webinar participants who agreed or strongly agreed on evaluation items (n=224)

Item	
This webinar has motivated me to try what I learned.	95%
The material covered in this webinar is useful to me, personally.	87%
The material covered in this webinar is useful to me, professionally.	94%
I am satisfied with the knowledge and skills gained from this workshop.	94%
I find the Elluminate Live! system easy to use.	98%
The interface of this system is pleasant.	97%
I find the system to be very interactive.	98%
Overall, I like using the Elluminate Live! system.	100%

In addition, faculty appreciated the physical convenience of the webinars as evidenced by the following quotes:

"This type of session is helpful to get a sense of what's out there while not venturing too far from one's own office. I appreciate the access and convenience of the technology."

"I had a chance to participate in my own office rather than go to another classroom. That convenience was great and like students taking advantage of online technology, I could do the same."

They also positively commented on the convenience of the webinars being recorded and archived:

"I plan to go through the presentation more thoroughly, so I am glad the webinar is archived."

I appreciate being able to enter half way through the webinar and listen into the discussion and then go back to replay the archived presentation"

By organizing these webinars, the COE leveraged the ElluminateLive! system to expand and extend its PD offerings to its constituents, not only in Hawai'i but throughout the Pacific:

"This is such an important connection for us to be able to connect via Elluminate for training sessions while we are in Am Samoa. It means a great deal to us to be included! Thanks."

When examining participants' reactions to the webinar sessions for specific indicators of success, categories of best practices became evident. The categories and examples of corresponding comments are listed in Table 2. Category development and further consideration of evaluation data led to the development of the PRIMER for designing effective synchronous online professional development for faculty.

Table 2. Participant comments in categories of best practice

Planning and Organization
"Great job coordinating this event"
"Great presentation. Very well organized"
Preparation and Rehearsal
"Chris [presenter] was well-prepared, and the session was paced just right, even for a beginner like me."
Moderation and Interaction
"Thank you for this informative and interactive presentation. The examples and demonstrations on the exemplary web course were excellent – it has me wanting to re-vamp my online courses. Great ideas"
"Donna [presenter] and Peter [moderator] did a good job of enabling the participants to use it [Elluminate Live!] actively"
"Great job on the podcasting webinar! It was very organized and the presentation went through smoothly. I've seen a few online workshops that experienced a lot of technical problems or there was a long delay in starting the workshop. But today's webinar was great! It started right on time. I also liked the orientation that Peter gave in the beginning of the webinar. I found it very useful and informative because this was the first time that I have participated in a webinar on Elluminate"
"The introductory comments/orientation about using Elluminate and the individual assistance for new users was very helpful"

Lessons Learned/Recommendations

The PRIMER for designing effective synchronous online professional development for faculty has emerged from the examination of data collected from fifteen, systematically designed COE webinar sessions delivered over two years.

PRIMER is an acronym for Plan, Rehearse, Interact, Moderate, Edit and Repeat. Based on

- **Plan**. There are a number to planning techniques that can make a presentation go more smoothly. Discuss with presenters how synchronous time might be spent most efficiently. Some have found it beneficial to give "homework" prior to a session to cut back on time spent presenting content and allowing for more time for discussion. Design and distribute a "Online Session in Progress: Please Do Not Disturb" sign as a pdf file that participants can post on their door when in the session. Encourage participants to log in 15 minutes early to test their audio connections prior to the session.
- **Rehearse**. Rehearse all sessions regardless of how savvy the presenter may be with the technology or expert they may be with the content. Rehearsing a presentation with the specific technology that will be used, for example the computer from which the presenter will be broadcasting, gives an accurate picture of how the tools will function "live" as well as the length of the presentation. Recording the presentation and providing the presenter with access to the recording allows them to evaluate aspects such as timing and voice from an objective standpoint.
- **Interact**. Incorporate as much interactivity into presentations as possible to keep participants engaged. Recommendations include posing questions and using the polling tool to display results, encouraging audio and chat comments from the audience, and using the whiteboard text and drawing tools for collaboration during a session.

- **Moderate**. Making presenters and participants comfortable in any new tool is critical. As a session organizer act as a "broadcast host" and welcome participants as they enter the session, ask each to test their audio and troubleshoot with them prior to the session's commencement, and keep participants abreast of when session will begin. Introduce the session and explain behavioral protocol. For example, "Questions are welcomed throughout the presentation. However in order to respect everyone's time, please type your questions in the chat window and they will be answered at the end of the presentation." Track questions as they appear in the chat and relay them to the presenter at the end of the session. Discuss protocol with presenter prior to session and encourage
- **Edit**. Presentations can feel quite lengthy for participants. Advise presenters to edit their presentations to their most concise versions in order to keep presentations short. One hour has been a successful amount of time for professional development. Start and end sessions on time. Presenters and participants appreciate your respect for the time of those who have arrived on time.
- **Repeat**. As with any instructional design process, consistency is important. Following these steps for every presentation will assist with making it a success.

Conclusion

Online PD offers a number of solutions to the challenge of declining budgets and time constraints, however as a relatively new PD method, knowledge of how to effectively design for this delivery medium cannot be assumed. Practitioners need practical, tested knowledge to complement their instructional design process when designing for online environments. It is our sincere hope that the PRIMER, a collection of lessons learned for designing effective synchronous online PD for faculty will assist others in the design and development of successful online faculty PD programs.

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Teacher Candidates' Knowledge Development in a Pedagogical Laboratory

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Introduction

In 2002, U.S. Department of Education published Visions 2020 (U.S. Department of Commerce, 2002), an anthology of articles describing educational leaders' visions of how advanced technologies may transform education. The articles depict a picture of children engaged in problem- and project-based learning in authentic, technology-enhanced virtual environments. Today, these visions still seem far-fetched science fiction to many teachers. Despite the investment in education technology (U.S. Department of Commerce, 2002), current use of technology in many schools is still limited to the application of basic computer tools to support traditional approach of teaching (Bauer & Kenton, 2005; Cuban, Kirkpatrick, & Peck, 2001; Ertmer, 2005). U.S. Department of Education is calling for a drastic change in schools to fulfill the vision. One of the action steps in the National Education Technology Plan 2004 (The United States Department of Education, 2005) is teacher training. As Ertmer (2005) argues, many of the conditions for technology integration already exist, the final barrier to technology integration are teachers' beliefs. Teachers have already developed a stable system of knowledge and beliefs on teaching and learning upon entering college (Pajares, 1992). They view teaching as a process in which teachers pass on knowledge for students to memorize (Brookhart & Freeman, 1992; Richardson, 1996; Wideen, Mayer-Smith, & Moon, 1998). This belief guides their future teaching practices (Richardson, Anders, Tidwell, & Lloyd, 1991) and prevents them from adopting a constructivist view of technology integration.

In this paper, we report an analysis of teacher candidates' knowledge development in a pedagogical laboratory. The pedagogical laboratory is a setting where teacher candidates develop and try out innovative technology integration curriculum with the help of expert teachers (Brandsford, Pellegrino, & Donovan, 1999). Findings from this study may inform the design of similar programs and contribute to the understanding of how student-centered, innovative instructional activities may affect teacher candidates' knowledge and beliefs.

Technological Pedagogical Content Knowledge

Technological Pedagogical Content Knowledge (TPACK) provides a framework to analyze the types of knowledge needed for technology integration (Mishra & Koehler, 2006). TPACK builds on the work of Shulman (1987), who advanced the thinking of teacher knowledge by introducing the idea of pedagogical content knowledge as a key type of teacher knowledge. Traditional notion of teacher knowledge focuses on content, pedagogy, and the intersection of the two. TPACK introduces another element, technology, into the picture. This framework categorizes teacher knowledge into seven types: Content Knowledge (CK), Pedagogical Knowledge (PK), Technology Knowledge (TK), Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), and Technological Pedagogical Content Knowledge (TPACK). CK is the knowledge of the subject matter per se. PK includes general principles and strategies related to classroom management and organization applicable to all subject areas. TK is typically the type of knowledge emphasized in training related to technology integration, which focuses on teaching teachers to use various computer hardware and software. PCK refers to the specific strategies that can be employed to make certain content comprehensible to learners. TCK is at the intersection of technology and content. It describes how specific subject matter is changed by technology. TPK refers to the knowledge of the affordances of different technological tools and generally how they should be used in teaching. TPACK is pedagogical knowledge in the context of specific content and technologies. A teacher who is good at technology integration knows how to leverage the affordances of particular technologies to teach certain difficult concepts.

TPACK has been used as a framework to understand teacher knowledge development in the context of designing technology-based lessons. It served as the codes for analyzing observation notes of activities and interactions of design teams (Koehler, Mishra, & Yahya, 2007) and provided the structure for a survey tool created to quantitatively assess teachers' knowledge development (Koehler & Mishra, 2005).

Teacher Learning in a Technology-Enhanced Pedagogical Laboratory

A technology-enhanced pedagogical laboratory was set up in a teacher education program in a southern research/teaching university to impact teacher candidates' knowledge and beliefs related to technology integration (Ma, Williams, Prejean, Lai, & Ford, 2008). The pedagogical laboratory emphasizes three key components found important in the teacher learning literature, including experience, reflection and support. Teacher candidates gain personal experiences in practicing research-based instructional strategies and acquire vicarious experiences by observing the teaching practice of their peers and expert teachers. Reflection is another key element. Teacher candidates are encouraged to reflect on their experiences. They are guided to think of themselves as scientists, who conduct experiments and reflect on the results and changes needed. This mentality may help them become reflective practitioners. In addition, instructional materials and expert teachers are available in the pedagogical laboratory to provide support to teacher candidates.

A series of studies have been conducted to evaluate the impact of the pedagogical laboratory experience on teacher candidates' knowledge and beliefs. In a qualitative study of teacher candidates' reflective journals and interviews (Ma, Lai, Williams, Prejean, & Ford, 2008), the pedagogical laboratory experience was deemed extremely valuable by teacher candidates. It gave them a new understanding of and inspiration for teaching. Teacher candidates realized how difficult but also exciting and rewarding teaching can be. The field experience also challenged some of their beliefs of teaching and technology integration.

In a quantitative study (Ma, Lai, Williams, & Prejean, 2008), an instrument, Teachers' Beliefs Regarding Technology Use Survey (TBTUS), was employed to measure the impact of the pedagogical laboratory experience on teacher candidates' beliefs regarding technology integration. Analysis of TBTUS indicates that the impact of the pedagogical laboratory experience was largely insignificant. The qualitative data suggest that changes might be incremental and TBTUS might not be sensitive to the changes that occurred after 22-hour of treatment, with only six hours of real teaching experience.

In a more recent study, researchers expanded the treatment time from four weeks to a 15-week semester (Ma, Williams, Ford, & Prejean, 2009). The treatment includes not only the pedagogical laboratory experience, but also skill development and lesson idea development for various software applications, presentation of theories related to student-centered learning, and case study analysis of how teachers use specific software applications in the classroom. Statistical analysis indicates that the pedagogical laboratory had statistically significant impact on the following beliefs: learner-centered beliefs about learners, learning, and teaching (LB-LLT), self-efficacy beliefs about technology integration (SEB), beliefs about perceived value (PV) of computers for instructional purposes.

Methods

Research Purpose and Questions

Previous research shows that a technology integration course that includes a 4-week pedagogical laboratory experience was effective in affecting changes in teacher candidates' beliefs. Yet, the impact of the pedagogical laboratory experience itself was insignificant on teacher beliefs as measured by TBTUS. However, qualitative data indicates that teacher candidates did benefit from the pedagogical laboratory experience. To gain a better understanding of what teacher candidates learned from pedagogical laboratory experience, we use TPACK as a framework to analyze teacher candidates' reflective writing after the field experience. The following two questions are addressed in the analysis:
1. How does the pedagogical laboratory experience contribute to teacher candidates' knowledge regarding technology integration?
2. Does teaching different lessons (digital storytelling vs. robotics) in the pedagogical laboratory contribute differently to teacher candidates' knowledge regarding technology integration?

Subjects

Forty-eight teacher candidates from four sessions of a technology integration course participated in the study. Twenty-eight of the pre-service teachers majored in early childhood education and 20 of the teacher candidates majored in elementary education. Each participating teacher candidates wrote two reflective journals.

Procedures

The pedagogical laboratory experience took place in the middle of the semester. It included three phases: teacher candidate preparation, laboratory experience, and reflective journal writing. It took teacher candidates a total of 22 hours over four weeks to complete. Teacher candidate preparation lasted three and a half weeks, with a total of approximately 14 hours. Laboratory experience took place on two consecutive Saturdays and lasted a total of six hours. Reflective journal writing took about two hours.

Teacher candidate preparation consisted of three main components. First, the university instructor modeled the teaching of a robotics lesson to elementary education majors and a digital storytelling lesson to early childhood education majors. The second component of teacher candidate preparation focused on providing vicarious experiences and pedagogical knowledge needed to affect teacher candidates' beliefs. Video case studies of project-based learning and cognitive apprenticeship were presented, and teacher candidates were encouraged to compare these student-centered learning environments with traditional classrooms to identify the rationale for and characteristics of student-centered learning. A list of facilitation strategies were presented to teacher candidates. The list includes not only general strategies such as questioning, modeling and providing motivational prompts, but also specific strategies to encourage reflection and guide group collaboration. Teacher candidates were required to watch video case studies from INTIME (2001) website and identify what strategies teachers used to facilitate the technology-enhanced lessons. The third component involved collaborative lesson planning. As a team, teacher candidates planned a series of robotics or digital storytelling activities for the children. Sample lessons were provided to guide lesson planning. Teacher candidates were required to consider the following in the planning phase: state and national standards, the children's' grade levels, lesson procedures, and possible facilitation strategies.

During the laboratory experience, every two teacher candidates were paired to facilitate a student-centered lesson to a group of one or two children for two three-hour field experience sessions.

During the break of the robotics program, teacher candidates took students outside to complete an educaching activity. Educaching is the use of goecaching to achieve educational goals. Geocaching is an outdoor adventure game where individuals use Global Position System (GPS) devices to find hidden caches (Groundspeak Inc., 2009). An educaching activity was added to the robotics camp, because the robotics challenges were intense for both the students and candidates; an educaching activity provided a change of pace and gave students an opportunity to take a break outside.

Teacher candidates wrote a reflective journal after each three-hour field experience session. They were required to think of a critical incident that happened during their field experience to anchor their reflection. A critical incident can be identified by thinking of an "aha" or "oops" moment that teacher candidates experienced during the field experience. It is typically a significant moment that may raise some questions or challenge one's beliefs. A three-step process display scaffold was used to guide the writing of reflective journals. In previous research, this scaffold significantly enhanced the teacher candidates' reflective journal writing (Lai & Calandra, in press).

Data Analysis

A total of 94 reflective journals were analyzed by using TPACK as a framework for coding. Each journal was assigned a descriptive code, summarizing the key idea that teachers learned from the critical incident occurred during the field experience. The codes were grouped by themes and then into categorical codes representing the different knowledge types including CK, TCK, TK, PCK, PK, TPK, and TPCK. The frequencies of the categorical knowledge type codes were entered into Excel to create a graphical representation so as to identify the patterns of teacher candidates' knowledge gains.

Findings

Question 1: How does the pedagogical laboratory experience contribute to teacher candidates' knowledge regarding technology integration?

Tables 1 shows that the pedagogical laboratory contributed to the following types of knowledge for teacher candidates who facilitated the digital storytelling lesson: PK, PCK, TPK, and TPCK. Close to

half (47%) of the reflections focused on PK. Among these reflections, about half of them were concerned with ensuring equal participation from the children. In these reflections, one child in the group played a dominant role, and the other child tended to be shy. Student teachers tried to give both children in the group an equal opportunity to participate in the storytelling activity. They reflected on the importance of this strategy. Some of them discussed the scenario at the personal level. A couple of student teachers sympathized with the children who were shy. One of them also tried to control her feelings. She wrote,

> I sympathized maybe more than I should have with her and I found myself trying to connect with her more than the other child, which as a teacher I know I can't do, I can't wear my feelings on my sleeve and I have to be able to treat my children equally."

Five of the reflections focused on strategies for managing inappropriate behaviors such as conflict between children, lack of respect to each other, and too much joking and chatting between the children. Three reflections discussed how a lesson may not run as planned and how teachers need to be flexible in changing the plan. Other reflections were concerned with giving children control and allow them to work at their own pace, working with other teachers who did not want children to handle equipment, working with children whose English is not the first language, and managing time to complete work before the lesson ended.

> Less than a quarter (22%) of the journals reflected on TPK. Seven reflections discussed the affordances of voice recording and movie making in engaging children. A candidate wrote about her experience working with two kindergarten children,

> I found that the kids participated most when they could actually see something or hear something as a result of their input. So I believe that when using technology, it works best if you can physically see or hear results. Because when they came to writing a script or coming up with a storyline, the children weren't as involved. Once it came to taking pictures and recording their voices, they were able to see how it all came together.

Candidates also reflected on the importance of giving children control when using technology.

> About one fifth (18%) of the reflections discussed PCK related to story development. Seven reflections discussed the strategies for guiding story development. Generating an idea for the story was a challenging task for many groups. Student candidates helped children develop story ideas by asking open-ended questions and analyzing sample stories. They learned that to help children generate an idea, it is important to "constantly interact with the children and to get down to their level." They found that "children learn a lot from modeling" and although story development was challenging, "with patience and gentle prompting, kids can collect their thoughts and create something special." Five reflections discussed strategies for helping children to compromise during story development. For groups consisting of a boy and a girl, it was especially challenging when the two children had totally different ideas for stories and would not compromise. They found that getting children to play with each other helped them get to know one another and made it easier for them to compromise.

> Thirteen percent of the reflections dealt with TPCK. They focused on strategies for teaching digital storytelling. To work with young children who cannot read or write, they discussed strategies such as having children draw pictures for each scene of the storyboard. They realized that the standard process of writing the script first and taking pictures second might not always work for digital storytelling. For children who already had a story idea, allowing them to take and view some pictures first actually facilitated story development. A candidate wrote, "My action in a similar situation would be to evaluate the students. If they seem to be able to handle doing things differently, and can still stay on task, I would handle the situation the same way." She reflected further," it is sometimes better to allow the student to lead you. By allowing them to provide input, and responding to that input positively, they felt as though we considered their ideas important."

Knowledge Types	Themes	Number of reflections
CK: 0		0
TCK: 0		0
TK: 0		0
PK: 26, 47%	Dealing with change of plan	3
	Ensuring equal participation	11
	Giving children control	1
	Managing inappropriate behaviors	5
	Engaging children	3
	Working with other teachers	1
	Managing time	1
	Working with ESL children	1
PCK: 10, 18%	Guiding story development	7
	Guiding students to compromise on story development	3
TPK: 12, 22%	Affordances of voice recording in engaging children and providing ownership	7
	Giving children control in using technologies	5
TPCK: 7, 13%	Strategies in teaching digital storytelling	7

Table 1: Coding summary for teacher candidates who facilitated the digital storytelling lesson

Table 2 shows that teacher candidates who facilitated the robotics lesson also gained knowledge in the following categories: PK, PCK, TPK, and TPCK. About 38% of the reflections were related to PK. Five of the reflections focused on ensuring equal participation from both children in the group. They cautioned themselves that they should not judge students based on whether they wanted to take over or not.

> One thing I learned was that students often take over and don't even realize it. Student one wasn't doing all the work on purpose and student two wasn't being lazy. It was the fact that both of these students were fully capable and one was simply more interested in the other. With this reason in mind, I had to realize that sometimes you need to nicely let students know to take turns and encourage them to work together.

Three reflections focused on addressing inappropriate behaviors such as getting off track, having conflict with each other, and failing to follow safety instructions. Two reflections were concerned with the strategies for dealing with interruptions from observers. Another two reflections discussed how teaching the lesson improved candidates' knowledge about the learners. They were amazed how students developed a scavenger hunt game on their own after completing educaching. Writing the reflections provided candidates with an opportunity to assess their own knowledge of robotics. Two reflections described how they were intimidated by children's ability and felt unprepared. They discussed the need to better prepare themselves, but also realized that sometimes children know more than teachers and teachers can still ask probing questions to lead students into deeper discussion. One journal reflected on the strategy of constantly monitoring time spent for the project and adjusting activities accordingly.

Knowledge Types	Themes	Number of reflections
CK: 0		0
TCK: 0		0
TK: 0		0
PK: 15, 38%	Dealing with interruption from observers	2
	Ensuring equal participation	5
	Knowledge of children's ability	2
	Managing inappropriate behaviors	3
	Managing teachers feeling of inadequacy	2
	Managing time	1
PCK: 2, 5%	Teaching mathematics	1
	Working with a child who was engaged in the storyline	1
TPK: 5, 13%	Affordances of microscope and geocaching in engaging children	5
TPCK: 17, 44%	Strategies to guide students to program the robot	14
	Engaging children in the robotics activity	3

Table 2: Coding summary for teacher candidates who facilitated the robotics lesson

About 44% of the reflections focused on TPCK. Fourteen of the reflections dealt with strategies for guiding students to program the robot. Teacher candidates learned that when students encounter a programming problem, it is important to allow student control and let them try out their solutions. Teachers should provide guidance for their experiments and encourage students to learn from failures. One candidate reflected,

> I think this also goes back to science and the scientific method. The students must form a hypothesis and test it. They are then taught that testing and retesting is important for learning new concepts. I learned that students learn best from performing tasks themselves.

They also practiced unique strategies such as designing a dance for the robot by actually having the children in the group dance themselves. This strategy was motivating and fun to the children. Student teachers reflected that it is important to be creative and to try "a variety of teaching strategies" in the lesson.

Thirteen percent of the reflections were concerned with TPK. They were accounts of affordances of microscope and geocaching. The robotics activity involves the use of microscope. Teacher candidates found that having children use the microscope in the middle of the robotics activity re-engaged them when they were tired.

Five percent of the reflections were related to PCK. One reflection discovered that there were different ways of figuring out a mathematics problem; teachers should allow children time to explore the problem themselves before giving out the answer. Another reflection discussed the importance of embedding a story in the robotics activity. A child in the group was pretending to be in the situation described in the story and was motivated to complete the tasks.

Question 2: Does teaching different lessons (digital storytelling vs. robotics) in the pedagogical laboratory contribute differently to teacher candidates' knowledge regarding technology integration?

Figure 1 shows that both lessons contributed to teacher candidates' knowledge related to PK, PCK, TPK, and TPCK. In both lessons, the reflections focused heavily on PK. In the digital storytelling lesson, candidates seemed to gain more knowledge related to PCK and TPK; whereas in robotics, candidates reflected more on TPCK.

Knowledge Types
(Digital Storytelling and Robotics)
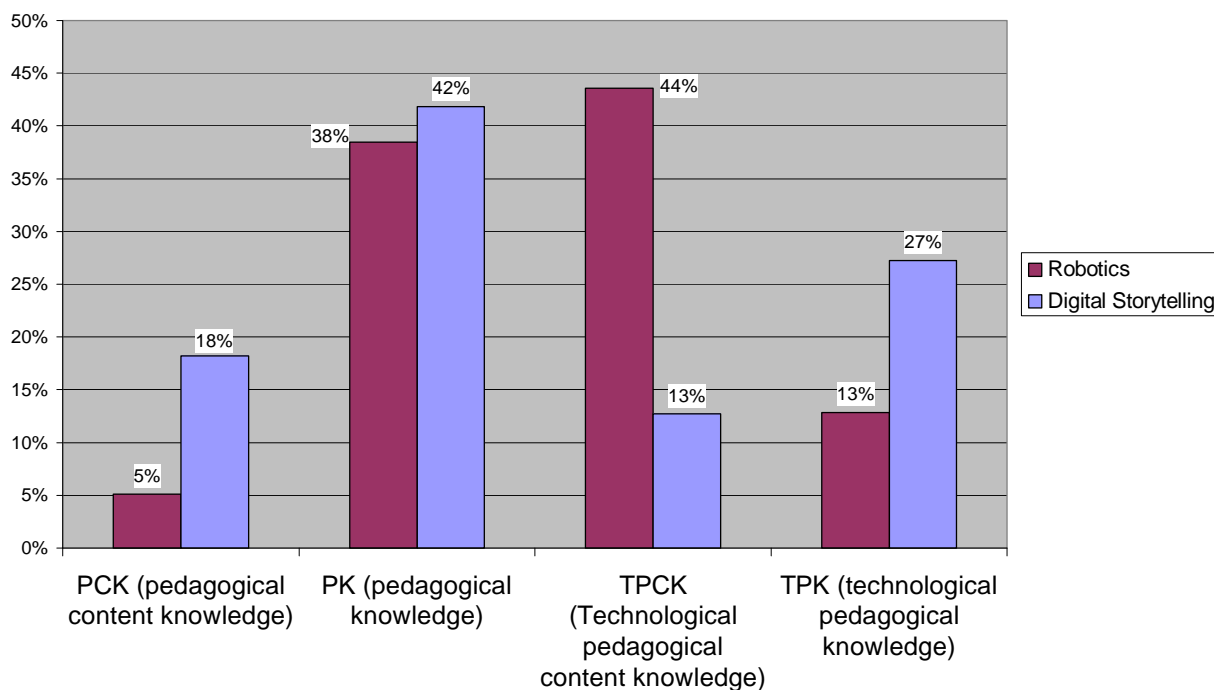
Figure 1. Contribution of the digital storytelling and robotics lessons to candidates' knowledge

Discussions

This study found that the pedagogical laboratory experience contributed to teacher candidates' knowledge regarding pedagogy and the intersection of pedagogy with content and technology. This is not surprising, because the focus of the pedagogical laboratory was teaching; candidates had to use various pedagogical strategies related to teach specific content using technology. The pedagogical laboratory might have also enhanced candidates' knowledge in the area of TK, because teachers' self-efficacy beliefs related to technology use improved significantly after the semester in which the pedagogical laboratory experience took place. However, the reflections were not a good assessment of this type of knowledge, because the reflection writing scaffold used in this study asked candidates to focus on the critical incidents during the field experience and these incidents tended to illicit reflection of pedagogical strategies in the context of a certain subject matter and technology rather than content and technology themselves. This study shows to researchers that the reflection of critical incidents in real world teaching experience may serve as an effective assessment tool of teachers' acquisition of PK, PCK, TPK, and TPCK.

This study confirms the value of the pedagogical laboratory experience. The knowledge that teacher candidates gained is subtle and situational, especially those at the intersection of pedagogy, content, and technology. These types of knowledge are difficult to teach without real world teaching experience. This finding adds to the argument in the existing literature why personal experience in teaching with technology should be an essential element in training teachers for technology integration.

Interestingly, although the pedagogical laboratory experience was designed to enhance teachers' knowledge related to technology integration, many of the reflections focused on teachers' knowledge gains in general pedagogical knowledge. This is consistent with our findings in previous semesters. As discussed in our previous research (Ma, Lai, Williams, & Prejean, 2008), candidates had little personal teaching experience in practicing pedagogical strategies. Therefore, common classroom management issues became salient for them in this

teaching experience. If teacher candidates had opportunities to practice general pedagogical knowledge such as classroom management strategies prior to taking the technology integration course, they might focus their reflection more on strategies related to technology and content.

This study found that although both robotics and digital storytelling lessons contributed to PK, PCK, TPK, and TPCK, there seemed to be some differences in teacher candidates' learning in the two lessons. Robotics was more challenging in terms of technology and content. Teacher candidates' reflections focused more on how to guide students to program the robots. Therefore, candidates reflected more on TPCK after the robotics lesson. As for digital storytelling, developing a story idea was the most challenging aspect of the project, so many reflections were related to PCK. After completing the difficult task of story development, voice recording provided a relief to candidates because it was more hands-on and engaging. Therefore, quite a few candidates reflected on the affordances of this technology, which contributed to their development of TPK. Requiring candidates to teach a variety of lessons that are challenging in different aspects of pedagogy, content, and knowledge may better prepare them for technology integration in the classroom setting.

Mapping candidates' knowledge development in the pedagogical laboratory not only confirmed the value of the experience, it may also help us identify the support that should be provided to teacher candidates. Offering various types of knowledge of the potential issues that previous teacher candidates may encounter prior to the field experience may better prepare candidates to deal with the issues and learn from the experience.

This study indicated that there is a gap in the types of knowledge that the pedagogical laboratory experience impacted. In either the robotics or the digital storytelling program, an important type of knowledge, TCK was not addressed in candidates' reflections. This is not surprising, because the technology integration course focused more on technology and related pedagogy rather than content. Faculty teaching technology integration courses may work with faculty who teach content and methods courses to help candidates develop TCK and TPCK.

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Understanding the Design Research Process:
Reflections on PictoPal

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Abstract

PictoPal is the name of a technology-supported intervention designed to foster the development of emergent literacy in four and five year old children. During the iterative process of context analysis, prototype design, evaluation, and revision, design research has been conducted to gain insight into desirable program characteristics, implementation strategies and the teachers as designers of curriculum materials. To date, five prototypes have been designed and evaluated, four of which contributed to pupil learning gains after eight weeks of classroom intervention. In addition to the PictoPal intervention itself, this study has yielded design guidelines for developing and implementing software for early literacy. This paper examines the research and development processes, as well as the results, in light of an existing model for design research.

Introduction

To explore how to use and apply emerging theories on learning and instruction, design studies are increasingly being used; these tend to emphasize the whole cycle of scientific inquiry, often involving sub-studies and analysis cycles throughout the stages of problem identification, hypothesis (re)forming, treatment development and testing. Design studies require interaction and collaboration between researchers, teachers, and other stakeholders. This paper speaks to a fervent call for design researchers to share their emerging insights on how to conduct design studies and communicate the results. Following a brief description of design research, several existing models for design research are discussed; and the model used to describe this study is presented. Thereafter, each element in the model is illustrated through the PictoPal case. The paper concludes with reflections on the PictoPal research in particular, and design research in general.

Design research

Momentum

According to Barab and Squire (2004), design research is "a series of approaches, with the intent of producing new theories, artifacts, and practices that account for and potentially impact learning and teaching in naturalistic settings." The field of design research has been gaining momentum, particularly in educational studies, over the last decade. In special issues of highly respected journals, the need for attention to be given to design research was demonstrated: *Educational Researcher* (2003, 31(1)), *Journal of the Learning Sciences* (2004, 13(1)); *Educational Psychologist* (2004, 39(4)). Books devoted to the topic examine design research conceptualization (van den Akker, Gravemeijer, McKenney, & Nieveen, 2006b), methodological considerations (Kelly, Lesh, & Baek, 2008), and even guides and tools for conducting design studies (Richey & Klein, 2007). While many of the publications are associated with the Science, Technology, Engineering and Mathematics (STEM) disciplines, one volume looks specifically at applications in language and literacy research (Reinking & Bradley, 2008). Across the different publications on design research, three main motives for using this approach are evident: Increasing the relevance of research; developing empirically-grounded theories; and increasing the robustness of design practice.

Characteristics

Design studies vary along with the research and design aims. Some studies set out to validate and develop learning theories; others focus more on developing practical solutions to educational problems; and yet others are geared more toward widespread adoption of new curricula (Nieveen, McKenney, & van den Akker, 2006). Despite these differences, there seems to be some degree of consensus on characteristics of design research. Wang and Hannafin (2005) describe design research as pragmatic; grounded; interactive, iterative, flexible; integrative; and contextual. According to van den Akker, McKenney & Nieveen (2006a), design research may be characterized as interventionist; iterative; process-oriented; utility-oriented; and theory-oriented. In their book about design research in the domain of literacy, Reinking and Bradley (Reinking & Bradley, 2008) delineate seven characteristics of design research: intervention centered; theoretical; goal-oriented; adaptive and iterative; transformative; methodologically inclusive and flexible; and pragmatic.

Models

Several different models for design research have cropped up in literature. The *Osmotic Model*, offered by Eljersbo et al (2008), depicts the design cycle parallel to elements in the research cycle. The authors point out that both cycles depart from the problem and would ideally run simultaneously, but state that this ideal is often not the case. Bannan-Ritland and Baek (2008) have developed the *Integrated Learning Design Framework*, which depicts four main stages and across those, 14 steps, in a combined approach to research and development. Along with the process model, guiding questions for research and examples of applicable methods for each main phase are given. Reeves (2000) offers a minimalist model that highlights four main phases of design research: problem analysis; solution development; iterative refinement; and reflection to produce design principles. He compares these phases to the four phases of predictive research. In contrast to the aforementioned three models, McKenney, van den Akker and Nieveen (2006) offer model which is more conceptually-oriented than process-oriented. This model depicts tenets guiding a research and development cycle, situated in a particular context, yielding three main outcomes: professional development of the participants; the designed intervention; and design principles. In addition to these visual models, Gravemeijer and Cobb (2006) describe important steps in the three main phases of their work: preparing for a design experiment; conducting a design experiment; and retrospective analysis. Finally, Reinking and Bradley (2004) pose six questions as a guide for conducting formative experiments, relating to: pedagogical goals; classroom intervention; factors affecting the intervention; modifications to the intervention; unpredicted effects of the intervention; and changes in the instructional environment due to the intervention. Each of these questions is tied to a characteristic of design research, as cited in the previous paragraph.

Building on the previous models, McKenney, Reeves and Herrington (in press) offer a model which depicts the research and development activities and outputs, along with how those interact with practice. In this model (see Figure 1), the research and development activities are shown in the three squares; the two outputs are the final intervention and design principles; and the interaction with practice is shown to increase over time, as mature designs warrant larger scales of implementation and diffusion. We use this model to describe the design research approach of PictoPal. The following section describes how each element in the model was undertaken in the PictoPal case.
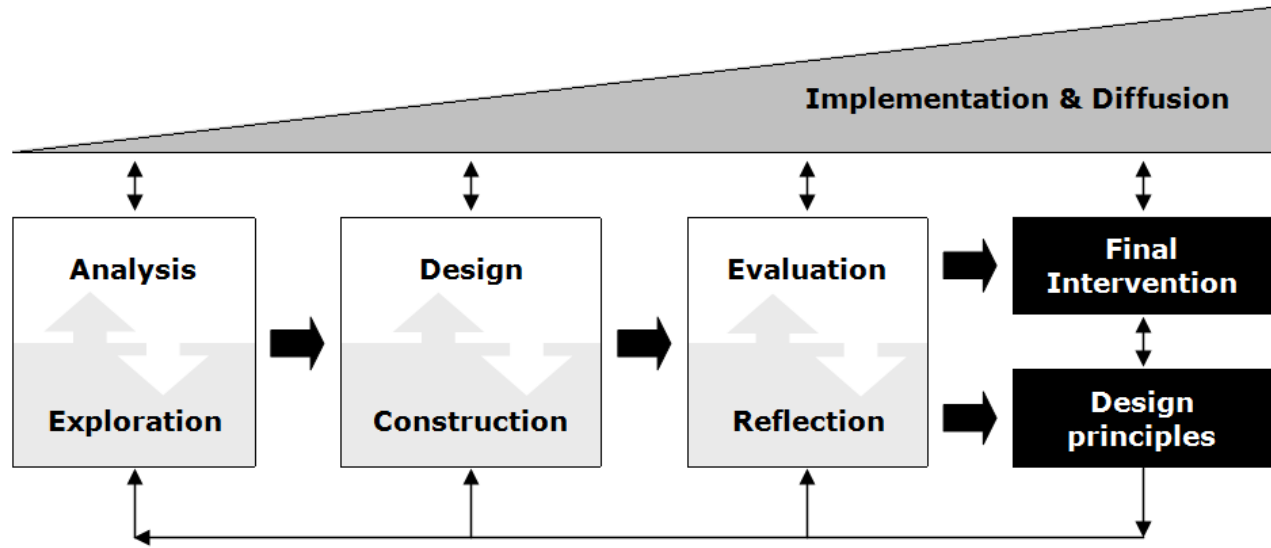
Figure 1: Design research model (McKenney, Reeves & Herrington, in press) used to describe PictoPal

PictoPal as design research

Research and development

Phase 1: Analysis and exploration. Recent increased interest in early literacy has been evidenced by the growing trend to set state standards for the literacy development of young children (Neuman & Roskos, 2005) and the call for teacher professional development to meet the corresponding curricular demands (Strickland, 2003). In the Netherlands and abroad, the implementation of early literacy standards in educational practice proves demanding for teachers. At the same time, teachers in general and of this age range in particular struggle to introduce pedagogically appropriate technology applications. The PictoPal study set out to address these problems through the design and development of a technology-rich learning environment for the development of early literacy skills in kindergarten. To understand the problem better, a small-scale needs and context analysis was carried out. Toward generating ideas for solutions, exploration of existing knowledge, products and interested parties was conducted.

The needs and context analysis was conducted to gain a working knowledge of the kindergarten setting; teacher views on technology and literacy; learner attitudes toward technology and areas of early literacy in which (a) materials are lacking; and (b) a technology-based solution might offer added-value. In the early stages of a small scale innovation, researchers sought collaboration with schools who would not only be involved in the initial analysis, but also in the design and evaluation of the learning environment. Two local schools were selected to participate in the needs and context analysis, based on: their interest in the project; their track records in endeavors to help teachers make effective use of technology; and their commitment, as evidenced by the willingness to invest their own time and resources. Data were collected through observations during site visits; interviews with school leaders; a questionnaire administered to all teachers; and a verbally-administered questionnaire for kindergarten through first grade learners. At the same time, a literature review was conducted to gain insights into early literacy; technology for young children; and technology for early literacy. Finally, document analysis was conducted on the language curricula used in the two schools as well as the national interim targets for early literacy.

Toward generating ideas for potential solutions, two types of exploration were carried out, evolving as insights from the analysis grew: review of existing products (described in literature, in sales brochures or at conferences like the National Educational Computing Conference); and contacts were sought with practitioners and experts that could serve as 'critical friends' to the endeavour.

For detailed findings from this phase, please refer to McKenney and Voogt (2005). The list below summarizes the main findings from the first phase:
- Kindergarten setting: Most classrooms serve about 25 children and have 2-3 computers; additional computers are available in the hallways.

- Teacher views: Teachers are generally positive about the use of ICT; feel comfortable with computers and are open to learning new educational applications. They find literacy important area, but say that they concentrate most on reading; comparatively little emphasis is placed on learning to write.
- Learner attitudes: Learners are generally quite positive about the use of ICT. At school, they mostly use the computer to play games and 85% say they use computers at home, also.
- Early literacy: Children develop early literacy through positive relationships; print-rich environments; daily reading; experiences that develop phonemic awareness; play involving literary props; and firsthand experiences that expand vocabulary.
- Technology and young children: Developmentally appropriate uses of technology with young children are integrated into the regular learning environment; equitably accessible to all children; and should promote appreciation and positive social values.
- Technology for early literacy: Most existing technologies for early literacy focus on technical aspects of reading or multimedia storybooks.

Phase 2: Design and construction. The findings from the analysis and exploration phase were used to elicit guidelines that shaped the design of the PictoPal intervention. Given the existence of technology tools for reading; the lack of emphasis and tools for writing; and the national interim targets related to writing, the primary focus was determined to be: understanding the nature of written language. With this in mind, PictoPal would be designed to help children recognize (a) the relationship between spoken and written language; and (b) purposeful reading and writing. Inspired by a principal's idea to use pictograms to help children create texts, we decided to create a means through which children could 'write' and print documents with the aid of the computer. The printed products would then be used either as literary props in dramatic play, or for authentic purposes. We viewed this use of technology as a form of constructionism (Papert, 1980), where children "learn by making."

The design and development of PictoPal was guided by several sets of principles, which were derived from the analysis and exploration phase. These relate to tenets underpinning the overall endeavour (core convictions); parameters for the product (product guidelines) and heuristics for developing (process guidelines), which are summarized below:
- Core convictions
  o Children want to express themselves in print, even before they are able to read;
  o The powerful combination of images and print can help children to express themselves;
  o The computer can offer added value by helping children to focus on formulating their message rather than the mechanics of writing.
- Product guidelines
  o PictoPal should be an open learning environment that facilitates children's active role in creating written products which may be used for a variety of purposes and in authentic ways.
  o PictoPal on-computer activities should elicit dialogue and collaboration, preferably with adults as well as peers.
  o The products of PictoPal computer activities should be used in related off-computer activities, to promote print-enriched play and authentic use, and to encourage interaction and language use in meaningful social settings
- Process guidelines
  o The design of PictoPal should be conducted in cooperation with teachers to enhance the practicality of the design, and with language experts to enhance the legitimacy of the design.
  o The design of the PictoPal computer environment should be informed by usability testing so as to address the ergonomic needs of kindergarteners.

Following a developer screening of a global outline and then a paper-based prototype, five successive functional prototypes were developed. The paper-based prototype and first functional prototype contained both closed assignments and semi-open ones. A major change between the first and second working prototypes was the shift to using a commercial software package (Clicker®) to deliver the PictoPal activities. This decision was made because: it allowed developers to focus more on developing the learning content and less on developing the technology; evaluation of the first working prototype showed the closed activity types to be superfluous; and 90% of the semi-open activity functions were present in the Clicker® program.

Phase 3: Evaluation and reflection. In total, seven formative evaluations were conducted with the five functional prototypes. Across the evaluations, the following aspects were studied: pupil learning gains; pupil engagement with PictoPal; integration of on and off-computer activities; and teacher experiences as enactors or designers of PictoPal activities. The first study (A) explored the feasibility of the design of the first prototype. The second prototype was primarily designed by one teacher, the design process was the focus of study (B) and the learning gains were evaluated in the third study (C). The third prototype was used for two studies, on learner engagement, one focusing more on the off-computer activities (D) and the other on the on-computer interactions (E). The sixth study (F), conducted with the fourth prototype, focused on the integration of on- and off computer activities, and correlation to learning gains. Conducted with the fifth prototype, seventh study to date (F) examines the influence of teacher perceptions of technology as well as their beliefs about teaching and learning on the way they integrate on- and off-computer activities, as well as correlation to learning gains. As the function of this paper is to describe the overall design research approach, and because each of these studies has been reported in detail elsewhere (Cviko, McKenney, & Voogt, 2009; McKenney & Voogt, 2009a, , 2009b), Table 1 presents only an overview of the seven studies, their respective foci and methods used.

	Study:	A	B	C	D	E	F	G
Prototype	1	■						
	2		■	■				
	3				■	■		
	4						■	
	5							■
Focus	pupil learning gains	■		■	■	■	■	■
	pupil engagement	■			■	■	■	■
	integration				■		■	■
	teacher experiences		■		■		■	■
Methods	Pre/post-test	■		■	■	■	■	■
	On-pc observation				■		■	■
	Off-pc observation				■		■	■
	Teacher interviews		■				■	■
Details	McKenney & Voogt, 2009a	■		■	■	■		
	McKenney & Voogt, 2009b							
	Cviko, McKenney & Voogt 2009							■

Table 1: Overview of PictoPal studies

Findings from the earlier studies informed both the development of the PictoPal tool, and development of the flanking research. Study A demonstrated that children are able to use the software, and enjoy the experience. It showed that children require assistance in understanding what to do on each screen, that the level of assistance needed does decrease over time, but that some supervision remains necessary. It also showed that children did not require the closed assignments to help learn the pictogram 'vocabulary' as suspected, because the images were sufficiently self-explanatory. Finally, it showed no learning gains; the researchers hypothesized that this was due to the limited duration of the intervention (4 sessions). This promoted several changes in the learning environment, which were incorporated into the second prototype: closed activities were eliminated; the number of sessions was doubled; and a commercial software package (Clicker®) was adopted. In addition to allowing researchers to focus more on content design instead of software design, the adoption of Clicker ® enabled the possibility of involving teachers directly in the design process. This was viewed as desirable because teacher involvement in design could help facilitate the implementation of PictoPal. When examined in Study B, it became clear that substantial pedagogical, linguistic, and technological expertise would have to be provided to enable teacher design of PictoPal materials. However, the learning gains (Study C) resulting from the use of the (heavily scaffolded) teacher-made materials were high enough to warrant further exploration. By the third prototype, the basic structure of PictoPal on-computer materials had become rather stable, and more attention was given the nature of pupil engagement, while creating their documents on the computer (Study E) and while 'using' their products in the classroom (Study D). While developmentally appropriate practices had indicated that young children's technology use should be integrated with off-classroom activities, the data prompted researchers to explore a causal link between the level of integration and pupil learning gain (Study F). Initial findings indicate that this causal relationship exists, and so factors affecting integration (teacher perceptions and beliefs) were also taken into account in Study G; here too, the hypothesized relationship was shown.

Outputs

Final Intervention. As PictoPal research is still in full swing, a final version cannot yet be described. However, the main elements of the fifth prototype are described here. As previously mentioned, children use PictoPal materials designed for Clicker ® software to create and print out documents, which are then used in off-computer activities. Throughout a PictoPal module, children go through eight sessions, each with the same basic elements: (1) Classroom starter activity; (2) On-computer text production; and (3) Off-computer classroom application. The eight on-computer activities scaffold the children's writing of different types of texts (list, letter story, instruction, etc.), the complexity of which increases over time (e.g. the first activity could be a simple list; a middle activity could be a several sentence-long report; a final activity could be a whole-page story). Figure 2 shows how one of the sentences in a weather forecast is constructed. Children click on buttons in the lower half of the screen, and the corresponding words are typed for them in the upper half. Figure 3 illustrates the associated off-computer classroom activity: presenting the weather forecast to the class. In the most recent study (G), teachers were supported in implementing PictoPal through an introductory workshop and a teacher guide. The weather forecast page from the teacher guide is shown in Figure 4.

Figure 2: Weather forecast grid

Figure 3: Presenting the weather forecast

Figure 4: The weather forecast lesson in the teacher guide

Design principles. In light of our research findings and experiences, we revisit our initial product and process guidelines, and comment on what we have learned through the PictoPal case.

- Product guidelines
  - Open learning environment
    - A semi-open environment is more practical for the on-computer activities than a fully open one because: (a) existing software can be used; and (b) for this age range, the amount of flexibility in semi-open assignments seems sufficient; and (c) the level of guidance necessary for a fully open environment is likely to be highly impractical.
    - While fully open, the environments for off-computer activities must be explicitly (not casually) linked to the type of product generated through the on-computer activity.
  - Activities should elicit dialogue and collaboration
    - During the first few sessions, PictoPal discussions during its use generally center around operating the computer. By devoting time to computer operations before starting the PictoPal sessions (e.g, one full pre-session module in studies F and G), more on-task behavior can be elicited.
    - Children discuss PictoPal with each other and with adults, although their conversations are more on-task with adults. However, adult guidance is very impractical for most schools. Student teachers and parent volunteers have been successful, but are difficult to rely on; tutor systems involving 6th graders have also been successful.
  - PictoPal products should be used in related off-computer activities
    - Single page products work better than multiple pages ones, because they are easier for the children to manipulate.
    - When children use the computer in pairs, their classroom applications should be designed around continued partnership.

- Process guidelines
  - PictoPal should be designed together with teachers and language experts
    - Teachers can clearly bring realistic, implementable ideas to the drafting table. They help ensure that the classroom activities are within the zone of proximal development for most other teachers. Product development is greatly enhanced when this kind of input is sought early on.
    - Measures should be taken to mitigate a sense of feeling overwhelmed. Even highly motivated teachers can have become more focused on 'getting the job done' and not see when they are making poor design decisions.
    - Providing sample materials and completed examples to teachers early on is crucial to teacher understanding
    - Pupil learning gains are highly motivating: Teachers are eager to continue/conduct PictoPal work when they see positive results
    - Substantial technical, process and conceptual support must also be provided to teachers designing PictoPal materials.
  - PictoPal design should be informed by usability testing
    - The misguided temptation to include fun and interesting, yet often distracting features on screen must be resisted.
    - On- and off-computer activities must be designed simultaneously or cyclically (not one after the other) to optimize integration.

Interaction with practice

Implementation. The PictoPal project has been developing at a relatively small scale. Across the seven studies, four schools have been involved. Implementation strategies are considered from the start of collaboration with a school. For example, efforts are made to accommodate teacher calendars, to draw links with the existing language curriculum, and to address topics recommended by teachers. Intensive support (coaching, feedback) has been provided when teachers design the on-computer activities. Far less support has been given when teachers use ready-made activities and only refine the classroom applications. Where teachers have taken the enactor role, the PictoPal has been implemented through an orientation workshop and a guidebook. As with many interventions, this has worked best when one person assumes accountability for the implementation; usually either the language coordinator or the early grades coordinator. During the formative evaluations of PictoPal prototypes, various approaches to offering pupil guidance have been tried out. Student teachers, parent volunteers and sixth grade tutors have all been conducted, and met with some success. However, teachers find these solutions to require too much time and hassle to organize on a regular basis. Participating teachers have, repeatedly, commented that they learn from the PictoPal experience. Through future studies, we would like to better understand the nature of this learning and how, if at all, it can be further supported.

Diffusion. The PictoPal endeavor was started as an exploratory research and development project, funded by the National Institute for Curriculum Development. It was not intended for large scale use and uptake. However, after years of iterative refinement, the PictoPal intervention may be nearing a degree of maturity that warrants consideration of how to promote diffusion of the intervention. To date, diffusion of the research and its outputs have taken place through researcher conferences; practitioner workshops; and journal articles.

Discussion

Reflections on the PictoPal initiative

A design research approach was used to gain insight into desirable program characteristics, implementation strategies and the role of teachers as designers of curriculum materials. Following a context analysis (McKenney & Voogt, 2005), literature search and curriculum analysis, multiple prototypes were (re)designed and formatively evaluated (Cviko, McKenney, & Voogt, 2009; McKenney & Voogt, 2009a, 2009b; Voogt & McKenney, 2007). The approach to used evidences the characteristics described in literature. These are briefly recapitulated below, using the set offered by Reinking and Bradley (2008):
  - Intervention-centered: Having a positive impact on early literacy learning is central to the initiative.
  - Theoretical: PictoPal development is informed by research findings and theoretical works; it contributes to theory building about emergent literacy and technology integration.
  - Goal-oriented: Aims to explore how technology can offer added value in literacy development.

- Adaptive and iterative: The tools and supports have evolved in light of the experiences and research findings.
- Transformative: The intervention stimulates new practices in kindergarten classrooms.
- Methodologically inclusive and flexible: Across the cycles, qualitative and quantitative data were collected; data source decisions were influenced by contextual opportunities and constraints.
- Pragmatic: Research, development and implementation efforts were driven by the desire to achieve an effective, sustainable, scalable intervention.

The PictoPal endeavor has yielded a functional intervention which has demonstrated its potential to positively influence kindergarten children's understanding of the functions of written language. Further, the successive studies have shown that learner gains increase along with teacher involvement in the design of activities. We think this is because the experience helps teachers to better integrate the on-computer activities into the ongoing classroom practices in general, and the PictoPal off-computer activities in particular. We also conclude that the classroom integration is affected by teacher perceptions of technology and their own beliefs about teaching and learning.

Lessons learned for other design research initiatives
This paper concludes by discussing several lessons learned from the PictoPal studies, which may be useful for other design research endeavors. These pertain to sustaining design and development; tensions and tradeoffs when what is theoretically legitimate is impractical; and methodological challenges.

Sustaining design and development. The PictoPal project was initiated as an exploratory research and development endeavor; and funding was only available for the first year (development of the initial working prototype). Thereafter, seven (under)graduate students continued the work in the form of their capstone assignments. Planning for capstone-sized chunks primarily during springtime (the semester when students are usually available), and tailoring the details of the studies to accommodate findings from previous studies as well as (where feasible) participating teacher and student preferences, allowed this initiative to mature. The benefit of experience and publications rooted in the student work has been demonstrated through two recently-awarded grants, each for a 4-year term. This approach has been a viable way to address the chicken-and-egg kind of problem that many (design) researchers face: We have to know enough about something to be able to secure funding for it; but without the funding for research – how do we learn enough?

Tensions and tradeoffs. From early on in the project, it became clear that adult guidance during on-computer activities was ideal because it (a) was developmentally appropriate; and (b) offered the greatest potential for on-task dialogue. However, such an approach is rarely feasible in kindergarten classrooms. The time and hassle involved in organizing adults or even older children as tutors is too demanding for most teachers. In the PictoPal studies, teachers have been willing to experiment with varying approaches to addressing this tension. But they generally indicate that failure to satisfactorily address issue is currently the only substantial weakness in the intervention. But that weakness is so great that, even when the values and benefits of older guides has been clarified, teachers question the viability of PictoPal. Practicality, it would seem, supersedes legitimacy, in this case. It is conjectured that this is no isolated case, and other design research endeavors would do well to embrace this when unbridled design ideals threaten to take charge.

Methodological challenges. In design research, more than in other research approaches, the tendency for researchers to take on additional roles (e.g. facilitator, designer) presents a significant challenge to the rigor of a study. In the PictoPal work, several tactics have been employed to mitigate those challenges. First, we strive to provide an explicit conceptual framework for each PictoPal study, so that readers can make their own analytic generalizations. We are still learning how to characterize salient elements of the context to further assist in this. Second, we rely on triangulation of data collection methods and sources. Third, while our student researchers have been subject to some biases, by collaborating on their mentors' projects, we do consider them more objective than those who have actually designed PictoPal materials. Finally, we try to employ both inductive and deductive data analysis. That is, we not only classify according to schemes based on our existing understanding; but we also explore data, trying to make sense of it and allowing themes to 'bubble up' to the surface.

In closing, we return to the three main motives for conducting design research: increasing the relevance of research; developing empirically-grounded theories; and increasing the robustness of design practice. The PictoPal

endeavour has yielded a practical solution to the problems of (a) meeting early literacy standards for the functions of reading and writing; and (b) struggling to integrate technology in developmentally appropriate fashion. Data show that children learn from using PictoPal, and anecdotal evidence suggests that teachers learn from the experience as well. The findings contribute to implementation theory by demonstrating the correlation between teacher beliefs and technology integration; and the correlation between the level of technology integration and learning gains. They also substantiate our convictions that, in a day and age where every additional hour spent at the computer means that much less time spent role-playing, building or painting, technology is only worth children's time and teachers' effort when carefully designed and implemented. Finally, we hope that some of our design process guidelines and design product guidelines will help inform future initiatives to design technology for early literacy.

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Enhancing user participation in an art gallery space through the development of a user generated wiki

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Abstract

A problem exists today around art galleries. Art galleries that do not keep permanent and publicly accessible collections or records of the artwork they display do not provide opportunities for artists and viewers to revisit artwork that has been removed from the gallery. The purpose of this study is to test the usability of a wiki platform for a university art gallery that allows past and present exhibiting student-artists and any other interested parties to create professional profiles and alternative exhibition spaces on-line in order to engage with, deepen, reflect upon, share among, translate between and expand their experiences with and understandings of art.

Introduction

The use of the Internet by people of all ages around the world (Lenhart 2009; Sutter 2009) to create, remix, and share media content (Lenhart & Madden, 2005) through engagement in "participatory cultures" (Jenkins, 2006) is rapidly increasing (Zuckerberg, 2009). According to Lu (2008), teaching professionals in the 21st century "need to think about how to engage and motivate students into using their favorite and familiar digital media as effective learning technologies" (p. 48).

At the Pennsylvania State University (2007), over forty-thousand students are currently enrolled at the University Park campus, just one branch of the larger University system. According to a survey conducted by the Educational Technology Services at Penn State, 83% of Penn State students are in the Facebook social network, 93% own cell phones, and nearly 90% own MP3 players (Camplese, 2008). The every-day lives of these college students are becoming increasingly interwoven with the use of contemporary popular technologies.

As a teaching and learning space at Penn State, the Edwin W. Zoller Gallery is, centrally, a space for students to push the boundaries of how they create and think about art. Each academic semester, the Zoller Gallery hosts as many as seven public exhibitions of student art work, and it is expected that entire classes of students will come into the gallery with their instructors at any given time to talk about the artwork on display. However, because the Zoller Gallery keeps no permanent collection of the artwork it displays, unlike a museum, students have no means to revisit an exhibition of artwork at the gallery after one has been removed to make way for the next.

Finding this inability of students to revisit prior learning experiences problematic, this design-based research study seeks to provide contextually relevant and meaningful opportunities for more media-rich and dynamically-connected art educational experiences within and beyond the Zoller Gallery. By providing ways for students to engage with social media, both inside and outside of the gallery, about the art, artists, and events happening there, the gallery becomes more culturally responsive and connected to contemporary student culture. Through the adaptation of social media to enhance and extend the opportunities for teaching and learning about and through art, the Zoller Gallery can offer students an alternative to the limitations of their current gallery experiences by providing them with an emergent multi-media exhibition and conversation platform to germinate.

Study

The purpose of this study is to test the usability of a wiki platform associated with, but not bound to or restricted by, the Zoller Gallery. This wiki allows past and present exhibiting student-artists and any other interested parties to create personal (artist) profiles and alternative exhibition spaces on-line in order to engage with, deepen, reflect upon, share among, translate between and expand their experiences with and understandings of art. Following the creation of an artist profile, artists upload an artwork, provide descriptions of the work, and allow other users of the wiki platform to provide comments and feedback on a whiteboard associated with that artwork. Figure 1 provides a screenshot of this discussion and feedback feature of the wiki platform.

Figure 1. Art gallery wiki discuss page. This figure provides an example of the whiteboard commenting feature for the artwork entitled *Catching a Bus at PSU*.

A qualitative usability test method was used to conduct this study. We followed Goto and Cotler's four-step process in setting up our usability test. Goto and Cotler recommend planning and prepping, finding participants, conducting the study, and finally, analyzing data and making recommendations based on the results (2005). We followed their guidelines and used their Likert-type post session survey items as part of our user post-test survey. The goals of our usability test were to provide specific feedback on common tasks within the system and determine expected performance on the current site and identify serious problems prior to the next phase of production. By conducting a usability test, we wanted to answer the following questions: *Are the basic tasks intuitive for a new user? Are the menu options and features intuitive for a new user?*

Method

Our study consisted of four graduate students that regularly engage and participate in an art gallery space. We gathered two types of background information. First, we asked how many hours a participant spent online per day, and second, we asked our participants to complete a pre-test power user scale survey to determine how "tech-savvy" a person is. Marathe et al. created the power user scale for classification purposes when conducting media effect studies (2007). The power user scale consists of nine Likert-type items and are provided in Appendix A.

Each session lasted approximately 30 minutes. During the usability test, each subject was greeted and then oriented to the design by a test monitor. Subjects were given four tasks to complete while the test monitors observed. Participants were asked to think-aloud, i.e. talk out their thought process, while they completed the four tasks. The four tasks are listed in Appendix B. Following the tasks, a post-test survey was given in addition to a debriefing on the significance of the study.

Results

The number of hours spent online was roughly equivalent across subjects, showing that our participants did have experience in online web applications with an average of 5.72 hours spent online per day. High power users consisted of participants who scored high across all items on the power user scale and low power users scored

low. We found that two of our participants scored high (average of 8.278) and two of our participants scored low (average of 4.611). In our study, the power user scale items were compared using a Multivariate factor analysis to determine that the scale was reliable (Cronbach's alpha of 0.8033).

When comparing our high and low power users across post-test survey results, we found that the high power (tech-savvy) users consistently scored higher across all items. These items are listed in Table 1. Each item is a score out of 5 (1=strong disagree; 5=strongly agree).

	Low Power Users	High Power Users
Easy to complete tasks	4	5
Clear Navigation	4.5	5
Pleasing Look and Feel	3.5	5
Relevance of images to content	4	5
Relevance of content (text)	4	5
Easy to use	4	5
Clear page layout	4	5
Inviting to use	4	4.5
Clear labeling of links	4.5	4.5
Recommend a friend to use	3.5	5

Table 1. Low vs. High Power Users. This table provides the score for each group of participants on the post-test survey.

Additionally, we provided three post-test survey open-ended questions. The participants that we classified as low power users found that the best features of the wiki platform were the numerous ways to post and transmit ideas. The high power users thought the best feature of the wiki platform was the ease of use. The low power users found that there was a lack of clarity with certain tasks (e.g. the discussion board) while the high power users were pleased with the system and listed the generic color scheme as the only complaint. When asked *what would you do to enhance the site,* one low power user participant called for more simplification of the features in the wiki platform. One of the high power user participants asked for a tagging system to categorize the types/mediums of artwork.

During the think-aloud process, subjects pointed out a few important concerns that were not addressed in our post-survey results. Below we provide what we found to be the most important concerns:

➢ Lack of information on the goals and outcomes of the site
➢ Lack of an "update" button after editing text (current system automatically updates)
➢ Problem finding the login area/information (current system has login on top right)
➢ Majority of feedback will be text-based, so make the whiteboard discussion an advanced feature
➢ Aesthetics of the site should be changed; too much of a template
➢ Possibility to use system with another school to collaborate and comment on other University student/artists' artwork
➢ Lack of ability to see text descriptions when you hover over buttons
➢ Lack of prompts of what to write in description boxes
➢ Explanation needed for whiteboard discussion board
➢ Lack of ability to make artwork full-screen

Discussion

Our results show that the participants that are considered high power users and "tech-savvy" found the site to be easy, clear, inviting, and relevant. In other words, the wiki platform architecture is appropriate and the system serves the function for which it was created. This is an important finding as we move forward to our next prototype.   For those participants that are considered less "tech-savvy", the findings are still encouraging. These participants also agreed, although not as strongly, with the ease and clarity of the site.   These results provide us with a positive response to our questions regarding the intuitive nature of the tasks and menu options.

The open-ended questions and think-aloud responses provided us with very valuable feedback and suggestions for improvement. A recurring theme across participants was the need for a better aesthetic and color scheme. The suggestion to add an artistic background is something that our design team will factor into our next prototype. We did get a positive response with the simplicity of the wiki platform and therefore, we are going to ensure that adding artistic elements do not interfere with the simplicity of the function and navigability.

An interesting find was the participant confusion and realization that text edits were automatically synced across the system. Our participants are used to having submit buttons upon completing a task and thus, thought that this feature was needed. This finding is intriguing because it suggests that we, as consumers of web media, are trained by web designers to locate buttons when editing text. In order to accommodate this disconnect, our design team will add a text rollover effect that informs the user of "editing text" and/or "text submitted" during the edit process, thus, eliminating the need for a button.

A non-design suggestion from the think-aloud responses provided us with an opportunity to reflect on our goals and outcomes and realize the potential and excitement that this system could generate. The suggestion was using the wiki platform with another school to collaborate and comment on other University student/artists' artwork. Although we are a few prototypes away from implementing this platform on that scale, this suggestion helps us refocus our design principles and rethink our social problem. By increasing collaboration among Universities, our wiki platform could serve as a solution to the problem of removed art education; removed, as in removed from society.

Implications

In the next phase of our work, we will add in many of the suggestions from this study. We plan to move forward with the prototype and increase the functionality of the wiki, including the amount of tasks that a user can perform without sacrificing its simplicity, clarity, and ease of use. Through this and subsequent usability studies, we hope to create a communication platform that is both highly usable by, and useful for, student-artists who want to engage in enhanced and extended educational experiences around artwork exhibited at the Zoller Gallery.

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APPENDIX A

Power user scale

On a scale of 1 to 10 (1=LEAST AGREE; 10=MOST AGREE), do you:
1. Think most technological gadgets are complicated to use.
2. Love exploring all the features that any technological gadget has to offer.
3. Prefer to ask friends how to use any new technological gadget instead of trying to figure it out myself.
4. In interfaces that you are familiar with, do you get frustrated each time you have to go through basic steps designed for new users.
5. Like to challenge yourself in figuring out how to use any new technology.
6. A little bit of intuition is all that is needed to figure out how to use any new technology.
7. Many of your friends come to you to get help related to technological gadgets.
8. Find yourself using keyboard shortcuts on the computer.
9. Make use of the 'Help' feature available in any software.

APPENDIX B

Task Information
1. Your first task is to enter a description for your artwork *Catching a Bus at PSU*. Update the description with a few phrases. If you are prompted to log in, use the username *mike* and password *mike.* Once you have accomplished this task, briefly discuss the positive and negative aspects of the system during this task.
2. Your second task is to change the Artist Biography Information for your video by going to My Profile. Once you add a few phrases, go back to the initial artwork page ART – ABOUT tabs and comment on what is different. Briefly discuss the positive and negative aspects of the system during this task.
3. Your third task is to provide feedback for the artwork on the ART - discuss tab. If you haven't already, you may watch the video to help with this process. Explore the function of the discussion board and see what you can do. Comment on your experiences including suggestions for improvement.
4. Your final task is to add a question to the Q+A discussion board. Your question can be about the art video or a general question.   Once you have accomplished this task, briefly discuss the positive and negative aspects of the system during this task.

SimTIE-Math: A Simulation-Game on Technology Integration for Mathematics Learning

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Descriptors: simulation games, teacher education

Abstract

This article describes the application of instructional design theories and game design principles in the creation of a paper prototype for a simulation game on technology integration in education (SimTIE-Math). The study employs a design and development research design in which artifacts that resulted from that design process are examined, including design documents, iterations of game components and rules, e-mail exchanged by the designers, notes from meetings, reports from playtesting sessions, and other related documents. The purpose of the study is to formulate principles for the use of instructional design theory in game design. By exposing and examining the design process, we intend to contribute to design knowledge in instructional systems design.

This article describes the application of instructional design theories and game design principles in the design and development of a paper prototype for a simulation game on technology integration in education (SimTIE-Math). We begin with a brief explanation of design and development research, the approach used in this study. Next we describe the purpose of this study and the methodology. We then describe the iterative design process of paper prototyping and playtesting and how the findings influenced revisions of the game components and rules. Finally, we reflect on lessons learned from the experience and formulate design principles for the use of instructional design theory in game design.

Design and Development Research

Richey and Klein (2007) define design and development research as "the systematic study of design, development and evaluation processes with the aim of establishing an empirical basis for the creation of instructional and non-instructional products and tools and new or enhanced models that govern their development" (p. 1). This approach has a pragmatic orientation in that it seeks to improve practice through evidence-based claims about the design and development of instructional products. The study of the design process and its artifacts can elucidate the ways in which designers apply theories, principles, and methods to attain satisfactory results in naturalistic settings. This design knowledge may be characterized by "common examples, patterns, and principles, and by the expertise required to apply these generalities in specific settings" (Design-Based Research Collective, 2003, p. 9). At the same time, it can also contribute to theories of teaching and learning, although generalizability can be problematic because context is often a significant factor in the enactment of an intervention (Hoadley, 2004).

Purpose of the Study

One of the major challenges to teacher education is to provide pre-service teachers with enough practice in teaching before they graduate. It is costly to place them in real classrooms, and if they make mistakes there are real consequences to the students they teach during practica and student teaching. Simulations are routinely used in a variety of professions (e.g. business, healthcare, engineering, military, law enforcement and fire fighting, etc.) to prepare people for real-life situations that they are likely to encounter. SimTIE is intended to provide pre-service teachers with opportunities to make planning decisions for selecting student learning activities, and then to experience the consequences of those choices. To succeed in the simulation, teachers will need to give up the notion of "sage on the stage" and adopt a "guide on the side" perspective. Moreover, teacher or student choice of learning activities that integrate information technology will be necessary in order to provide individualized learning experiences for simulated students to work at their own pace on activities suited to their skills and knowledge.

The purpose of this study is to examine the design process and decisions made during the development of a paper prototype for a simulation game on technology integration in education. In particular, the focus is on the ways in which instructional design theory informed the decisions regarding simulation, game, and pedagogical elements (Aldrich, 2005). We have sought to answer the following design and development research questions. First, how can

instructional design theories be applied in the game design process? Second, what design principles may be formulated from a retrospective analysis of the design and development process and artifacts?

Methods

Participants

The design and development of the paper prototype was undertaken in an advanced design class within the context of an Instructional Systems Technology (IST) graduate program at a large midwestern university. The class consisted of five residential students and one distance student. Four of the students were nearing completion of their Master's degrees, while the other two (including the first author) were beginning their doctoral studies. The second author was the instructor of the class and also played the role of the client who was contracting the team to design the instructional product.

The second author had previously led a team of students in adapting a board game, the Diffusion Simulation Game (DSG), for online use (Frick, Kim, Ludwig, & Huang, 2003). A few of the students in the current study had some limited experience in designing board games, card games, puzzles, and digital games. To prepare for the project, the students created and tested some simple games from Thiagarajan's (2003) book on game design. Thiagarajan also came to speak with the class about game design.

Procedure

Klabbers (2006) has argued that the analytical sciences employ a variable approach (based on variables and the correlations among them) as a mode of explanation while the design sciences should employ a process approach (based on events and the processes that connect them, cf. Maxwell, 2004) because causality is purposefully designed into the utilization of artifacts with the ultimate goal of changing existing situations into preferred ones (cf. Simon, 1969).

> Evaluating games (and simulations) from the viewpoint of an analytical scientist is distinct from assessing games (artifacts) from the position of a design scientist. Design scientists (game designers) build their artifacts to function in well-defined contexts of use for intended audiences. The artifact should be assessed from that viewpoint, in principle taking on board the option of "causality from single cases." Key questions in the design sciences are, Does it work? Is it usable in this context for this audience? (Klabbers, 2006, pp. 167-168)

The design process for SimTIE-Math utilized rapid prototyping (Tripp & Bichelmeyer, 1990) to create and evaluate prototypes in an iterative and systematic manner. This study employs an examination of artifacts that resulted from that design process, including design documents, iterations of game components and rules, e-mail exchanged by the designers, notes from meetings, reports from playtesting sessions, and other related documents. During the design process, these artifacts were posted to a learning management system (LMS) that was accessible to all designers. All e-mail was exchanged through this system as well. Furthermore, the first author, who served as lead designer during the development of the paper prototypes, saved intermediate iterations of game components and rules that had not been posted to the LMS. The authors, who have continued to refine the game while seeking funding for development of a digital version, retrospectively analyzed these artifacts to create a chronology of the origins and evolution of the game to its present state. As designers, we tried to determine if the game met the stated goals; as researchers, we are interested in *how* and *why* the game did or did not meet those goals. By exposing and examining the design process, we intend to contribute to precedent in instructional systems design (Boling & Smith, 2008).

Description of the Project

A review of the literature related to the use of games and simulations for learning indicated that while there is an increasing amount of research in this area, much of it has been anecdotal rather than empirical (Dempsey, Rasmussen, & Lucassen, 1996; Hays, 2006; Randel, Morris, Wetzel, & Whitehill, 1992; Van Sickle, 1986). Furthermore, little research has been done regarding the application of instructional design theories to the development of games and simulations for learning (Aldrich, 2003; Van Eck, 2007). In this project, instructional design theories are explicitly used to increase the probability that the game will promote the desired learning outcomes.

The decision to design a game as opposed to some other medium of instruction was driven in part by the desire to increase motivation (Garris, Ahlers, & Driskell, 2002; Malone, 1981), engagement (Dickey, 2005; Egenfeldt-Nielsen, 2005) and academic learning time (ALT; cf. Berliner, 1990; Brown & Saks, 1986; Kuh, Kinzie,

Buckley, Bridges, & Hayek, 2007; Rangel & Berliner, 2007) by providing an authentic learning experience (Cannon-Bowers & Bowers, 2008; Galarneau, 2005; Magnussen, 2005; Ruben, 1999). We know from research on ALT that successful student engagement in tasks that are similar to those they are later expected to perform is positively correlated with objective tests of such performance. In addition, the design of the game system and game components was informed by the elaboration theory (Reigeluth, 1999), first principles of instruction (Merrill, 2002; Merrill, Barclay, & van Schaak, 2008), theories of intelligence and learning styles, cognitive load theory (Sweller, 1988; 2008; Sweller, van Merrienboer, & Paas, 1998), and research on differentiated instruction (Hall, Strangman, & Meyer, 2003; Tomlinson, 1999).

Initial Conception of the Simulation Game

The second author's idea for the project was to create a simulation game that would enable pre-service teachers to practice integrating technology into their teaching and to experience the consequences of their decisions. The project developed such that each player would manage a simulated classroom in which she or he must facilitate individual student engagement and learning achievement by identifying activities and resources most appropriate for each student. The player would succeed by most efficiently guiding the simulated students' mastery of curriculum standards during a fixed period of time. The underlying game logic would reward the selection of activities that complemented students' learning needs, styles, and preferences while utilizing appropriate technologies.

The broad goals of the project are to provide a means for radically improving pre-service teachers' ability to individualize instruction through the use of appropriate technology and to advance research on effective and efficient development of instructional games and simulations. While the players' objectives changed as the designers refined the game, the initial learning goals as defined by the second author persisted:

1. Given an existing education system, players will make changes in that system over time that lead to effective technology integration in that particular system.
2. Through repeated engagement with the game, players will begin to understand systems concepts and apply systems thinking to the problem of technology integration into education.

Description of Design Process

The designers initially met with the second author for several hours over two days to clarify needs and define deliverables and a timeline. They chose to follow an iterative process that is commonly used in game design as well as in design-based research which consists of cycles alternating between rapid prototyping, playtesting, evaluation, and revision (Brathwaite & Schreiber, 2009; Design-Based Research Collective, 2003; Reeves, 2000; Salen & Zimmerman, 2004). An iterative process is useful not only for improving the emerging intervention but also for identifying reusable design principles (Reeves, 2006) and creating models to inform design practice (Ma, Williams, Prejean, & Richard, 2007). The designers decided to produce at least two paper prototypes, playtest each prototype, and use the formative evaluation results to modify the subsequent prototype. The final playtest would also include an assessment of the players' learning.

Given the paucity of empirically-tested design theories for instructional games, the designers decided to take an eclectic approach in which theories of learning and instructional design would be selected initially to guide design decisions and subsequently whenever they seemed applicable to ensure that the game promoted learning.

An initial brainstorming session resulted in a general structure for the game system and a list of design constraints to help focus the design problem. The designers originally envisioned a hub-and-spoke model with the main game as the hub with optional side games designed to teach and reinforce relevant concepts and processes (i.e., supportive instruction to help the players do better in the main game). However, they soon switched to a model based on the elaboration theory (Reigeluth, 1999). Using this approach, the game would begin with a level that offered the simplest version of the whole task (the epitome); subsequent levels would become increasingly more complex—an approach common to videogames—with opportunities for review and synthesis. The list of constraints identified by the designers included:

- Limit the beginning cast to one teacher and 3-5 students;
- Identify core areas in which students must achieve proficiency;
- Identify elective areas in which different students must reach varying levels of achievement, depending on the particular student's attributes and goals;
- Determine relevant student attributes (which may include intelligences, learning preferences, attitudes, behaviors, personal goals, etc.);
- Provide many student models so that there is some variety in the challenges the player must meet;

- Identify technologies (hard and soft combined) and resources available to the player;
- Require that the player use appropriate technologies to affect student engagement (academic learning time) and student achievement;
- Ensure that the player has a generous amount of resources in order to simplify learning and encourage success in this initial epitome game.

A couple of key ideas emerged during the initial brainstorming session that persisted throughout the development of the game. The first suggestion was to limit the context of the game to a particular grade level. Even though this approach might reduce the relevance as perceived by the target audience, the designers envisioned the computer version of the game as a shell capable of accommodating content for different grade levels. The second suggestion—which foreshadowed a vexing design problem that persists to this day—was to incorporate lesson plans in the game. Initially this was considered too complicated, but the designers later reformulated the idea in more abstract terms, not as specific, detailed lesson plans but as a more general game mechanic for framing the use of instructional objectives, activities, and resources. With the goals and constraints defined, the designers decided to work individually on concepts for the game and then meet several days later to compare ideas and achieve consensus on next steps.

Initial Iterations

Two designers returned with descriptions of possible games, and the other designers contributed ideas for game rules, components, and mechanics. Topics of discussion included whether the players would act individually or in teams and whether they would compete or cooperate with each other. One designer suggested that players take turns acting as teacher and students. However, others felt it would be better for all players to stay in the role of teacher. While discussions about the structure and mechanics of the game continued, there was general agreement on the need for some sort of student model, a curriculum model, an instructional activity model, a method for evaluating the success of an activity with one or more students, and a method for tracking student achievement.

The original conception of the student model was to incorporate Gardner's multiple intelligences (1999) with student attributes like socio-economic background, strengths, interests, preferences, anxieties, experiences, and goals. However, the designers also explored Myers-Briggs type indicators (Pearman, Lombardo, & Eichinger, 2005), Keirsey temperaments (Keirsey & Bates, 1984), Hermann brain dominance instruments (Hermann, 1990), and the Felder-Silverman learning styles model (Felder & Silverman, 1988) before finally settling on Kolb's learning style inventory (Kolb, 1984), primarily for the practical reason that it is simple enough to model in a board game.

An early version of the *student information card* that the players would receive is shown in Figure 1 on the left along with the version that was used during expert review and playtesting on the right. These cards reflect the decision to narrow the focus from general skills to specific mathematics standards, which were color-coded on the *assessment log* (described below). Information on interests/hobbies and friends was not used in the paper prototype but was included because the designers thought it might be used in the digital version of the game.
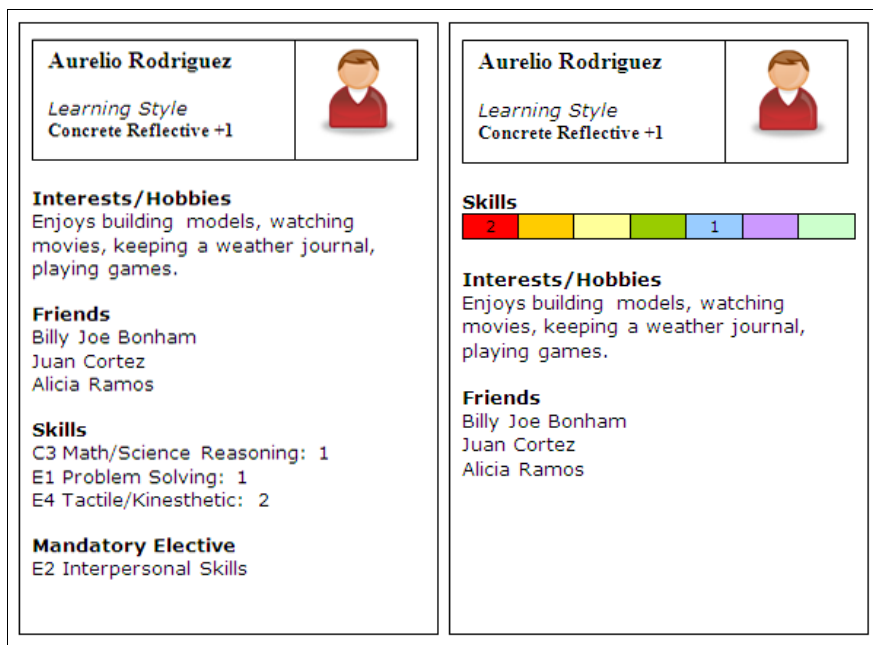
Figure 1. Two versions of the student information card.

     The first author mapped Keirsey's temperaments and Myers-Briggs' types to Kolb's learning styles and then compiled lists of the kinds of activities that would appeal to each learning style. This map guided designers in evaluating the effectiveness of an activity for each learning style and assigning bonus points.

     The initial curriculum model consisted of core competencies (reading comprehension, writing skills, math/science reasoning) and elective competencies (problem solving, interpersonal skills, technology skills, tactile/kinesthetic skills, naturalist skills, leadership skills) that are applicable across grade levels and subject areas. Players would be required to foster learning in the core competencies for all students, while the elective competencies would vary by student. After some debate, the designers decided to focus the prototype on mathematics at the fourth- to sixth-grade level. One reason for this decision was that there are well-defined state standards, adherence to which would be a criterion for evaluating the appropriateness of an activity. This would reinforce the real-world expectation that teachers help students to meet those standards. Another reason was the practical matter of eventually seeking funding to develop a computer version of the game. The designers thought that focusing on a high-priority subject area like mathematics would increase the chances of obtaining a grant.

     Because the primary game mechanic was the selection of appropriate activities for students, the instructional activity model became a crucial element of the game's design. There was agreement on the need to provide a variety of activities, including poorly designed activities that would result in little or no learning for the simulated students. However, this meant that the players would have a large number of activities to search through. The designers struggled to define the salient attributes of an activity and express them succinctly to reduce cognitive load while maintaining fidelity to the real-world task being modeled.

     The concept of fidelity in games/simulations seems to be a point of contention among instructional designers, and it was at the center of many discussions regarding SimTIE-Math. Fidelity is the degree to which a simulation is faithful to that which it simulates. Reigeluth and Schwartz (1989) theorized that the most fundamental aspects of a simulation should have high fidelity, while lower fidelity is appropriate for the more superficial aspects that may otherwise lead to cognitive overload and impede learning and transfer. They suggested that factors to consider include the complexity of the real world environment, the potential for transfer, the motivational consequence of high fidelity, and the expense of achieving high fidelity. More recently, Feinstein and Cannon (2002) examined numerous studies from the 1960s and 1970s that focused on the effects of fidelity on training and education. They report that greater fidelity did not result in greater learning and may in fact reduce effectiveness through unnecessary complexity and overstimulation. Similarly, Winn (2002) notes that a virtual environment does not need to simulate the real world to be useful for instruction, and that high fidelity may lead to constrained and inflexible understanding and make it difficult to transfer knowledge and skills to new contexts. Ultimately the designers working on SimTIE-Math decided that the learning objectives of the game determine the primary game mechanics, so those primary game mechanics should have the highest fidelity to real-world situations.

The earliest version of the *learning activity card* was an 8 ½ x 11 page that included information on the activity's type (e.g., group discussion, project), a brief description of the activity, the general skills addressed, the resources required (e.g., a computer for each pair of students, a calculator for each student, art supplies; the amount of teacher involvement was also specified), and an assessment matrix that indicated which learning styles would benefit from the activity. The designers found it difficult to search though the pages and decided to redesign to fit the information on a 4 x 6 index card. An example of the card used during expert review and initial playtesting is shown in Figure 2. This version addresses mathematics standards with colors corresponding to those on the assessment log (described below). During gameplay, the success of an activity was determined by rolling a special die that would result in 0, 1, or 2 points being awarded. Additional points were awarded as specified on the activity card if technology was being used effectively and if the activity corresponded to the student's learning style.

TIE Learning Activity   low low low

Type: Problem Solving (Individual)—Shopping Spree

Resources:
- Teacher – partial involvement
- 1 Computer for every student
- Internet Access

Description:
Teacher tells students that they each have $100 to buy toys. Students' goal is to spend as much money as possible without going over $100. Teacher gives students URLs for online toy stores. Students may record purchases on paper or on a computer file, but they must record their purchases and present them to teacher.

Assessment Bonus: *Tech +1*
Abstract Active +1, Abstract Reflective +2

Figure 2. Learning activity card.

The designers created 76 activity cards based on lesson plans and activities found by searching the Web, most of which indicated which mathematics standards were addressed. The designers used the learning styles map described above to decide which learners would benefit most from each activity and assigned bonus points accordingly. A revised version of the learning styles map, which functioned here as a design tool, was provided to the players in the second playtesting session as a scaffold for selecting appropriate activities for students.

Scorekeeping in the game was done on an assessment log. Each time a student participated in an activity and was awarded points in specific competencies, the player updated the student's log to indicate the student's progress toward mastery. An early version of the assessment log, shown at the top of Figure 3, was based on the original approach of using core and elective competencies. If a student failed to make adequate progress by the end of the round (achieving from 1 to 7 points), he would become a dropout and be removed from the game with no points awarded to the player. If a student ended the round in the "Don't Graduate" section (achieving from 8 to 11 points), she would remain in the game for the next round; the player would acquire a new set of students in addition to any students who did not graduate, increasing the difficulty due to the greater number of students. If a student achieved from 12 to 14 points, he would graduate and be removed from the game, and the player would score 1 point in the "Score" column. If a student achieved 15 points, he would graduate and be removed from the game, and the player would score 2 points.

Student Name:

Core	Dropout							Don't Graduate		+1				+2	Score
C1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
C2	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
C3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	

Electives (Must score +1 in two or don't graduate)								+1						+2	Score
E1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
E2	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
E3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
E4	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
E5	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
E6	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	

Total Score

Student Name: **Learning Style:**

Round	Standard	Low Mastery									Partial Mastery				Near Mastery					Player Score
1 2 3	Number Sense	1	2	3	4	5	6	7	8	9	10 11 12	13 14 15 16 17	18 19 20	21						
2 3	Computation	1	2	3	4	5	6	7	8	9	10 11 12	13 14 15 16 17	18 19 20	21						
2 3	Algebra & Functions	1	2	3	4	5	6	7	8	9	10 11 12	13 14 15 16 17	18 19 20	21						
3	Geometry	1	2	3	4	5	6	7	8	9	10 11 12	13 14 15 16 17	18 19 20	21						
3	Measurement	1	2	3	4	5	6	7	8	9	10 11 12	13 14 15 16 17	18 19 20	21						
3	Problem Solving	1	2	3	4	5	6	7	8	9	10 11 12	13 14 15 16 17	18 19 20	21						
3	Data Analysis & Probability											13 14 15 16 17	18 19 20	21						

Total Score

Figure 3. Two versions of the assessment log.

The version of the assessment log used during expert review and the first playtest is shown at the bottom of Figure 3. The shift from general competencies to mathematics standards is evident, with the addition of color coding that is also used on the student information cards (to indicate a student's beginning achievement level in each standard) and on the activity cards (to indicate which standards are addressed by the activity). Three rounds are indicated with difficulty increasing through the addition of standards in each round. That is, in the first round (the epitome, in terms of the elaboration theory) only Number Sense is addressed, while in the second round Computation and Algebra & Functions are added; in the third round all standards must be met. At the end of the third round, the player would tally points for each student/standard, with no points for Low Mastery, 1 point for Partial Mastery, 2 points for Near Mastery, and 3 points for Mastery. Therefore if a student achieved Mastery in all 7 standards, the player would receive a total of 21 points for that student.

Student achievement progression changed to mastery levels so that the student was required to achieve mastery (21 points) in each standard. However, there was some debate among the designers regarding the handling of students from round to round. One option was to have the player retain the same students for each round, so that the only change was the addition of standards. Another option was similar to the first, but the player also received some additional students to increase difficulty. A third option was to tally the player's points for each student at the end of a round, and then begin the next round with a new and larger set of students. This decision remained unresolved, in part because neither playtesting session went beyond the first round.

A week before the first scheduled playtesting session, a full paper prototype was produced. One designer used poster boards to create individual "classrooms" for each player as well as a shared "computer lab." The first author printed student information cards on 3 x 5 index cards, activity cards on 4 x 6 index cards, multiple resource cards on 8 ½ x 11 paper that was then hand-cut, learning styles maps, and job aids that described the sequence of events in a turn. Small wooden cubes were used to create custom dice, and play money was borrowed from a Monopoly game.

Expert Review

Once a playable paper prototype was assembled, the designers wanted some reassurance that the game would serve the needs of instructors in teacher education. Two faculty members who teach education technology classes for pre-service teachers agreed to conduct an expert review (Richey & Klein, 2007) which consisted of a structured walkthrough of two turns with feedback and discussion of strengths, weaknesses, and design alternatives. Each reviewer was paired with a member of the design team and together they examined their students' attributes, selected instructional activities, and scored the results. Other members of the design team observed and made notes. The reviewers, who were experienced school teachers before becoming professors, were impressed by the decision making required of the players and the fidelity to real-world teaching with technology. In addition to numerous minor suggestions regarding the design of game components, key suggestions for revisions included:

- Emphasize the assessment of technology integration in the selected activities to diminish the "pervasive attitude of not needing technology" to teach.
- In addition to numeric feedback indicating the success of a selected activity, provide narrative feedback describing the outcome to increase engagement.

- Include an assessment matrix for each activity to increase variability of outcomes, including the potential for technical problems and reward for anticipating such problems and arranging a contingency plan.

Because the first playtest with representatives of the target audience was scheduled for five days later, the designers decided not to attempt any major changes in the interim. The first author agreed to create a prototype of an activity card with an assessment matrix and narrative feedback that might be shown to playtesters at the end of the session.

Playtesting

Playtesting is a methodology commonly used throughout the game design process to systematically test "gameplay, systems, balance, and interface to find all the errors, inconsistencies, or issues and report them to the design team" (Brathwaite & Schreiber, 2009, p. 12). A playtest may be a full or partial play session and, depending on the development stage and the objectives of the playtest, may include the designers, their friends and family, experienced gamers, or "tissue testers," people who have never seen the game and are only used once (Schell, 2008). Playtesting is similar to usability testing, although Schell (2008) considers the former to encompass the overall experience of the game and the latter to focus on whether the interface and systems are easy to understand and use. The playtesting protocol for this project consisted of observation of the players combined with prompts to think aloud (Preece et al., 1994) during gameplay. Playtesting sessions ended with informal questioning of the players and the solicitation of freeform comments. Further details regarding each playtesting session are provided below.

Playtesting session 1. To prepare for the first playtesting session, the designers used several approaches to recruit participants. One of the faculty who participated in the expert review session was teaching an undergraduate teacher education class, and she offered her students extra credit for participating in the playtesting. In addition, one designer contacted several faculty who were teaching sections of an undergraduate class on technology integration and asked them to encourage their students to participate. Nevertheless, only three playtesters were recruited: two male pre-service teachers in social studies (one freshman, one sophomore) and a female graduate student in math education.

The primary goals of the first playtesting session were:
- to test the game mechanics for usability, cohesion, and "luck/skill balance" (Brathwaite & Schreiber, 2009, p. 112);
- to test the scoring for usability and timing;
- to get a sense from the playtesters as to whether they found the game engaging.

At this point the designers had a sense of how the game should be played and had even drafted a set of operational rules (Salen & Zimmerman, 2004); however, rather than spend time assessing the effectiveness of the written rules (which would surely change through iterations of the game), they decided it would be best to explain the game and basic rules and then let the players begin playing.

The first playtesting session was scheduled for one hour on a Tuesday evening near the end of the semester and was held in a classroom in the School of Education. One designer served as facilitator of the playtesting session while three other designers observed, took notes, asked questions, and occasionally prompted the playtesters to think aloud while playing. The sophomore and the graduate student played as a team (Team 1) against the freshman (Team 2). The facilitator explained the goal of the game and the basic game mechanics and components. The game began at 6:32 p.m. and ended at 7:34 p.m.

Each team took seven turns, but the seventh turn was perfunctory as each team had two students at mastery level with the third student one or two points away from mastery level. Excluding the seventh turn, the average duration for a turn was 4:45 minutes, with the first turn being 10 minutes. Team 1 earned a total of $580 from the Resource die and spent a total of $290 on four resources. Team 2 earned a total of $500 and spent a total of $220. Both teams bought Calculators and Art Supplies. Team 1 used the Computer Lab 5 times with 8 students. Team 2 used the Computer Lab 2 times with 5 students.

Results of playtesting session 1. One playtester said that the overview of the game scared him because it seemed like there was a lot involved. However, after a couple of turns he realized that it wasn't that difficult. He suggested (and the others agreed) that the game should start with a very short round (maybe three turns with Number Sense as the only standard) to introduce the game, then move on to a second round with multiple standards. The players on Team 1 thought that having two people on a team was helpful, and the player on Team 2 agreed that having a partner would have been useful, in particular to avoid making mistakes when matching students with activities. Both teams felt that it was too easy to get money and suggested raising prices for resources or somehow making resources more difficult to obtain. Both teams noted that they were never too concerned about having access to the Computer Lab, but they saw how it would be more of a concern with three or four teams playing.

There was a significant amount of discussion regarding scoring and scorekeeping. One playtester suggested that when a student moves to the next mastery level, he should stop at the beginning of the level. For example, if a student is near the end of Low Mastery and receives three points for a Low Mastery activity, he shouldn't receive any Partial Mastery points. This recommendation is consistent with the idea that students don't receive points for participating in activities that are outside their current mastery level. Another playtester suggested making the Near Mastery level longer. Her team had enough success on an activity near the end that a learner went from Partial Mastery to full Mastery. Both teams thought that playing a digital version of the game would be more enjoyable because they wouldn't have to spend so much time on scorekeeping.

In general, the playtesters characterized the prototype as a matching game. The activity cards showed the bonuses for particular learning styles and the student information cards showed the students' learning styles, so they simply had to pair them while paying attention to the standards and mastery levels addressed by the activities and the resources required. In other words, players were not required to think about the nature of the activities. One playtester clearly realized this after a few turns and developed the strategy of first searching for activities that matched one or more of his students' learning styles, and then choosing from that subset an activity that also specified a technology bonus. When shown the next proposed iteration of the activity card, which would hide the activity's association with learning styles and the technology bonus until the scoring phase of the turn, the playtesters thought that the change would increase difficulty but also make the game more realistic (i.e., enhance fidelity of the primary mechanic).

Playtesting session 2. To prepare for the second playtesting session, the designers revised several of the game components and developed an assessment of learning to be administered to the playtesters before and after the session. The activity card (see example in Figure 2) now had the results on the back, with a greater variety of results that nonetheless were more likely to reward the selection of an appropriate activity for a given learning style (see Figure 4).

Figure 4. Revised activity card (front and back).

Furthermore, there was now narrative feedback for each result and a single number for each combination of result and learning style, eliminating the calculations required in the previous version and simplifying scorekeeping. Players would be told not to look at the backs of the cards until they had paired students with activities and rolled the die for results. Overall, the designers thought that these changes would reward players who learned to associate certain types of activities with learning styles and who learned to recognize appropriate use of technology resources.

A revised version of the learning styles map, which initially functioned as a design tool for evaluating the appropriateness of an activity for each learning style, was used in the second playtesting session as a scaffold (Wood, Bruner, & Ross, 1976; cf. Vygotsky, 1978) to assist players in identifying potentially successful activities for their students' learning styles (Figure 5).
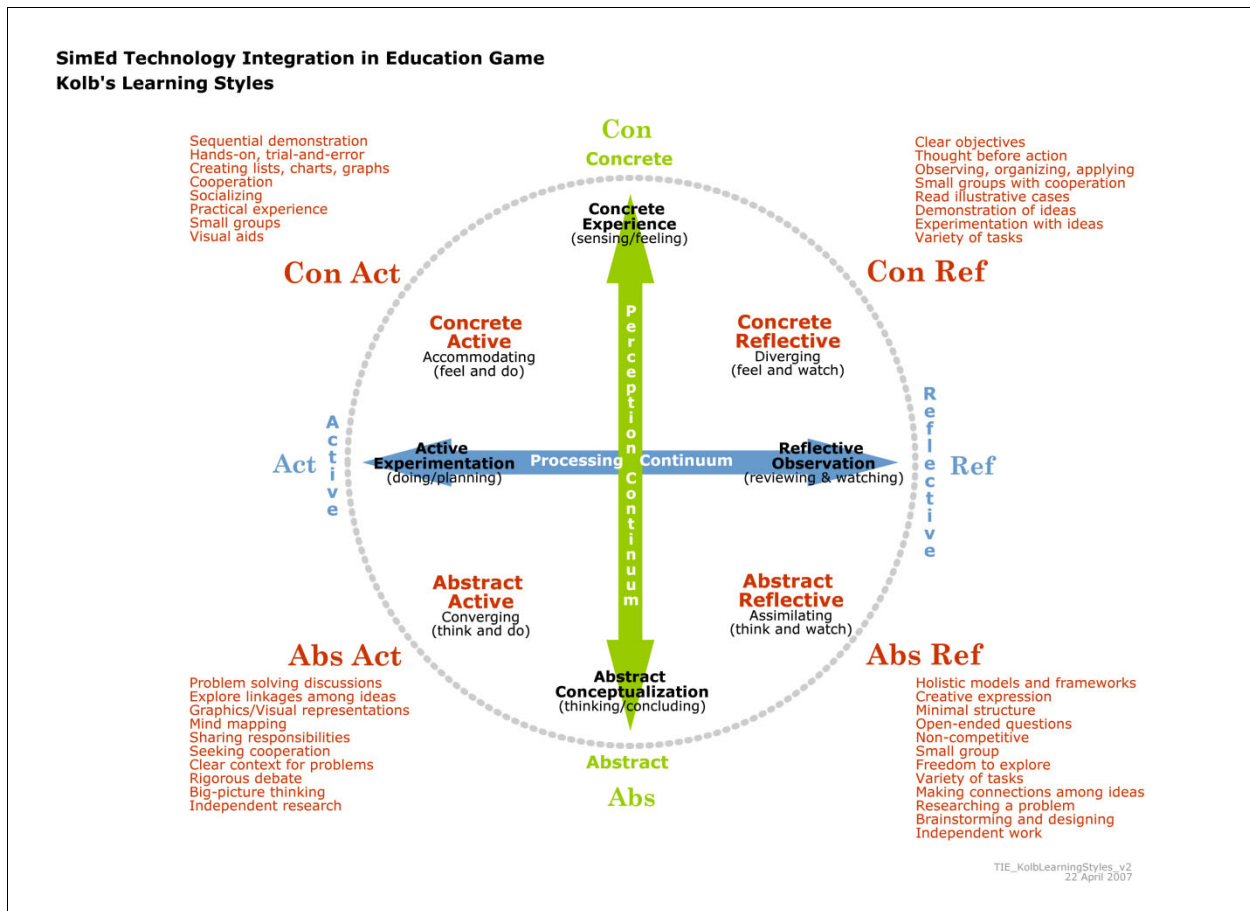
Figure 5. Learning styles map.

The descriptions of experiences amenable to each learning style suggested—but did not specifically duplicate the text of—particular types of activities. The designers thought that this approach would replace the simple matching that occurred in the first prototype with more deliberate analysis of activities, which would be more likely to transfer to real-world practice. Some minor changes were made to the assessment log (Figure 6) based on the results of the first playtesting session. The Near Mastery section was extended and the Mastery section was clearly labeled and assigned a score of +3. An extra round was added so that a practice round of a few turns with one standard (Number Sense) and three students would serve as a tutorial at the beginning of the playtesting session.

Student Name:												Learning Style:				Concrete Active			Concrete Reflective			Abstract Active			Abstract Reflective		
Round				Standard	Low Mastery +0									Partial Mastery +1									Near Mastery +2						Mastery +3	Player Score
1	2	3	4	Number Sense	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
	2	3	4	Computation	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
	2	3	4	Algebra & Functions	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
		3	4	Geometry	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
		3	4	Measurement	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
			4	Problem Solving	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
			4	Data Analysis & Probability													13	14	15	16	17	18	19	20	21	22	23	24	25	
																											Total Score		

Figure 6. Revised assessment log.

For the second playtesting session, the designers hoped to recruit eight playtesters to form four teams. One designer made flyers which were posted around the School of Education. Flyers were also distributed to faculty who taught technology integration classes for undergraduates and to the Dean's advisory council, a group of student leaders in the School of Education. In addition to specifying details about the playtesting session, the flyers

promised pizza, cookies, and beverages for participants. A few days before the scheduled playtesting session, two designers spent a couple of hours in the School of Education's atrium distributing information about the session to potential participants.

The second playtesting session was scheduled for two hours on a Wednesday evening two weeks after the first session and was held in a classroom in the School of Education. Six undergraduate students participated: three females (two of whom were sports marketing majors while the third was a pre-service teacher) and three males (all of whom were pre-service teachers).

The primary goals of the second playtesting session were to test the revised game components and rules, and to see if playtesters learned about learning styles and differentiated instruction through the appropriate integration of technology. Several designers collaborated on the development of an instrument to assess the players' knowledge of technology integration gained from playing the game. They intended to use this playtesting session as a pilot test of the instrument, which would then be refined for use with subsequent prototypes. Space precludes a detailed description of the instrument and analysis of the results.

The playtesting session began with brief introductions of the participants, who were encouraged to help themselves to the food and drinks that were provided. The facilitator for this session was the same designer who facilitated the first session. The administration of the pre-test took approximately five minutes. The playtesters formed three teams with the help of the facilitator, who then spent approximately 30 minutes guiding the playtesters through a couple of practice turns and answering their questions. The playtesters then played the game for 45 minutes, completed the post-test, and spent approximately 25 minutes discussing the game.

Results of playtesting session 2. In general the playtesters found the game to be enjoyable and challenging. As might be expected (and desired), the pre-service teachers obtained better results in the game than students who were not studying to be teachers. The revisions to the game components and rules, along with the practice turns, seemed to reduce the amount of confusion regarding scorekeeping. Because there were three teams this time instead of two, each team had a little more time between its turns to search for activities. However, selecting activities was more difficult because the results were on the backs of the cards. Instead, the playtesters used the learning styles map to infer which activities might be appropriate for their students, a process that took more time and effort. The designers did not take detailed notes regarding the duration of turns or resources used.

Discussion

We began this study by positing two questions that we thought could be answered through the design and development research approach. The first was, how can instructional design theories be applied in the game design process? We based the structure of our game on the elaboration theory as a way of ensuring that our players were engaging in whole tasks that increased in difficulty as they progressed. While we only partially tested gameplay to validate this approach, it is so commonly (if unknowingly) used in game design that it seems a natural application of the theory. However, given a game with different goals, a different theory may be suitable. A potential line of research might consider how game genres align with learning objectives and with instructional design theories.

We applied Merrill's first principles of instruction and Kolb's learning styles to evaluate the quality of learning activities and their effectiveness with given students. We would conclude from this that instructional design theories and learning theories are applicable as models for game components, including scoring mechanisms.

We drew upon cognitive load theory to make decisions about the design of game components and the amount of information players need to make successful decisions in the game. We are still struggling to resolve issues regarding the balance between cognitive load and fidelity in the design of activity cards. Instruction that embodies Merrill's first principles should describe how the learner's prior knowledge will be activated, how demonstration and practice will be provided, and how integration of the new knowledge and skills will be facilitated. This is more textual information than games generally require players to manage. Furthermore, at least in our current conception of the game, players must search through a large number of activities in a short time to keep gameplay moving forward. There may be a technological solution that would be difficult to incorporate in a board game, such as an interface for specifying desired criteria that retrieves only satisfying activities. That approach would simplify the primary game mechanic of selecting appropriate activities by splitting it into two steps: specifying criteria and examining in detail the applicable subset of all activities.

Our second question was, what design principles may be formulated from a retrospective analysis of the design and development process and artifacts? It is clear that we intuitively decided that our primary game mechanic—the selection of activities that complemented students' learning needs, styles, and preferences and that utilized appropriate technologies—needed to be aligned with our primary learning objective. We might conclude that designing core game mechanics that are aligned with learning objectives is a fundamental design principle for

instructional games. In other words, if someone needs to be able to do something in the real world, design a way for him or her to practice that action and receive feedback in the game. Furthermore, the primary game mechanic should have high fidelity to real-world practice to facilitate transfer. Our initial attempt at this was flawed and resulted in a simple matching game; we provided too much guiding information on the activity cards whereas in a real-world context those data would not be so explicit. However, by focusing on the learning objective, we were able to redesign the components of the game—in this case the learning activity cards and the student information cards—to require the player to practice the real task.

Based on our experience in using models to design game components, we would suggest that when designing a scoring mechanism based on the relationship between two models (e.g., the relationship between learning activities and learning styles), and further when multiple designers are collaborating on evaluating components of those models, that the process be treated as a matter of inter-rater reliability. In our case, we created a map to assist designers in making this judgment, and we had one person serve as final arbiter of all scoring decisions. It is worth noting that we ended up giving a version of that map to players as a scaffold. This suggests that there may be a relationship between design tools and learner scaffolds that merits further investigation.

As we reflected on our design experience, we noted the similarities between playtesting and participatory design (Carr-Chellman & Savoy, 2004). Our playtesters gave us several creative and concrete suggestions for improving our game, and this highlights the usefulness of combining rapid prototyping with playtesting. It is increasingly common in game design to playtest frequently (cf. the designers' commentary included in the videogame *Portal*, 2007; Barnett, Swift, & Wolpaw, 2008), while in instructional design the formative evaluation of products seems less frequent and in many cases less open to design suggestions from participants.

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Cyber Bullies Come to Campus: Are Administrators and Faculty Ready?

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Abstract

An increasing number of kindergarten through 12th grade students are using interactive technologies as part of their daily lives; but its usage comes at a price. One of the costs of technological interconnectedness among students is cyber bullying – the willful and repeated harm inflicted through the medium of electronic text (Hinduja & Patchin, 2007). Previously Myers and Carper looked at the impact of cyber bullying on schools and what legal guidance is currently available (Myers & Carper, 2008). They reported that cyber attacks affect over half of our teenagers (National Crime Prevention Council, 2007) and 42 percent of children in fourth through eighth grade (iSafe America, n.d.). It is not surprising that the effects of these attacks transmit over to performance and diminish school safety.

It is vital that school personnel clearly understand their role in protecting students from harm while promoting free thought. Enforcing cyber bullying policies cannot come at the expense of Constitutional free speech rights. The challenge is in knowing the difference and applying the appropriate response within the schoolyard gates. To that end, this research involves a survey of K-12 school teachers and administrators in Illinois and their perceptions of abuse of cyber technology in the schools, the type of cyber bullying occurring, and the actions taken in response to inappropriate cyber incidents. The findings and conclusions of this study support both a need and a desire for educational training on cyber awareness and cyber policy development. The results suggest the need for appropriate responses to specific instances of cyber activity involving students, school property, school events, or school personnel. Basic guidelines for training will be addressed as well as, the need for further research on the topic.

Problem and background

Today's youth have a great deal of technological sophistication. They have embraced cyber technology and digital media as a lifestyle for communicating, for making cultural connections, for interacting, and for social networking. Cyber technology usage allows children to easily communicate with their friends locally and globally. World events, scientific breakthroughs and information on every conceivable subject are available by surfing the Internet as are services providing guidance, finding people, locating products, and purchasing supplies and tickets. Use of this technology is essential for student success in today's society. Internet usage is often a requirement and a

necessary tool for researching and gathering resources for completion of school assignments. Although the technology has brought advantages in communication, information, and entertainment from the world to student fingertips, it has also brought with it certain disadvantages.

Disadvantages associated with technology typically include: identity theft, online predators, pornographic displays, viral attacks, and spamming (Mueller, n.d.); however, school personnel should be concerned with the use of technology by children to harass, humiliate, or bully others online. It is this inappropriate usage of technology that is more problematic to more eight to 15 year- olds than issues concerning violence, drug and alcohol usage, racism or the pressures to have sex. In a national survey commissioned by the Kaiser Family Foundation and Children Now, 55% of 8 to 11 year-olds and 68% of 12 to 15 year-olds reported bullying and teasing as the "biggest problem" for people their age ("Talking with Kids About Tough Issues", 2001). Among 8 to 11 year-olds, only 46% of them reported violence as a "big problem"; 44% reported alcohol or drugs as a "big problem"; and 33% reported pressure to have sex as a "big problem." Similarly, in the 12 to 15 year- old category, 68% reported alcohol or drugs to be a "big problem"; 62% reported violence as a "big problem"; and 49% reported pressure to have sex as a "big problem" for people their age.

So how does this "big problem" relate or connect to schools, school administrators and faculty? The media is replete with stories of cyber aggression. Its extent is so pervasive that the Centers for Disease Control and Prevention recognize electronic aggression as an emergent health risk to students (CDC, n.d., a) affecting nearly 75% of teenagers between 12 and 17 (Wolpert, 2008). Further, Wolpert reports on a California study where of the 75% of teenagers who were bullied online, 85% had been bullied at school. Other studies find a minimum of 9 to 35% of all school-aged children (CDC, n.d., b), and 42 to 53% of children in fourth through eighth grades have been cyber victims (iSafe, 2006). Every day 160,000 children miss school because they fear bullying (Shore, n.d.). Associated effects include emotional distress, depression, suicide, loss of interest in learning and conduct problems including increased risk of substance abuse, truancy, and in-person victimization. A recent U.S. Secret Service and Department of Education study reported that 71% of the 41 school shooters between 1974 and 2000 had been targets of bullies (Vossekuil, Fein, Reddy, Borum, & Modezeleski, 2002). Cyber aggression and its effects ha**ve** crept into classrooms, affecting student learning and school administration. Its damaging impact interferes with student learning and prevents students from achieving their highest potential. The children who are bullied, teased, harassed or ostracized are not the only victims. The bystanders (Coloroso, 2004), teachers and administrators are also affected in terms of education, mental and physical health, and lost productivity, by the climate of disrespect and fear created by cyber aggression. The extent to which schools are aware of the problem and have instituted programs, policies and plans to address this phenomenon is the focus of this research.

Methodology

From early December, 2008 until mid January, 2009, the College of Education and Human Services at a U.S. midwestern university conducted a collaborative study entitled "Cyber Technology in Schools: A 21st Century Dilemma." This study focused on cyber bullying and cyber technology as it relates to school policies and school training of K-12 administrators and teachers. Four faculty members (two law enforcement and justice administration, one instructional design and technology and one curriculum and instruction) conducted this survey. Electronic surveys for administrators and teachers were sent to the area districts covered by nine regional offices of education in the state of Illinois. A total of 552 teachers and 141 administrators responded to the survey. This research focused on the questions in the survey that related to school personnel perceptions of cyber abuse in the schools, types of cyber bullying occurring, actions taken in response to cyber incidents and need for further instruction for handling cyber aggression situations impacting the educational system.

Survey findings

This survey was sent to nine regional offices of education in Illinois. One hundred and forty-one administrators responded and described the population area of their schools as 71% rural, 11% small city (15,000-29,999), 10% medium city (30,000-74,999), 4% large city (75,000-150,000), 3% metropolitan area (above 150,000), and 1% other. Five hundred and forty-four teachers responded and described the population area of their school as 60% rural, 13% small city (15,000-29,999), 22% medium city (30,000-74,999), 2% large city (75,000-150,000), 2% metropolitan area (above 150,000),and 0% other. This survey did not address the difference in availability of Internet or cell phone access between rural, urban and suburban areas and any possible impact on cyber activity.

District policies

School personnel were asked whether their school or district has a formal policy for handling and/or responding to suspected incidents of cyber bullying. The responses from administrators and teachers were contradictory. As seen in Figures 1 and 2, 64% of administrators reported that their school had a policy while 81% of teachers who responded reported that their school had either no policy or were unsure as to whether a policy existed.
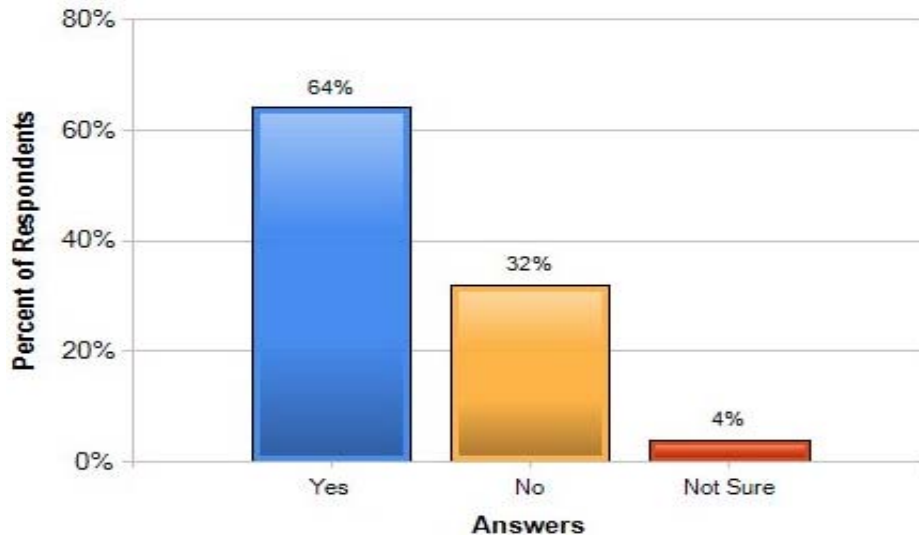
Figure 1. Administrators - policy
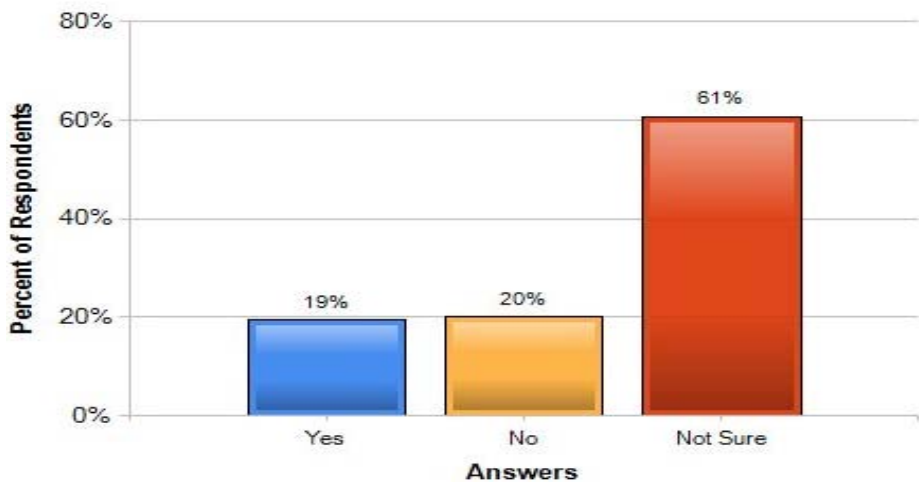
Figure 2. Teachers - policy

Not only did administrators and teachers disagree as to the existence of a school policy; they disagreed as to the extent of training on electronic aggression. In response to the question "Have you received training on cyber bullying and school behavior?" as displayed in Figures 3 and 4, 48% of administrators said they had received training while 47% said they had not; and 5% were not sure if they had received such training. Of teachers responding, 17% said they had received training; 79% said they had not; and 4% were not sure if they had received training.
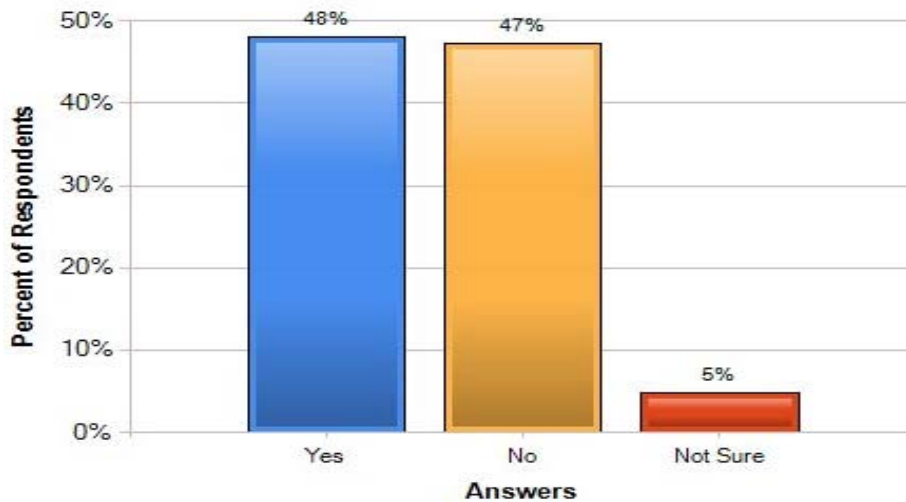
Figure 3. Administrators - training

Reported incidents of cyber bullying

        Despite the discrepancy in definition of cyber bullying, both administrators and teachers report its occurrence as evidenced in Figures 5 and 6. Over 45% of the 128 administrators reported having had a student, faculty member, or another administrator comment on or reported an incident involving cyber bullying. Only 13% of the 503 teachers responding reported having had a student, faculty member, or another administrator comment on or report an incident involving cyber bullying.
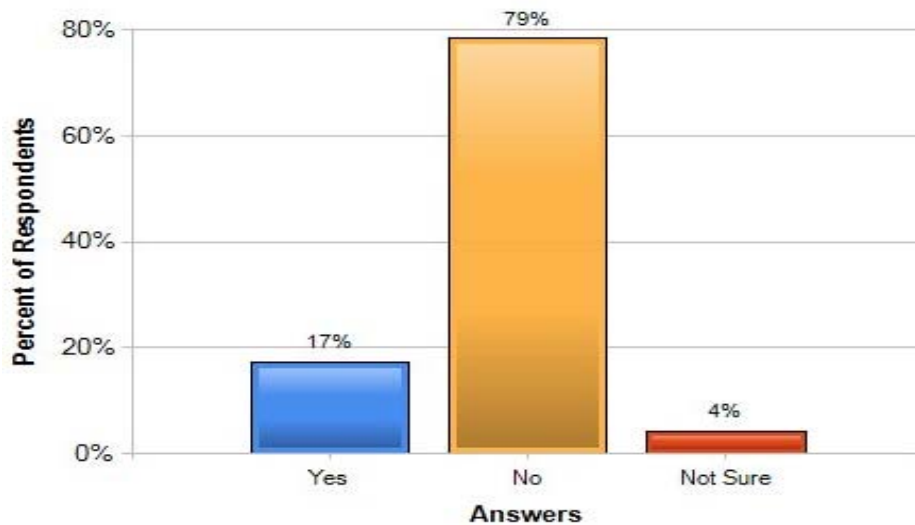
Figure 4. Teachers - training

Despite the reported discrepancies in the existence of cyber bullying policy and training, both administrators and teachers noted its occurrence. As seen in Figures 5 and 6, over 45% of the administrators and 13% of teachers reported receiving comments or reports of cyber bullying incidents from a student, faculty member, or another administrator. These numbers are disturbing in light of the previous responses concerning policy. Without policy guidelines and supportive training, too many open questions remain. What behavior is reported? When is reporting required? To whom should reports be made?
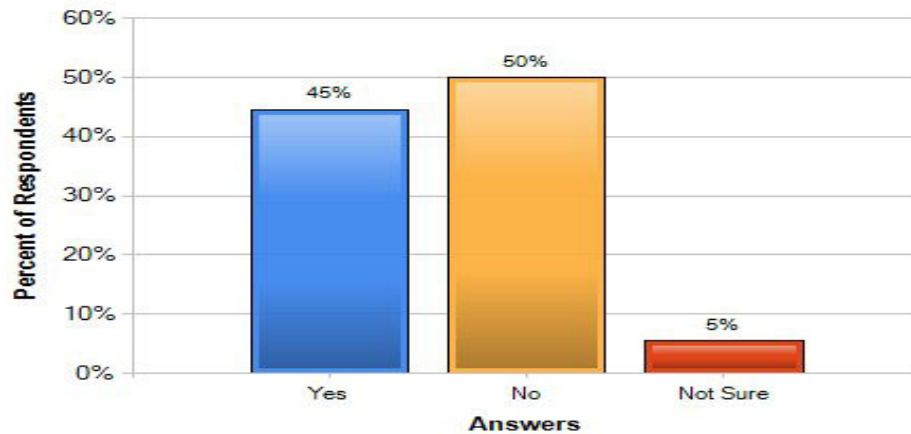
Figure 5. Administrators – reported incidents
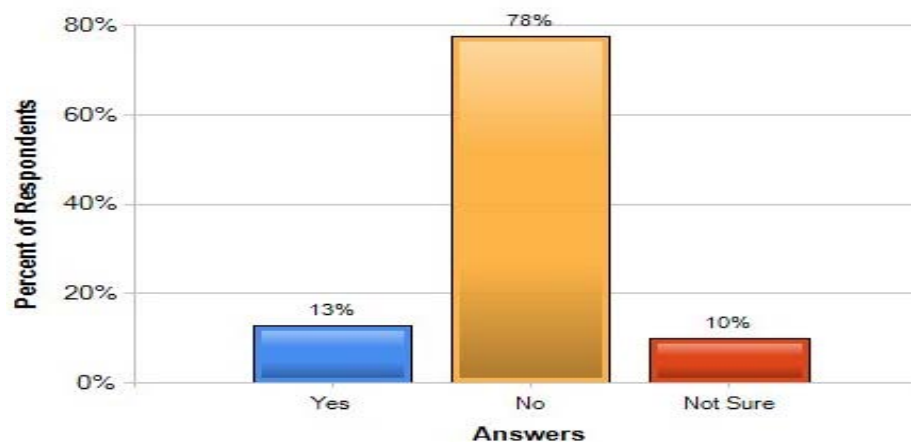
Figure 6. Teachers – reported incidents

Cyber bullying – an all encompassing definition

The varied responses given both by administrators and teachers concerning cyber bullying policy and training (displayed in Figures 1 through 4), and in incident reporting (displayed in Figures 5 and 6) indicate confusion -confusion in terms of policies in place to limit cyber bullying practices, confusion concerning what activity allows educators to intervene, and confusion as to whether off-campus incidents authorize a school to step in and intervene. Part of the difficulty stems from the definition of cyber bullying. The survey asked the question, "What is your definition of cyber bullying?" Administrators responded at the rate of 81% (N=115); teachers (N=378) and the definitions were so varied as to escape classification, except to state that some responses included activities protected by the First Amendment guarantee of free speech, and some focused on criminal activity with a wide variety of definitions in between.

Many administrators and teachers in this study broadly defined cyber bullying pursuant to the Li (2007) definition, using electronic communications to bully others; or the Patchin & Hinduja (2006) definition, as "willful and repeated harm inflicted through the medium of electronic text" (p. 148). The responses included bullying through e-mail, instant messages, social networking websites, in chat rooms, or through digital messages or images sent to computers, cellular phones, or handheld communication devices as defined by Kowalski, Limber, & Agatston, (2008). Other responses included any attempt or intimidation that is "unwelcome", "belittles", "makes someone uncomfortable", or "creates a hostile environment" through the use of technology, the Internet or an electronic device. Also included were "inappropriate name calling", "teasing", "making fun of", "defaming", "tormenting", "vilifying", "gossiping", and "spreading rumors" about others.

All of the definitions of cyber bullying listed above have the potential to cause harm, to be hurtful, uncivil or rude, but not all may be regulated by school policies. Students, like everyone else, have First Amendment rights that school officials cannot encroach. No precise definition or universally acceptable policy for handling online student postings has been proclaimed by statute or legal precedent. The Supreme Court has yet to decide a case

concerning school censorship of student expression specifically involving online postings. Lower courts that have addressed the issue are not all in accord (Hudson, 2000). Individual state statutes and some state policies provide greater protection of Constitutional provisions than others for student-generated school speech. California, for example, provides students with the same guarantees of free speech in school as they have out of school with the exception that they use proper English (Cal. Ed. Code Sections 48907 and 48950, 2006). These codified variations make it more difficult to differentiate between actionable and inactionable expression over the Internet and between protected and unprotected speech. Furthermore, not all messages have the same impact on all audiences of all ages, gender, and sensitivities. This challenge is further complicated by the Internet's omnipresence off and on campus. Thus, it is understandable that school officials are confused concerning policies addressing the situation. The dilemma becomes – what to do, when to intercede, what is protected and what is unprotected speech.

Before school policies can be created, school officials must be taught that certain categories of undesirable speech may not be regulated. Harassment, true threats, aggressive expressions and stalking may provide causes of action, whereas parodies, political commentaries, obnoxious activities or rude and uncivil behavior may not. For example, student- on- student harassment envelops many forms: ranging from subtle teasing to name calling referencing physical characteristics, racial epithets and sexual preferences. Under federal law, harassment forms the basis of civil action only when based on race, ethnicity, gender, religion or disability and then only when those harassing acts have a systemic effect on educational programs and activities *(Davis v. Monroe County Board of Education, 1999)*. School officials first must be taught these subtle distinctions before policy can be created and training conducted.

Speech rights of students are "not automatically co-extensive with the rights of adults in other settings" (*Bethel v. Fraser, 1986).* Children are not given the same latitude permitted to adults to use offensive expression. Elaborate, graphic, and explicit sexual metaphors and lewd, indecent, or offensive speech by students may be regulated in public schools. School officials may protect minors from exposure to vulgar and offensive language including cyber language. The Supreme Court has held that while a school may not discipline a student for a political viewpoint; it may sanction a student for making a sexually explicit speech during a school assembly. This distinction illustrated in *Bethel v. Fraser* speaks to the form and manner of student speech, not its substance. It addresses the time, place and manner of expression, not its content or viewpoint. In a K-12 setting "lewd," "vulgar," "indecent," and "plainly offensive" speech offends and undermines the school's basic educational mission.

Additionally, student expressions may be regulated when the speech would substantially disrupt or interfere with the work of the school or the rights of other students (*Tinker v Des Moines, 1969*). Specific and significant fear of disruption, not just some remote apprehension of disturbance is required. Students have the right to express their opinions, even those disliked by other students or school officials, but only as long as they do so without materially and substantially interfering with school discipline or the rights of others.

Further, a school may limit speech that is reasonably perceived to be inconsistent with the shared values of a civilized social order. A school may also regulate school sponsored speech on the basis of any legitimate pedagogical concern including not only speech that would "substantially interfere with its work or impinge upon the rights of other students," (*Tinker v. Des Moines, 1969 p. 509*), but also speech that is, for example, "ungrammatical, poorly written, inadequately researched, biased or prejudiced, vulgar or profane, or unsuitable for immature audiences" (*Hazelwood v. Kuhlmeier, 1988, p. 271)*. Additionally, schools any always sanction true threats regardless of their origin, on or off campus, as no First Amendment protection applies.

Notwithstanding state and federal variations, and the discord as to definitions and decisions, most experts and several administrators and teachers participating in the survey define and regulate cyber bullying along the same lines as traditional bullying. The only difference is the medium of expression. They attempt to resolve cyber aggression situations by using the same methodologies imposed for traditional bullying – fitting the square peg in the round hole. Policies appropriate for traditional bullying may not necessarily be appropriate for cyber bullying due to differences in physical location, global reaching, anonymity and repetitive, non-escapable electronic communications. Training and research is needed to distinguish traditional bullying from cyber bullying and distinguish protected online expression from unprotected online behavior.

Training content

Early criticism of technology usage led to legislation concerning Internet safety for children (Children's Online Privacy Protection Act, 1998). Social networking sites created policy provisions focusing on preventing children from becoming victims of sexual predators, sexual harassment and pornographic displays. Today, according to the Kaiser study the inappropriate usage of technology is the biggest problem facing children; thus, school personnel should shift their concern from Internet safety to the use of technology by children to harass, humiliate, or bully others online. The shift in focus from Internet predators to online harassers should generate

further training. Current policy formulation and training should now include netiquette issues as well as safety issues.

The school surveys produced differing responses between administrators and teachers with regard to the content of their training. Administrators received extensive training on traditional Internet safety and sexual predator issues; but less training on netiquette issues. Specifically, administrators received information on Internet safety (100 %), sexual predators (84%), sexual harassment (82%), netiquette/appropriate Internet behavior (74%), other (2%) and none (2%). See Figure 7. Teachers reported different findings. Teachers reported training for Internet safety (90%), sexual predators (41%), sexual harassment (46%), netiquette/appropriate Internet behavior (71%), other (1%) and none (1%). See Figure 8.
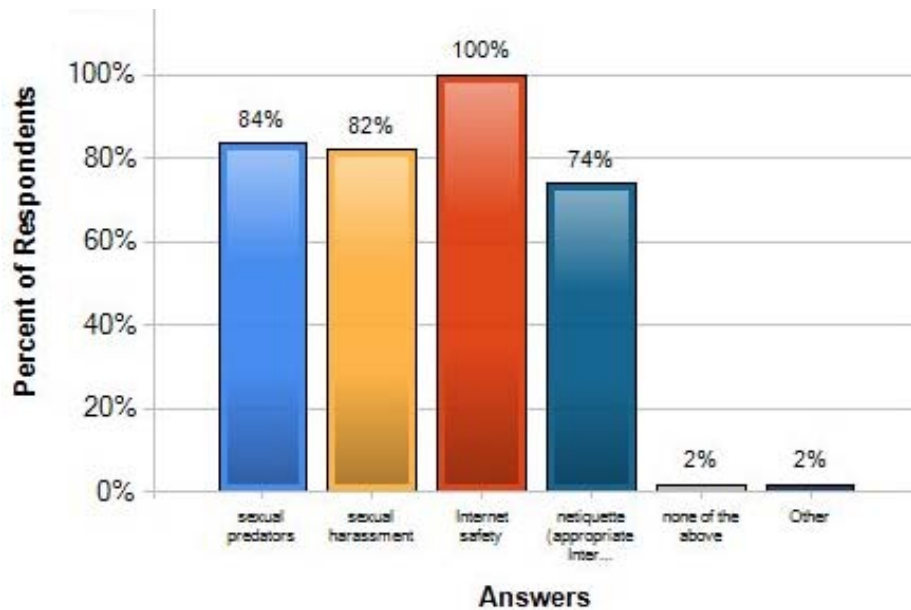
Figure 7. Administrators – training content

Future training

Despite high responses for past training opportunities (Figures 9 and 10), both teachers and administrators expressed a desire for more training opportunities, recognizing the changing nature of technology, its uses and the legal standards governing the schools role in restraining use. As seen in Figure 10, administrators expressed interest in training in protocols for handling/preventing bullying/cyber bullying incidents (87%); terminology and language specific to technological communications (66%); discussing cyber bullying and the school's role in restraining its use (74%); discussing training for appropriate use of electronic devices by students (67%). A majority of responding teachers responded in similar fashion (Figure 11). They said would be interested in supporting or attending training in protocols for handling/preventing bullying/cyber bullying incidents (75%); terminology and language specific to technological communications (50%); discussing cyber bullying and the school's role in restraining its use (63%); and discussing training for appropriate use of electronic devices by students (55%).
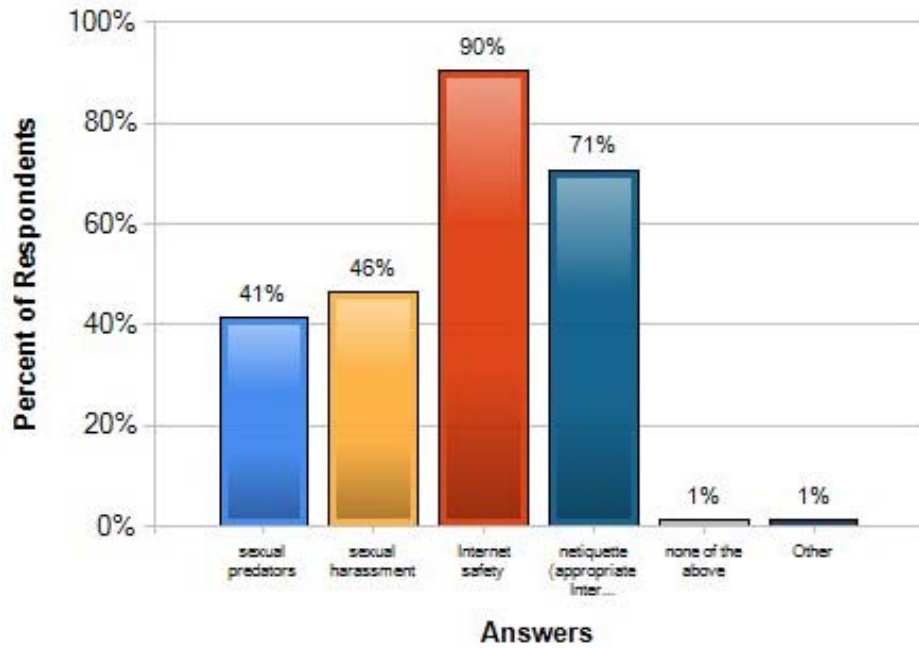
Figure 8. Teachers – training content
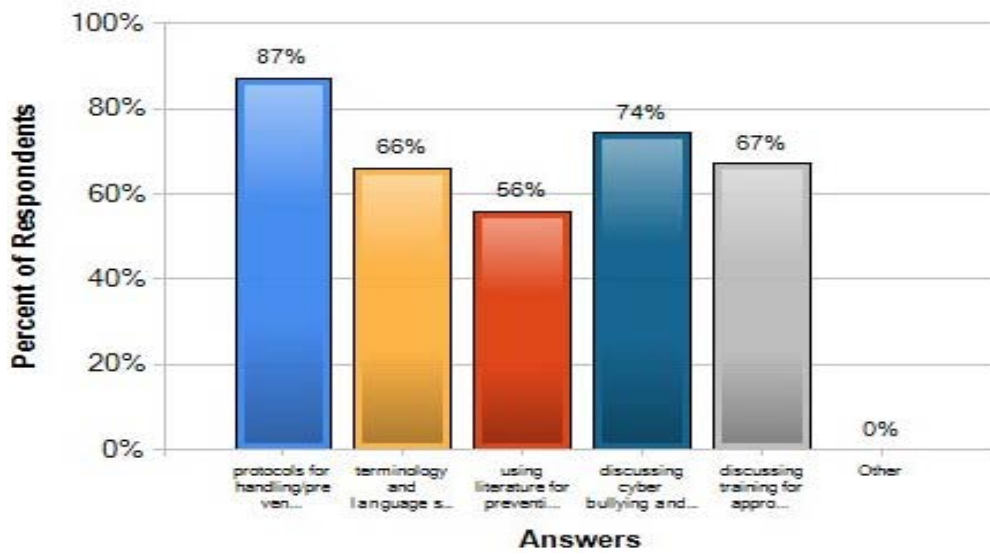
Figure 9. Administrators - future training
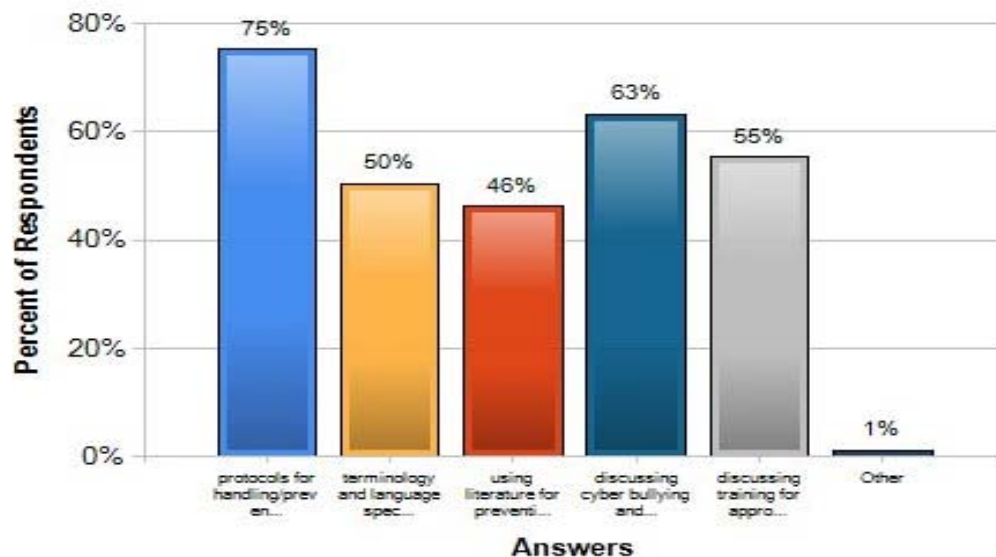
Figure 10. Teachers - future training

Conclusion

The main finding of this study is confusion: confusion over the definition of cyber bullying, confusion over existing policies and when and to whom policies apply. Administrators and teachers need to know the distinction between protected and non protected cyber expression and the different legal standards that apply. Fortunately teachers and administrators in this study recognize the need for future training in all aspects of cyber expression.

Students have always and will always bully one another, say offensive things, and test the limits of their teachers' and administrators' patience while learning to express themselves and develop into adults. The manner of student inappropriate behavior has changed with the advent of technology; thus, schools too must change to meet the new challenges. From the courts we have learned that some forms of harassing speech or cyber bullying does not warrant First Amendment protection or school sanctions. Yet, doing nothing is not an option. Cyber bullying affects students' reputations and their futures, disrupts the educational process and causes serious health concerns. So then, what must be done? Again, courts have provided the answer. The school's proper response is to train the professionals to educate the audience rather than squelch the speaker.

Acknowledgement

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Web 2.0: What Works – and What Doesn't – Experience From the Trenches

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Descriptors: Web 2.0, Teacher Education, Technology Integration

Abstract

The purpose of this presentation is to highlight some of the ways that Web 2.0 tools and pragmatic source ware can be useful to student learning. Based on our experiences with these tools and feedback from our students, we also highlight some of the pitfalls to avoid. This presentation will be of interest to teachers, teacher educators, media specialists, and administrators whose goal is to prepare students for the future in an uncertain global economy.

Introduction

As new technologies become available, it is important to examine them to determine how they might be used to advance the learning process. Web 2.0 technologies, which generally refer to those Web applications that promote sharing and interactivity, are sometimes thought of as "new", but critics point out that many of the technological features of Web 2.0 were available in early web use (Wikipedia, 2009a). This is evinced in the fact that approximately two decades ago users were able to "participate and directly interact and change web pages" with the development of Really Simple Syndication/Rich Site Summary (RSS) robust Technologies in 1994 (O'Connor-Petruso, 2010).

Although diversified definitions of Web 2.0 exist today, it is commonly referred to as "the changing trends in the use of World Wide Web technology and web design that aim to enhance creativity, communications, secure information sharing, collaboration and functionality of the web. Web 2.0 concepts have led to the development and evolution of web-culture communities and hosted services, such as social-networking sites, video sharing sites, wikis, blogs, and folksonomies." (Wikipedia, 2009a).

Social networking sites (SNS), or online communities who share common penchants and interact through emails and/or blogs, have gained increasing popularity worldwide; they are usually free, user-friendly, and offer multiple diversified attributes such as posting personal profiles, uploading pictures, videos, music, and so forth. Users generally interact through email and/or blogging. Although analysts disagree as to the top twenty most popular social networking sites, Facebook, Twitter, and MySpace are usually on the list (Lewin, 2009).

One author does not advocate nor use the SNS in her classes as she found too many students (both graduate and undergraduate) were fledglings with these tools, readily sent personal information over the web and were completely unaware of the lack of security in SNS. Several recent startling events such as "Spyware designed to steal Facebook users' information…Cross site scripting vulnerabilities in Facebook…Twitter accounts used to send SPAM…" are discussed by experts in network security (Schultz, 2009).

Folksonomies are "collaborative tagging, social classification, social indexing, and social tagging" (Wikipedia, 2009b). As these new and emerging technologies continue to grow at a supersonic rate and are utilized

and shared on a global platform, it is important for educators and educational technology specialists to share their experiences with these tools as there is a shortage of empirical evidence on their effectiveness.

In addition, how technology tools are used in the classroom can make a difference in the way a learner learns. Although educators mean well when they adopt or adapt technology tools for classroom use, sometimes the technology tools are not maximally helpful to the learner for a variety of reasons. This presentation will highlight some of the ways that Web 2.0 tools can be useful to student learning and some pitfalls to avoid. Similarly, effective open source ware will be discussed. Following are three groups of tools we will highlight, aligned with the conference sub-theme, Exploring New Media in Learning, Instruction and Performance.

Wikis

Wikis first came into existence in 1994, when Ward Cunningham, an American programmer, developed the WikiWikiWeb – the term Wiki orginates from the Hawaiian language meaning fast and quick (O'Connor-Petruso, 2010). A wiki is a collaborative interactive community, has a designated web master, offers multiple attributes such as multimedia tools, communication tools, mathematical equations and spreadsheets to name a few, can have public or private membership, and be proprietary or open source. Wikis continues to emerge and flourish at a rapid rate – both in business and education.

There are many open source wikis, however, some are more difficult to master, are not very user-friendly, and offer diversified attributes. After experimenting with several of the wikis, one author found wikispaces.com to be the most user-friendly and offer tools that are relevant to teachers and teacher candidates.

Over the past year, three separate hybrid graduate level classes at Brooklyn College of the City of New York (comprised of teachers and teacher candidates) are utilizing http://earlyactionresearch.wikispaces.com (2009), http://actionresearchprojects.wikispaces.com (2009), and http://mymstwiki.wikispaces.com (2009). Overall, the majority of the students found the sites beneficial because they introduced new vocabulary terms, familiarized students with new skills in technology and/or increased their present skills, and provided them with examples of their predecessor's work on specific assignments. In addition, many of these students turn-keyed the skills they learned to their cooperating teachers, students in the field setting, and/or students in their college classroom.

Although confined to a handful of students each semester, a persisting problem one author still encounters with the wikis, is the students' confusion in believing they have "Joined" your specific wiki (ie: MyMSTWiki and/or Earlyactionresearch); when in reality these students have only created an account and become a member of wikispaces.com – thus becoming a member of the wiki community and not the specific wiki. There are two separate places to join wikispaces (see red arrows in Figure 1).

Figure 1: MyMST Wiki screen shot
http://MyMSTWiki.wikispaces.com

Similarly, students can only join a specific wiki (red arrow on left) after they have both created and activated an account on wikispaces. Accounts are activated via email by confirming wikipspaces' invitation to join their community. Unfortunately a few of the students never respond to wikispaces's email and are consequently prevented from becoming a member. Although numerable demonstrations were given, the only remedy for the aforementioned pitfalls is to walk these students "step-by-step" through the process.

Another pitfall is the issue of students haphazardly placing their work in the wrong area (usually on the top of the page – see Figure 2). Albeit the professor verbally states and posts numerable instructions as to where to place their cursor (in the next available cell) before pasting and/or uploading their document, the issue remains. To counteract this problem of posting work in the appropriate area, one author supplements her posts with a "hands-on" demonstration and/or individualized instruction. For the majority of the cases, the use of posting instructions, "hands-on" demonstrations, and individualized instruction ameliorates theses issues.

Figure 2: Early Action Research Wiki screen shot
http://earlyactionresearch.wikispaces.com
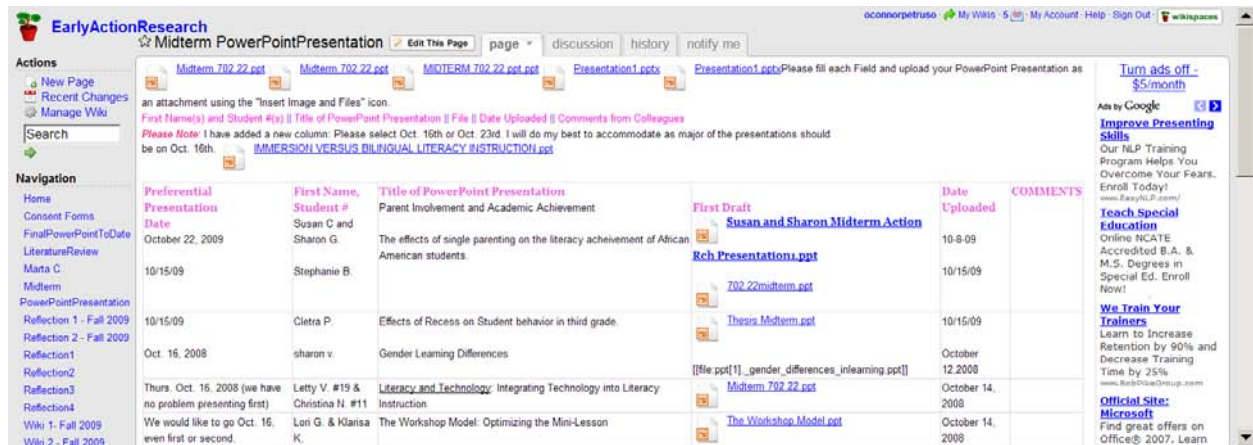
However major problems that affect the entire class arise when non-techno savvy students either do not read and/or disregard the author/professor's instructions and warnings about Page Updates and the History Tab. The wiki post "The page has been updated" informs the student that their post was saved and the new page created reflects their work. Unfortunately some students log off before they receive a post from wiki stating that their "Page was updated" and thus become confused when they log back in and see wiki's query "Revert to previous version?" Students erroneously select "no" and lose their prior work. To counteract this problem, in addition to posting instructions and warnings about Page Updates, a "hands-on" demonstration (sometimes more than one) is given in class.

However the quandary of non techno-savvy students deleting entire pages when they go to post their work remains steadfast. Although these students are less in number each ensuing semester, this problem has not been rectified. The professor has also abandoned her numerable previous attempts to show students how to use the History Tab (which allows the user to revert to previous versions) – as this tool was too often misused by the non techno-savvy students and turned the issue of one deleted page into a chronological quagmire. When other students saw that their the page/work was deleted they went to the History Tab and started reverting to the version which listed their work and were ironically deleting each other's recent posts. The only remedy from this quagmire was for the professor to take full control of the History Tab and instruct students to email her when they inadvertently delete a page and then she alone can immediately rectify the issue. This also alleviates the non techno-savvy student with the onus of finding the previous page.

Blogs and Discussion Boards

In a traditional classroom, the class ends when the time is up on the clock. There might be some assigned homework, but the discussion is cut off when the closing bell rings. With blogs (web logs) and discussion boards, communication between class meetings can continue online.

Further, students who do not normally have a voice in a traditional classroom can share their thoughts. For example, the shy student may not feel confident expressing thoughts with the whole class. An immigrant student might not feel comfortable speaking English in front of the whole class. The student with a speech impediment may be embarrassed to speak. These students can take time to prepare their ideas before they are "heard" by the classroom community. Sometimes thoughtful students are silent in the traditional classroom but appreciate the opportunity to make their opinions known.

As a sounding board, blogging serves its purpose. However instruction is needed in "netiquette" (net etiquette) using professional ethics and standards. Similarly, the instructor must set parameters and instructional direction as student blogging tends to become unfocused.

We do not advocate the use of blogs for the aforementioned reason. In addition, blogs do not always allow you to upload/attach files. We advocate for the use of Discussion Boards on course managements systems such as Moodle (n.d.) and Sakai CLE (Collaboration and Learning Environment)(n.d.), (open source ware) and/or

372

Blackboard (n.d.) (proprietary software) as most universities subscribe to it. In addition, both the professors and students can post topics that arise in class, especially if there is not enough time for a full discussion.

Another problem that arises concerns the amount of class credit (or lack thereof) for posting to a blog or discussion board. Our students are very busy – almost all hold teaching positions and are taking other classes. To ask them to post their opinions online without awarding credit does not seem to work well. Students view posting as an extra burden – they don't look at it as a way to increase their knowledge base. They are concerned with their grades, but if this doesn't "count," they don't want to bother. A recommendation is to make sure to award credit for online posting.

One author gives points for a minimum number of "substantial" postings throughout the semester. This means that there should be some substance to the posting. (For example, "*Yes, I agree*" would not be considered "substantial." Students must make a meaningful contribution to the dialogue for it to be counted as a substantial posting. Of course, short postings are permitted but they don't count toward credit. Postings should be submitted throughout the semester, otherwise some students will wait until the end to send all their postings, thereby reducing the potential dialogue during the semester.

One author uses the Discussion Board for dialogue on topics that are related to the course as well as commentary on readings that are not discussed during class sessions. The best dialogue has come from controversial issues that are related to student experiences. For example, the controversy at the beginning of the fall 2009 semester over President Obama's speech to school children that was opposed by some parents in Texas (McKinley & Dillon, 2009) generated a lot of discussion. Although the course professor thought there might be some differences of opinion, all the students were against the parental boycott. However, the discussion was heartfelt and passionate, and important points were made that were relevant to the course objectives.

YouTube Videos

Creating YouTube videos under Microsoft Word 2007 became markedly easier for the students as compared to its predecessor MS Word 2003. Several students were able to use the Developer tab and create insightful videos on their projects. Two such examples of exemplary videos on the tenets of the "Water Cycle' - a major learning objective from an elementary science inquiry unit - by Ashley Martin & Bradley Appeal (see Figure 3) and LaShaun Ellis and Cory Feldman (See Figure 4) respectively, serve to enhance learning and motivate teachers and teacher candidates to learn how to use web 2.0 source ware in their college classes and integrate it in an elementary curriculum.

Figure 3: *Water Cycle Song* by Ashley Martin & Bradley Appel
http://www.youtube.com/watch?v=KQ8KRznrXiA
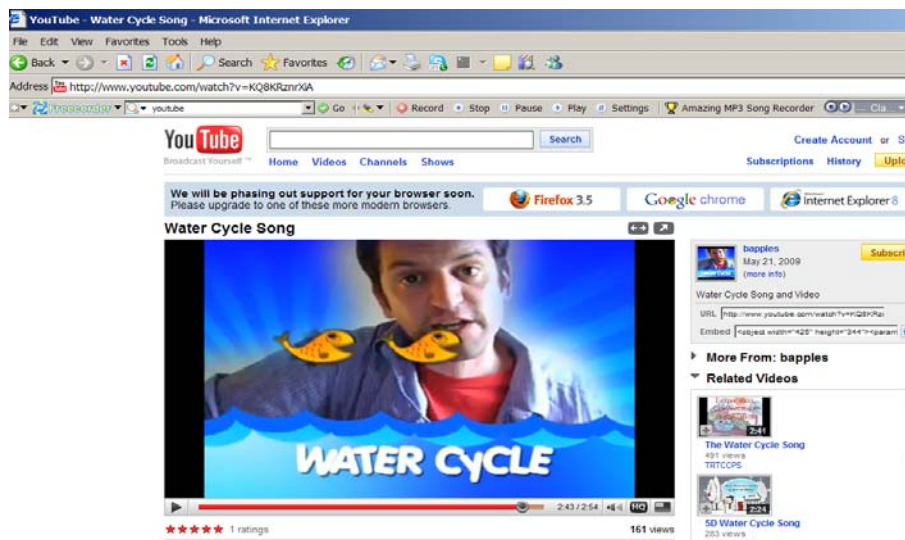
Figure 4: *Water Cycle Boogie* by LaShaun Ellis & Corey Feldman
http://www.youtube.com/watch?v=ipAiWXvH_24
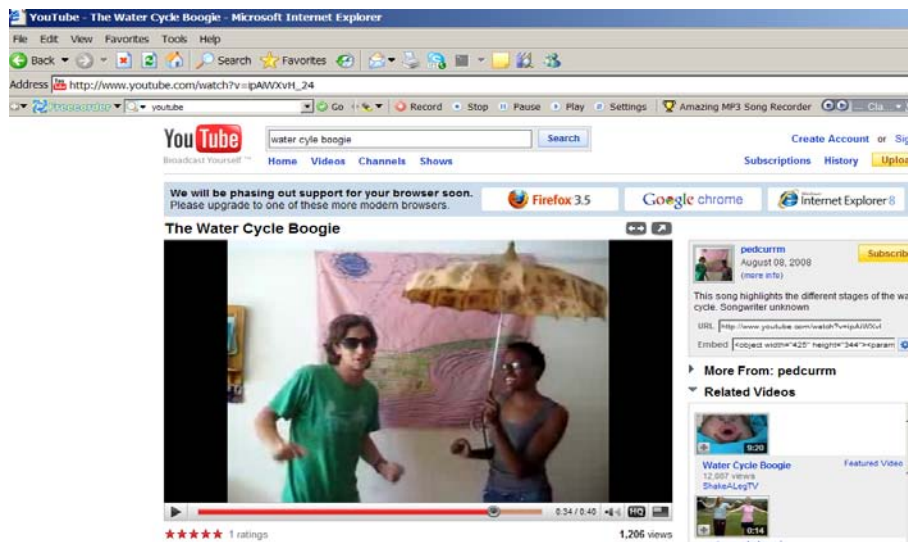
The only issue one author found was the lack of source ware comparable to MS Word 2007. In addition, several students had issues with both MS Word 2007 and some of the newer browsers such as Bing, Firefox, and Chrome. Several students found MS Word 2007 (precluding the benefits of the Developer tab) difficult to navigate and locate the desired attribute. Students also found it easier to gain a YouTube account and upload videos using the tabs from Window Explorer as opposed to Mozilla Firefox and/or Google Chrome; perhaps this is more of a YouTube management issue.

Conclusion

Although both these authors/professors have seen growth in the technological level of their students – teachers and teacher candidates, the majority of their students' skill levels are not up to par with the international community. In light of globalization and the critical necessity to prepare our students with "Information Age" skills, and the current dire economic condition that may hinder updating technological infrastructures and purchasing new software and hardware, these authors believe strongly in sharing effective Web 2.0 tools and source ware with the educational community at large. Hence these authors strongly recommend that more professors and K-12 Technology and Media Specialists use new and emerging technologies, with a strong focus on source ware, in their classrooms. Students will then learn to adroitly use these tools and become competitive citizens in the global economy. This is particularly important as these tools continue to propagate at a cataclysmic rate as the yet unforeseen horizon of Web 3.0 approaches.

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The development of Web-based Instruction model by using Knowledge Management Strategies on Educational Technology Subject for Higher Education Level

Rattakorn Kidkarn

Abstract

This research aimed to: 1) develop a Web-based Instruction model by using knowledge management strategies on educational technology subject for higher education level, 2) test an efficiency of the model, and 3) test an effectiveness of the model. The research methods comprised of three steps: 1) create a Web-based Instruction model, 2) a quality assessment of the Web-based Instruction model, and 3) the assessment of the effectiveness of the Web-based Instruction model with undergraduate students of education program at Nakhon Ratchasima Rajabhat University. The subjects were 30 of second year undergraduate students of education program at Nakhon Ratchasima Rajabhat University, by simple random Sampling. T-test dependent used for data analysis. The research results revealed that:

The Web-based Instruction model using knowledge management strategies called "DASSU model" includes 5 steps as follows: 1) dream draw (Defining: D), 2) find acquisition (Acquisition: A), 3) share knowledge created by me and you (Sharing: S), 4) keep in storage (Storage: S), 5) use when necessary (Utilization: U). The Web-based Instruction model by using knowledge management strategies on educational technology subject for higher education level comprised of 11 components: 1) goals, 2) objectives, 3) subject contents, 4) computer system and internet, 5) supportive factors, 6) a learning process, 7) web interaction, 8) learners, 9) instructors, 10) specialists, 11) an evaluation. The educational technology Web-based Instruction model by using knowledge management strategies has an efficiency of 87.13/86.25, which is corresponding with 85/85 provided criteria. The assessment of the effectiveness of the Web-based Instruction model was found that the post-test average scores in achievement of students were statistically significantly higher than pre-test scores at 0.01 level, and the post-test average scores on Self-directed Learning ability, were statistically significantly higher than pre-test scores at 0.01 level. Furthermore, the student's opinions toward learning through the Web-based Instruction model was acceptable.

Introduction

Advances in technology are the cause of competitions in terms of economy, society, culture and even education. The world at present is going to become a society of knowledge and learning, as many put it "Knowledge-based Society" which uses intellectual capital and knowledge to gain more advantages in the competitions. In order that a country becomes a society of good quality knowledge, the most important factor is quality human resource which reflects the importance of education and the demands of the changes as well as paradigm in the modern world. Higher education plays an important role in developing scholars so that such country can compete with others. According to Ministry of Education about the standards of higher education, the graduates at the higher education level must have knowledge and be skillful in their science. They must be able to learn, create and apply knowledge to develop themselves. They must be able to work and create work to develop their society so that it can compete with others in an international level (Ministry of Education, 2003). Self-directed Learning, therefore, is considered a kind of learning which should be cultivated in students at higher education level.

Self-directed Learning is a kind of learning in which learners are responsible for their plans, practice and evaluation of their learning progress. Learning in this way can be done in every learning situation because learners can transfer what they learnt and skills they acquired from one situation to another with meaning (Hiemstra, 1993). Dixon (1992: 2) states that Self-directed Learning is a process where learners analyze their learning needs, set their goals of learning, seek knowledge, provide learning resources as well as evaluate their own learning. These steps are important for life-long learning. This is the important goal of students at higher education level (Wichai Wongyai, 1999: 18; Amornwit Nakorntap, 1999: 1; Somkit Issarawat, 2000: 169).

Educational technology is an important subject for teacher reformation. According to the study, it was found that Faculty of Education in various universities in Thailand has been offering such course on educational technology as a requirement for students who are going to become instructors in the future so that they are prepared for tools about educational technology. They can develop and apply technology in their instruction. Therefore, they have to learn principles, theories and skills essential for educational technology (Wasan Atisap, 2004: 11-12). Since the topic is wide, the students have to grasp the overall concept about educational technology first before they can go to other aspects. They have to practice how to use technological tools and

how to develop the media in various forms according to the set topics. There is less time for practice since there are many issues about the theories. As for practice, some students can neither follow up with the demonstration nor review their practice. They are not eager enough to seek knowledge about both theories and practice by themselves. In order to make them aware of the rapid changes in technology, an instruction model for the course on educational technology is to be sought in order to solve the problems arisen from such changes. Abilities to learn should be put to learners. In order to make it successful, technology should be used because traditional instruction alone cannot respond to students effectively any more. Computer technology and internet for instruction are widely used and known such as online learning, e-learning and Web-based instruction.

Web-based Instruction makes the best use of world wide web in learning. Online learning plays an important role in changing instruction forms by using the potential and the facility of technology and telecommunication system to facilitate the way the students learn. Now they can learn anywhere anytime without the limitations about the places and the schedule. Instruction is not teacher-based any more; it is now student-centered. Moreover, instead of learning individually, students learn in a collaborative manner. They change their roles from waiting for the knowledge to going out for the knowledge (Khan, 1997). Online learning has advantages for both instructors and learners (Tanomporn (Tanpipat) Laocharatsaeng, 2002: 18-19) like instructors can transfer the contents in various and more interesting ways through multimedia. Their classroom period becomes shorter so that instructors have time to learn new things. Moreover, instructors can observe the learning behaviors and the progress of each learner in details all the time through Course Management tool. Learners can learn according to their own paces. This is called "Self-paced learning" in which learners control their own lessons because hypermedia technology is integrated in such course with texts, still images, sounds, graphics and animations. Learners can access the information in any sequence. Furthermore, online learning helps facilitate the interaction among instructors, learners and peers because there are many tools for many kinds of interaction. There is no limitation about campus so students from numerous institutes can come and share their knowledge. Despite many advantages, there are also disadvantages like students must have high responsibility for their learning. They have to be eager to seek knowledge by themselves. They must be able to work with others and help their peers in time of need. This kind of instruction is quite new to many students, resulting in obstacles to them (Wichuda Rattanapian, 2005: 22-23). Besides, there are also limitations about time in that people are not free at the same time. They cannot learn at the same time. As for place, virtual places cannot replace physical places because face-to-face interaction and socialization are a part of building trust and team learning. Lack of face-to-face interaction can lead to nonconformity and bond in online community. Learners might not be brave enough to work and share knowledge with others (Na Ubon & Kimble, 2000).

According to the problems and limitations of web-based instruction, many approaches and methods of content presentation, including activities must be put on web sites so that Web-based Instruction becomes effective for self-directed learning. This kind of concept is related to Knowledge-based economy which every organization faces due to rapid changes and competitions. One of the popular strategies widely acknowledged is Knowledge Management or KM.

Knowledge management is mainly about using technique and various tools to collect scattered knowledge in the same place, making atmosphere where people are ready to think, learn and build new bodies of knowledge. The knowledge is organized in such a way that it can be retrieved with ease. Moreover, knowledge management allows people to have channels for exchanging knowledge in order that they apply the knowledge in their work with success (Davenport, 1994; Gavin, 1994; Prawase Wasee, 2002; Vicharn Panich, 2005). There are two kinds of knowledge (Nonaka; & Takeuchi. 2004: 53): Explicit knowledge is knowledge which can be collected, stored and transferred easily in the form of information technology or lessons specific to the demand of the learners. Tacit knowledge is knowledge accumulated from experience, proficiency and skills of an individual. It is hard to be collected and stored in a concrete way because this kind of knowledge is normally hidden in such individual. Therefore, the mechanism of meeting, trust and knowledge exchange has to be done. The main elements of knowledge management are humans, technology, and knowledge process. Humans are considered the most important element because they are the resources of knowledge. Technology is a tool to search for, store, exchange and make the best use of knowledge in an easy as well as fast manner. Knowledge process is a strategy for managing knowledge from users to users, resulting in system improvements and innovations. These three elements must be integrated in balance to make knowledge management successful. Using such approach with Web-based Instruction needs a certain kind of framework or a frame of practice which many scholars have already proposed. The users, therefore, need to understand and choose the best methods according to the contexts and situations.

According to the problems as cited above about the course on educational technology, the approach of knowledge management along with learning activities will help solve such problems because knowledge management strategies will help learners set their learning objectives, how to seek information, how to share the information, how to store and retrieve as well as make the best use of their knowledge. Learners will become more responsible for themselves and they can seek the knowledge by themselves. Therefore, the development of Web-based Instruction for the course on educational technology must comply with the knowledge management

strategies to solve the problems and the limitations found in traditional Web-based Instruction so that learners can learn, make and apply the knowledge for themselves. The results from this research will provide an understanding of effective and efficient Web-based Instruction which affects the learning achievements of educational technology course takers and the learning abilities of students at the higher education level.

Research Methodology

This research followed the research methodology as explained below:

Stage 1 The Development of a Web-based Instruction model by Using Knowledge Management Strategies on Educational Technology Subject for Higher Education Level

The researchers did the literature review from various sources like documents, books, journals and research works in order to get an overall picture of the approach appropriate for this research. There were in total 11 kinds of knowledge management strategies from all the sources both in Thailand and from foreign countries. The researchers put all kinds of them into a table to analyze and synthesize the procedure in knowledge management strategies. Afterwards, the Web-based Instruction was outlined with knowledge management strategies. The draft was reviewed by 3 experts in knowledge management and 3 experts in educational technology. The model based on knowledge management strategies was to be revised according to the experts' suggestions.

Stage 2 The Study of Efficiency of Web-based Instruction model by Using Knowledge Management Strategies on Educational Technology Subject for Higher Education Level

After the revision model was acceptable, the model was used in developing web-based instruction. The structure of course description about educational technology was analyzed and included all the contents about Web-based Instruction and behavioral objectives in each chapter. The web-based instruction, after the complete development, was reviewed by 3 experts in educational technology in order to check the accuracy of the contents and the design techniques as well as content presentation. The Web-based Instruction was then tested to determine the efficiency whose criteria were set at 85/85. The test was done for 3 times with the sampling group. In the first time, it was tested with 3 students to check the basic quality in terms of the understanding of the contents, the meanings conveyed, the content presentation, and steps for activities. The data from the observation and the interview was used in order to revise the instruction. In the second time, it was done with 9 students to find out the tendency of efficiency of Web-based Instruction and to find out the errors. Then the instruction was revised. In the third time, it was done with 20 students to find out the efficiency of Web-based Instruction by using exercises and tests to measure learning achievements. After the students had completed each theory lesson, they had to do a test. Scores from each lesson test were used to find out the efficiency (E_1). After the students had completed the course, they had to do the final test, the score was used to find out the efficiency (E_2)

Stage 3 The Study of Effectiveness of Web-based Instruction model by Using Knowledge Management Strategies on Educational Technology Subject for Higher Education Level

After the Web-based Instruction was efficient, the course was to be used by the second year students majoring in education at Nakhon Ratchasima Rajabhat University. There were 240 students who registered for this course. The sampling group of 30 students was chosen by simple random sampling method by lottery system. The students did the pre-test and evaluated their learning abilities before learning by themselves. After the students had completed the course, they did the final test and evaluated their learning abilities again. They could express their opinions. The learning achievement scores before and after the course was compared. So were their learning abilities before and after the course. The opinions toward the Web-based Instruction were also collected.

Research Results

The development of Web-based Instruction model by using knowledge management strategies on educational technology subject for higher education level yielded the following results:

Results from the Development of Web-based Instruction model by Using Knowledge Management Strategies on Educational Technology Subject for Higher Education Level

The development of Web-based Instruction model by using knowledge management strategies on educational technology subject for higher education level as evaluated by experts was that the average scores for relevance and appropriateness was 4.58 or the highest level. The details were shown in Figure 1.

Figure 1 shows Web-based Instruction model by using Knowledge Management Strategies on Educational Technology for Higher Education Level

Elements of Model

The model of Web-based Instruction was developed according to the systematic approach consisting of 11 elements as follow: 1) goal; 2) objective; 3) contents; 4) computer system and internet network; 5) supporting factors; 6) instruction process; 7) interaction; 8) learners; 9) instructors; 10) experts in the course and 11) evaluation. Each element consisted of the fallowing:

1. Goal was to be used as a norm for Web-based Instruction for students at higher education level. The idea, the principles of web design and knowledge management were integrated to help develop student-centered learning so that students have higher learning achievement for educational technology subject and they have abilities to learn by themselves at the higher education level.

2. Objective was to improve learning achievement for educational technology subject and develop abilities to learn on one's own at higher education level.

3. Contents covered the topics about educational innovations, learning resources, information technology for education and computer for instruction. This subject had both the contents about theories and opportunities to practice.

4. Computer system and Internet network consisted of one server where the website was stored. It was connected to clients so that students can access the learning activities all the time.

5. Supporting factors consisted of

5.1 Webpage which was considered as virtual classroom where students, instructors and experts in the course could meet

5.2 Virtual library was a place where students could seek information about the contents in the course from all over the world through internet network. This was facilitated by search engines on the web.

5.3 Supporting service which aided communication and exchange of knowledge through searchable and retrievable functionalities.

6. Instruction process was the process based on the approach in Web-based Instruction along with knowledge management strategies. The process was designed, analyzed and synthesized by many local and international scholars. This was known as "DASSU Model" which included 5 steps as follows: **"Dream draw, Find acquisition, Share knowledge created by me and you, Keep in storage, and Use when necessary"**. The details were as follows:

6.1. **"Dream draw"** (Defining: D) was an activity in which students set their learning goal by considering learning objectives of the subject. Then the students set BAR (Before Action Review) together and then did self-assessment in terms of the level of knowledge they belong to and what elements they knew and needed to know.

6.2 **"Find acquisition"** (Acquisition: A) was an activity in which students set approach or method to acquire knowledge by learning plan and then they had to follow the plan they designed.

6.3 **"Share knowledge created by me and you"** (Sharing: S) was an activity in which students shared their knowledge or what they knew with one another. They could create knowledge together by contributing to Wikipedia, blogs and communities united out of volition. There were 3 kinds of communities: 1) Community of Interest (Co-I), 2) Community of Practice (Co-P), and 3) Community of Expert (Co-E). Moreover, there were 3 strategies to integrate knowledge in this process as follows: 1) Codified & Personalized Strategies (S1), 2) Conversion& Spiral Strategies (S2), and 3) Technology& KM Techniques Strategies (S3).

6.4 **"Keep in storage"** (Storage: S) was an activity in which students did Benchmarking (B1) to make sure that the knowledge they acquired is accurate and to provide Best practice (B2) by refining, synthesizing, organizing the knowledge from Wikipedia, blogs of friends to summarize and create their own body of knowledge as well as write down systematically on their blogs.

6.5 **"Use when necessary"** (Utilization : U) was activity in which students tested their knowledge through activities in each topic. They would know their level of knowledge and make the best use of their knowledge. This was called AAR or "After Action Review" to summarize and evaluate the acquired knowledge together in groups. They would determine whether the knowledge meets the goal and why. They would find solutions for further improvements.

7. Interaction was an activity among members in the group of the same interest in which they discussed the topics, made contacts with instructors and experts in the course through website.

8. Learners had an important role in self-directed learning, especially Web-based Instruction because they had to share their knowledge and follow the activities offered in the course. They could ask for information and suggestion with instructors and experts in the course as well as their peers.

9. Instructors had a role to facilitate the learning of learners. They provided the students with tools ready to be used. They also tracked down and observed the way the students learn online so that they could come to help in the time of need when students found difficulties with web-based instruction. They also guided and motivated students to learn and complete all learning activities.

10. Experts in the course were experts in educational technology. They were chosen out of the lecturers who were specialized in educational technology. They made the best use of their knowledge and experience in assigning the tasks suitable for each individual in each topic. They gave guidance to students in every step of the learning process.

11. Evaluation was a kind of assessment done online. The learning achievement test was done before and after the course on educational technology in terms of knowledge, understanding, and application. The test consisted of 40 objective questions, each of which had 4 multiple choices. The learning achievement scores before and after the course were compared and evaluated through self-assessment tools and the students' opinion towards Web-based Instruction model. Students' behaviors and participation were also observed and evaluated according to the Web-based Instruction model.

Results from the Study of Efficiency of Web-based Instruction model by Using Knowledge Management Strategies on Educational Technology Subject for Higher Education Level

The development of Web-based Instruction model by using knowledge management strategies on educational technology subject for higher education level as evaluated by experts yielded the following results. The average score for the content suitability was 4.36 or at high level. The average score for the design and presentation technique was 4.38 or at high level. The test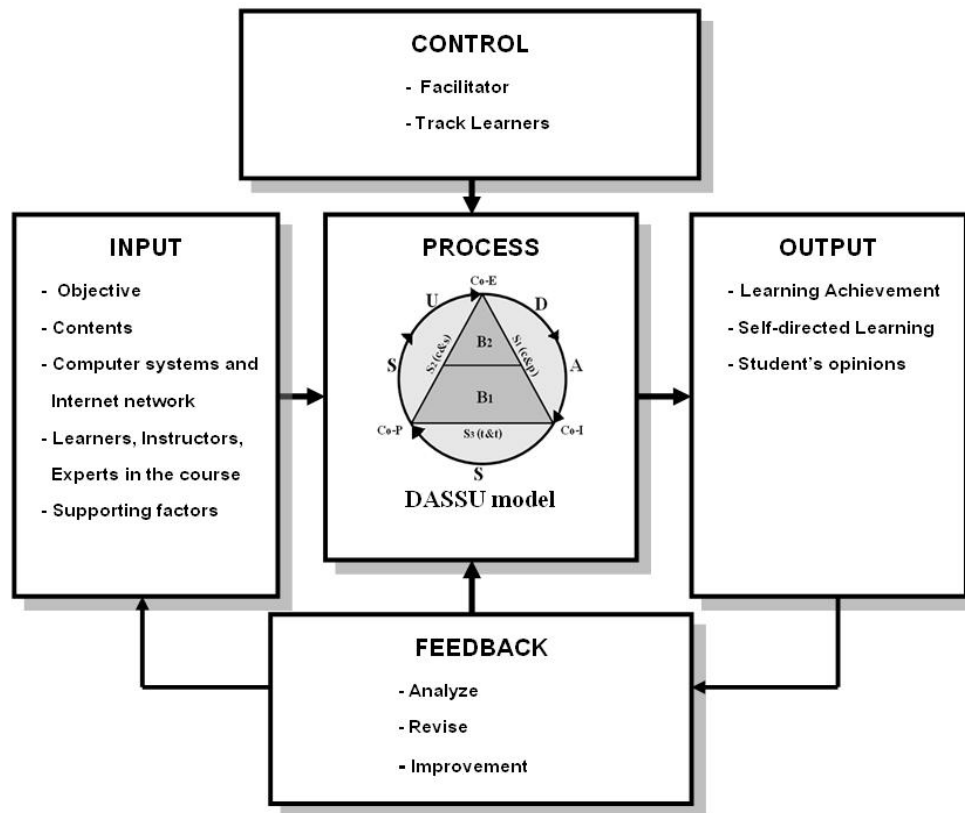 to find out effectiveness yielded the score of 87.13/86.25. To conclude, the Web-based Instruction model by using knowledge management strategies on educational technology subject for higher education level corresponded with 85/85 provided criteria. That is to say, the model was efficient and suitable for students at higher education level.

Results from the Study of Effectiveness of Web-based Instruction model by Using Knowledge Management Strategies on Educational Technology Subject for Higher Education Level

It was found that the pre-test and post-test average scores in achievement of students were statistically significantly different at 0.01 level. The post-test average scores in achievement of students were higher. The ability to learn on one's own was also improved. The students' opinion towards learning through the Web-based Instruction model was 4.32 on average or acceptable.

Discussions

According to the development of Web-based Instruction model by using knowledge management strategies on educational technology subject for higher education level, there were 2 issues to be discussed: 1) the development of Web-based Instruction and 2) the study of efficiency of the learning through web-based instruction.

1. As for the development of Web-based Instruction model by using knowledge management strategies on educational technology subject for higher education level, the issues to be discussed were given below:

1.1 The results from the development of Web-based Instruction model by using knowledge management strategies on educational technology subject for higher education level yielded the supporting factors as follows:

1) The development of Web-based Instruction model in a systematical manner. The web site was developed systematically and processed in a step-by-step manner by analysis and synthesis of the traditional instruction. The philosophy in education was also applied to emphasize on the self-directed learning, in which the students were the one to create knowledge. Other theories used in the course were theories about behaviorism, motivation, approach in web-based instruction, knowledge management strategies. The elements of Web-based Instruction were analyzed and synthesized into the model which was revised many times according to the suggestions by experts. The model was tested for the efficiency before real use.

2) Instruction process consisted of 5 activities which came from analysis and synthesis of knowledge management strategies proposed by scholars in Thailand and abroad. The results from the synthesis were used to provide students with activities suitable for web-based instruction. Those were defining, acquisition, sharing, storage, and utilization. To make them easy to remember, the activities were given new names as follows: **"Dream draw, Find acquisition, Share knowledge created by me and you, Keep in storage, and Use when necessary"**. The steps corresponded with the student-based instruction in which students were the center of the instruction. The students know themselves, know the world and depend on themselves in terms of economy, spirit, society and learning. They were happy to learn (Prawase Wasee, 1999). This corresponds with the Self-directed Learning in which the students set their goal and plan the learning path by themselves. They control and evaluate themselves by seeking the methods suitable for their success in learning (Oladoke, 2006: 13)

1.2 According to the test to find out the efficiency of the Web-based Instruction model by using knowledge management strategies on educational technology subject for higher education level, E_1 / E_2 were 87.13/86.25, higher than 85/85 provided criteria. This was because the model was designed in a systematic order and revised many times by experts. Therefore, the efficiency of the Web-based Instruction was acceptable.

2. As for the study of the Web-based Instruction model by using knowledge management strategies on educational technology subject for higher education level, it was found as follows:

2.1 The post-test average scores in achievement were higher than the pre-test average scores in achievement. This indicates that the instruction model could be used as a tool to facilitate learning because the Web-based Instruction was developed in a systematic order, allowing all students to participate in studying and doing revision for all the topics from seeking the contents to posting in Wikipedia. This corresponds with the strategies proposed by Hansen & et al (2004) in that codified strategy is suitable for explicit knowledge. The organization with a server benefits from this by encoding knowledge and storing it in an accessible database where everybody can get connected. Due to the limitation that the contents to be posted had to be different from others, the students had to read all the information first before posting. This way, the students got higher post-test average scores in achievement.

2.2 The learning abilities of students were improved after the course indicated that the instruction model helped the students to improve their learning abilities due to the following reasons.

2.2.1 The instruction model was based on knowledge management strategies and included 5 activities. This was done through analysis and synthesis proposed by scholars in Thailand and abroad. The activities focused on the participation by students from the first stage like setting their goal, defining how to learn, evaluating what they already know, and planning to the last stage like following the plan and evaluating. The students were responsible for their own learning. Their practice was recorded in portfolio and posted in blogs, allowing other students to do a revision and correct their goal according to their plans.

2.2.2 As for the application of technology and technique in knowledge management, the technology used consisted of Course Management Systems (CMS), webboard, chatroom, and blogs. These tools were learning resources and factors for accessibility as well as interaction between instructors and students and

among students. This technology resolved the limitations of students in terms of time and place. They could also chat online to discuss at the same time, increasing the level of interaction. They could trust and confide in the online community. They were also voluntary in working together as well as sharing information. Knowledge management technique which reduced the instructional limitations consisted of 2 things: First, process management which is to make sharing and applying knowledge easier to be done by the most of the participants through awards like gifts and scores; Second, space management which is to create an atmosphere where students can know and trust one another in the end. This idea corresponds with Na Ubon & Kimble (2002) in that confiding in each other is the base of sharing knowledge which leads to effective knowledge sharing and transferring.

      2.2.3 Knowledge could be shared by all participants. The atmosphere facilitates the learning through online community. There were many activities and people shared knowledge with all members in chatroom through knowledge conversion process and knowledge spiral according to SECI Model proposed by Nonaka & Takeuchi (1995). This model was adopted in supporting education through self-learning educational technology. The students could learn individually and learn in group (group-learning). This was to transform tacit knowledge to explicit knowledge by using computer as a tool. Students could learn by various methods, increasing their achievement and learning abilities after the course.

Suggestions

    The Web-based Instruction model by using knowledge management strategies on educational technology subject for higher education level was developed with the approach that all students are able to improve themselves. Learners are the most important element. Therefore, instruction should correspond with their preference and skills by considering their differences among them. This way, students will have abilities to learn by themselves. The approach meets the trend of current education which focuses on life-long learning.

1. Suggestions for Using this Instruction Model

    1.1 The application of Web-based Instruction should be based on the readiness of many elements, especially the readiness of students. There should be an orientation for students so that they understand the objectives of learning in this way. The students also have more responsibilities in their learning. They should know the benefits and have to get familiar with the technology. The instructors need to prepare themselves too. They must provide students with time for guidance and help. They have to know how to use the tools for instruction. Computers and server are also important. They must be ready for use all the time.

    1.2 To make the instruction model effective, it can be used both online and face-to-face, or mixed. However, the activities should be done in the organized steps.

    1.3 To apply the instruction model with various factors like space, time, event and people (STEP: Space: S, Time: T, Event: E, People: P), the space or place to be used can be real or virtual. If the space is virtual and people are not free at the same time, the exchange of knowledge cannot be done. Time to engage in the activities is, therefore, essential. As for event and people, the model should be adapted to correspond with the event and the group of people.

    1.4 The roles and the responsibility of members should be clarified so that they are ready for the proper use of the technology, making the instruction model effective to the maximum.

2. Suggestions for Further Studies

    For further studies, the researcher gives the following suggestions.

    2.1 The Web-based Instruction model should be applied in other subjects or courses and then the comparison of the permanence of the model is done so that we achieve the general instruction model by using knowledge management strategies.

    2.2 The effectiveness of the instruction model in terms of changed learning behaviors should be studied by using knowledge management strategies and learning styles in real life.

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An Exploratory Study on the Use of a Recommendation System to Facilitate Discussion Board Activity Awareness within an Online Learning Environment

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Abstract

A common challenge within large online learning or training environments is helping the user find information that is useful and relevant to their needs. Recommendation systems have been used successfully in E-commerce sites (e.g. Amazon.com) to help customers find products they may be interested in, however, their potential uses within online learning environments have not been fully explored. An exploratory study conducted at a large Midwestern university surveyed students using a recommendation system to provide recommendations of discussion board activity occurring in their online course site. Results indicated that while students appeared to find the recommendation systems easy to use, and largely understood what the recommendations were, many did not find the recommendations provided all that useful. The author proposes that additional research be undertaken to fully understand the nature of activities students find important, and how to tune recommendation systems to match this paradigm within online learning environments.

Introduction

Background

The rapid growth of the use of online learning environments to provide training and instruction creates new challenges when trying to determine methods to make online interaction and collaboration between participants easier and more effective. A key requirement to effective online interaction is being aware of what has, and what is currently happening in your environment (Carroll et. al, 2002). As Moody (2000) argues, this awareness of activity in our environment is a precursor to any type or level of interaction between participants. Despite this importance, many popular learning environments in use today (such as Blackboard or Sakai) are severely lacking in any type of awareness or notification tools. In an attempt to remedy these shortfalls, middleware tools such as the Context-aware Notification System (CANS) have been developed. CANS was designed to provide a centralized awareness notification tool for a multitude of external environments (Amelung, C., 2007). CANS works by monitoring specific events (i.e. a discussion board response, or a change to a document) that occur within an environment, and then refining these events into visible notifications to the end user.

However, one issue that soon arises from presenting all potential activity notification information directly to the participants is that in a busy online learning site, the amount of notifications can grow extremely quickly. As Jacoby (1977) indicates in his article on information load, it can be difficult for a user to identify relevant information after their information processing capacity is reached. A natural, and common solution to the information overload challenge caused by "excessive" notifications is to simply aggregate the notification information. Thus, instead of showing individual notices of each event; the system instead displays a summary of how many events occurred of a certain type (i.e. There are 21 new discussion posts since yesterday). However, a major drawback to this aggregation model is that users lose all the important data elements from the notification. In other words, the user can no longer determine the nature or location of the activity happening within their environment; rather they only can ascertain that some activity has occurred somewhere in the site. The user is still left to their own devices to search out where this activity is occurring, and whether or not it is of interest to them.

Thus, another potential solution that could help reduce information overload, while still keeping the rich notification data intact, is the use of a recommendation system (Good et. al, 1999) for activity notification. Using techniques of knowledge discovery, a recommendation system attempts to generalize user preferences, compare this knowledge with what is known of the dataset, and then make a personalized recommendation to the user (Sarwar et. al, 2001). For activity notification, a recommender system would take the past behavior of a user (e.g. where they

visited, what they read, who they responded to) and compare it to other user behavior within the system. This comparison would then yield a more personalized list of activities to the user, based on prior behavior (Haubl and Murray, 2006).

Purpose of Study

Although recommender systems have been successfully integrated and utilized in various other domains such as eCommerce applications (e.g. Amazon) and social sites (e.g. MovieLens), there is still much work to be done in applying recommendation systems to e-learning (Zaiane, 2002). The purpose of this study is to learn more about the student perceptions of using recommendation systems within an online learning environment.   For this exploratory study, we are primarily concerned with three questions:

1) To what extent will students find the recommendation system easy to use?
2) Do the students perceive the recommendation system as useful/helpful?
3) To what degree do the students become "attached" to having recommendations provided in their course?

Methods

Context

The research study took place at a large Midwestern University, using online courses taught on the Sakai Collaborative Learning Environment (Sakai).   Each course consisted of at least 20 students, and was taught primarily online.   Membership in these courses was mostly graduate level students, however some undergraduate students were also enrolled.   Instructors were recruited to be apart of the pilot study, which required them to modify their course home page to include a "Social Widget" which contained the recommended discussion activity.

Social Widget

To provide recommendations for students, a custom Flash-based Social Widget was constructed using the Flex development environment. The Social Widget included three sections: a social comparison chart, a list of hot topics, and recommended discussions (see Figure 1).

Figure 1: A screenshot of the "Social Widget" tool that was added to each course Home Page.
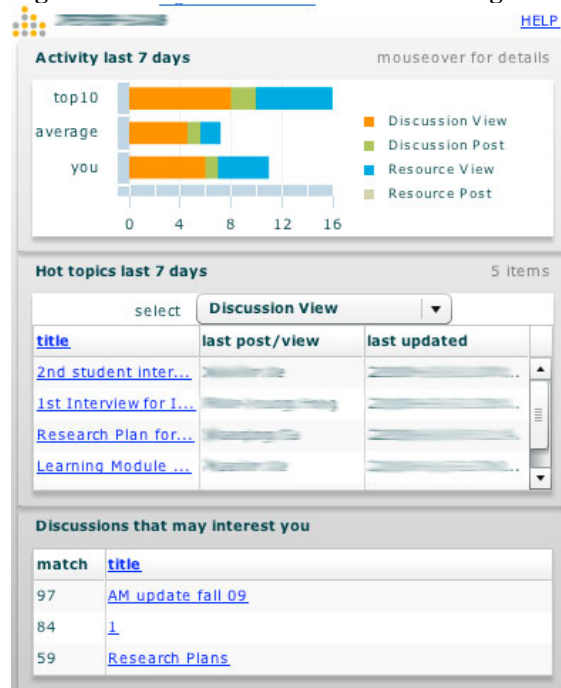
Students were provided recommendations in the third section of this Social Widget entitled: "Discussion that may interest you". This section consisted of a discussion topic title that the student was recommended, as well as a "match" number that indicated how well this particular recommendation matched the user. Clicking on the topic link would launch the recommended discussion topic in a new browser window. The match number and recommended discussion topics were based on a student's individual historical activity on the discussion boards.

For this study, the Taste collaborative filtering engine (part of Apache's Mahout project) was used to provide the recommends. Each day, a student's historical discussion board activity was obtained from the Context-Aware Notification System (CANS) and input into the Taste collaborative filtering engine. The Taste engine would analyze the activity data, and output a list of recommended discussion posts for each student. These recommendations were then added into the Social Widget to be displayed to the user each morning.

Study Procedure

At the beginning of a semester, the "Social Widget" was added to the Home Page of 4 different online courses taught on Sakai. The students were not instructed on how to use the social widget, it just merely appeared to them as an additional tool to use. The Social Widget did contain a small Help page, which the students could click on to view more about the widget.

After approximately 1 month, we sent out a recruitment email to each of the 96 students enrolled in our four test courses, asking for volunteers to take a short survey relating to their experiences using the recommendation system, and the other social tools within Sakai.

The survey included 10 questions on the recommendation system, and attempted to measure the following three constructs: usefulness, ease of use, and attachment. Survey questions for usefulness, and ease of use were adapted from the Venkatesh and Davis (2000) TAM2 Measurement Scale, while questions for attachment were adapted from Madsen and Gregor (2000) Human-Computer Trust scale. Respondents were asked to rate each question using a Likert scale where 1= strongly agree, 2 = agree, 3 = kind of agree, 4 = neutral, 5 = kind of disagree, 6 = disagree, and 7 = strongly disagree. Of the 96 invitations sent, we received 45 responses to the survey.

Results & Discussion

Ease of Use

The survey results came back favorably when the students were asked about the difficulty of using the recommendation portion of the Social Widget. When we combine the survey questions dealing with ease of use, we see over 58% of the students at least somewhat perceived the recommendation system was easy to use, 34% were neutral to the system, with the remaining 8% indicating it was not easy to use (see Figure 2).

Figure 2: Frequency distribution of respondents to the combined survey questions regarding "Ease of Use"
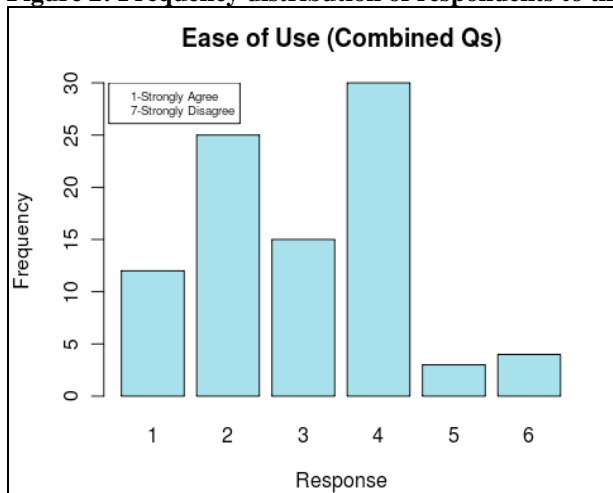
This result was not surprising, as the recommendation system was extremely straightforward, and specifically designed to be passive (e.g. the students were not required to "rate" discussions) so as to minimize the time and mental effort required to use it. In addition, some students may have already had interaction with recommendation systems on popular ecommerce sites like amazon.com, or movie rental sites like Netflix, and thus may already have a well-established mental model of the purpose and use of a recommendation system.

Usefulness

While the majority of students found the recommendations easy to use, only about 38% indicated that the recommendations were at least somewhat useful. Conversely, 39% of the respondents at least mildly disagreed with the survey questions dealing with usefulness, with the other 23% as a neutral response (see Figure 3).

Figure 3: Frequency distribution of respondents to the combined survey questions regarding "Usefulness"
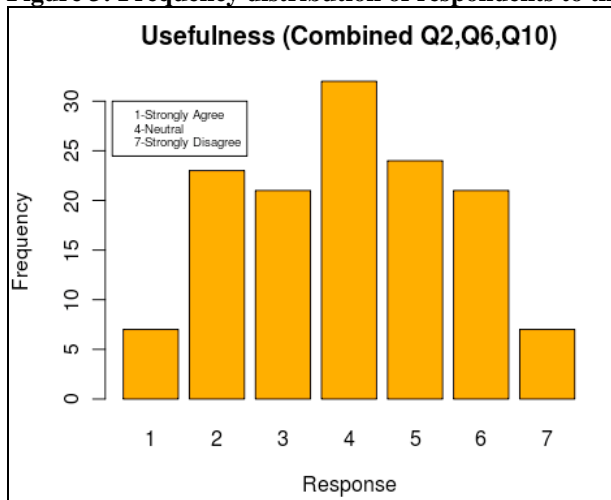
The responses to our usefulness questions indicate that while some people found the recommendations useful, the vast majority were either indifferent, or didn't find the recommends all that useful. From these results, we might interpret that the discussions recommended were not the discussions the students "wanted" to see. One explanation for this is the recommendation system did not have enough activity data on some of the users to provide good recommends. Another explanation could be the recommendation system treated every discussion "equally", yet in an online learning site, this is not typically the case. Learners may value posts from the instructor/trainer more highly, and/or perhaps posts relevant to specific assignments. In this manner, the recommendation systems included in an online learning environment may need to know more about the nature of activity occurring in a site, and apply appropriate weighting to tune the results to what the learners would be better interested in.

Attachment/Value Add

The final aspect we attempted to measure was the sense of "attachment" to the recommendation, or would the learners feel a sense of loss if they no longer were given recommendations of discussion activity. The majority of students indicated, they would not feel a sense of loss if they did not have the recommendations, which is not surprising given the fact many did not find the recommendations useful in the first place (see Figure 4).

Figure 4: Frequency distribution of respondents to the combined survey questions regarding "Attachment"
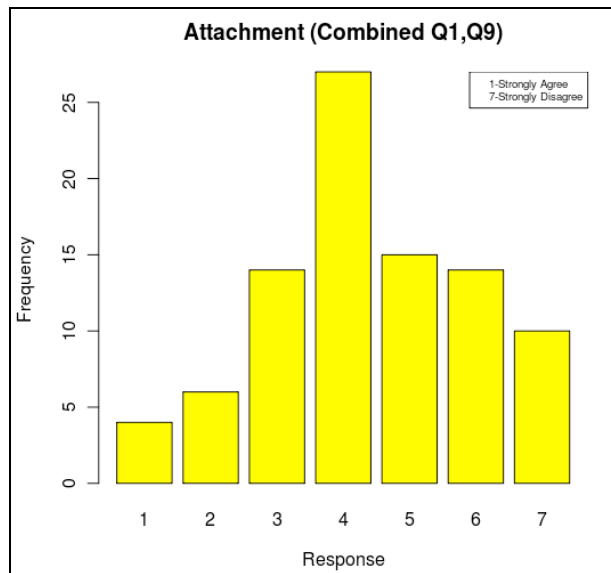
Conclusion

Despite finding our recommendation system easy to use, the majority of participants in our study did not find the recommendations provided all that interesting.   Thus, additional research will be required to better understand what types of discussion board activity the students find most useful.   If we can ascertain the "useful" or more valuable discussion board activity we may be able to train our recommendation system to weight this activity more, and hopefully provide better recommendations to the students.

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Enhancing user participation in an art gallery space through the development of a user generated wiki

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Abstract

A problem exists today around art galleries. Art galleries that do not keep permanent and publicly accessible collections or records of the artwork they display do not provide opportunities for artists and viewers to revisit artwork that has been removed from the gallery. The purpose of this study is to test the usability of a wiki platform for a university art gallery that allows past and present exhibiting student-artists and any other interested parties to create professional profiles and alternative exhibition spaces on-line in order to engage with, deepen, reflect upon, share among, translate between and expand their experiences with and understandings of art.

Introduction

The use of the Internet by people of all ages around the world (Lenhart 2009; Sutter 2009) to create, remix, and share media content (Lenhart & Madden, 2005) through engagement in "participatory cultures" (Jenkins, 2006) is rapidly increasing (Zuckerberg, 2009). According to Lu (2008), teaching professionals in the 21st century "need to think about how to engage and motivate students into using their favorite and familiar digital media as effective learning technologies" (p. 48).

At the Pennsylvania State University (2007), over forty-thousand students are currently enrolled at the University Park campus, just one branch of the larger University system. According to a survey conducted by the Educational Technology Services at Penn State, 83% of Penn State students are in the Facebook social network, 93% own cell phones, and nearly 90% own MP3 players (Camplese, 2008). The every-day lives of these college students are becoming increasingly interwoven with the use of contemporary popular technologies.

As a teaching and learning space at Penn State, the Edwin W. Zoller Gallery is, centrally, a space for students to push the boundaries of how they create and think about art. Each academic semester, the Zoller Gallery hosts as many as seven public exhibitions of student art work, and it is expected that entire classes of students will come into the gallery with their instructors at any given time to talk about the artwork on display. However, because the Zoller Gallery keeps no permanent collection of the artwork it displays, unlike a museum, students have no means to revisit an exhibition of artwork at the gallery after one has been removed to make way for the next.

Finding this inability of students to revisit prior learning experiences problematic, this design-based research study seeks to provide contextually relevant and meaningful opportunities for more media-rich and dynamically-connected art educational experiences within and beyond the Zoller Gallery. By providing ways for students to engage with social media, both inside and outside of the gallery, about the art, artists, and events happening there, the gallery becomes more culturally responsive and connected to contemporary student culture. Through the adaptation of social media to enhance and extend the opportunities for teaching and learning about and through art, the Zoller Gallery can offer students an alternative to the limitations of their current gallery experiences by providing them with an emergent multi-media exhibition and conversation platform to germinate.

Study

The purpose of this study is to test the usability of a wiki platform associated with, but not bound to or restricted by, the Zoller Gallery. This wiki allows past and present exhibiting student-artists and any other interested parties to create personal (artist) profiles and alternative exhibition spaces on-line in order to engage with, deepen, reflect upon, share among, translate between and expand their experiences with and understandings of art. Following the creation of an artist profile, artists upload an artwork, provide descriptions of the work, and allow other users of the wiki platform to provide comments and feedback on a whiteboard associated with that artwork. Figure 1 provides a screenshot of this discussion and feedback feature of the wiki platform.

Figure 1. Art gallery wiki discuss page. This figure provides an example of the whiteboard commenting feature for the artwork entitled *Catching a Bus at PSU.*

A qualitative usability test method was used to conduct this study.   We followed Goto and Cotler's four-step process in setting up our usability test. Goto and Cotler recommend planning and prepping, finding participants, conducting the study, and finally, analyzing data and making recommendations based on the results (2005). We followed their guidelines and used their Likert-type post session survey items as part of our user post-test survey. The goals of our usability test were to provide specific feedback on common tasks within the system and determine expected performance on the current site and identify serious problems prior to the next phase of production.   By conducting a usability test, we wanted to answer the following questions: *Are the basic tasks intuitive for a new user? Are the menu options and features intuitive for a new user?*

Method

Our study consisted of four graduate students that regularly engage and participate in an art gallery space. We gathered two types of background information. First, we asked how many hours a participant spent online per day, and second, we asked our participants to complete a pre-test power user scale survey to determine how "tech-savvy" a person is. Marathe et al. created the power user scale for classification purposes when conducting media effect studies (2007). The power user scale consists of nine Likert-type items and are provided in Appendix A.

Each session lasted approximately 30 minutes. During the usability test, each subject was greeted and then oriented to the design by a test monitor. Subjects were given four tasks to complete while the test monitors observed.   Participants were asked to think-aloud, i.e. talk out their thought process, while they completed the four tasks. The four tasks are listed in Appendix B. Following the tasks, a post-test survey was given in addition to a debriefing on the significance of the study.

Results

The number of hours spent online was roughly equivalent across subjects, showing that our participants did have experience in online web applications with an average of 5.72 hours spent online per day. High power users consisted of participants who scored high across all items on the power user scale and low power users scored

low. We found that two of our participants scored high (average of 8.278) and two of our participants scored low (average of 4.611). In our study, the power user scale items were compared using a Multivariate factor analysis to determine that the scale was reliable (Cronbach's alpha of 0.8033).

When comparing our high and low power users across post-test survey results, we found that the high power (tech-savvy) users consistently scored higher across all items. These items are listed in Table 1. Each item is a score out of 5 (1=strong disagree; 5=strongly agree).

	Low Power Users	High Power Users
Easy to complete tasks	4	5
Clear Navigation	4.5	5
Pleasing Look and Feel	3.5	5
Relevance of images to content	4	5
Relevance of content (text)	4	5
Easy to use	4	5
Clear page layout	4	5
Inviting to use	4	4.5
Clear labeling of links	4.5	4.5
Recommend a friend to use	3.5	5

Table 1. Low vs. High Power Users. This table provides the score for each group of participants on the post-test survey.

Additionally, we provided three post-test survey open-ended questions. The participants that we classified as low power users found that the best features of the wiki platform were the numerous ways to post and transmit ideas. The high power users thought the best feature of the wiki platform was the ease of use. The low power users found that there was a lack of clarity with certain tasks (e.g. the discussion board) while the high power users were pleased with the system and listed the generic color scheme as the only complaint. When asked *what would you do to enhance the site,* one low power user participant called for more simplification of the features in the wiki platform. One of the high power user participants asked for a tagging system to categorize the types/mediums of artwork.

During the think-aloud process, subjects pointed out a few important concerns that were not addressed in our post-survey results. Below we provide what we found to be the most important concerns:

➢ Lack of information on the goals and outcomes of the site
➢ Lack of an "update" button after editing text (current system automatically updates)
➢ Problem finding the login area/information (current system has login on top right)
➢ Majority of feedback will be text-based, so make the whiteboard discussion an advanced feature
➢ Aesthetics of the site should be changed; too much of a template
➢ Possibility to use system with another school to collaborate and comment on other University student/artists' artwork
➢ Lack of ability to see text descriptions when you hover over buttons
➢ Lack of prompts of what to write in description boxes
➢ Explanation needed for whiteboard discussion board
➢ Lack of ability to make artwork full-screen

Discussion

Our results show that the participants that are considered high power users and "tech-savvy" found the site to be easy, clear, inviting, and relevant. In other words, the wiki platform architecture is appropriate and the system serves the function for which it was created. This is an important finding as we move forward to our next prototype.   For those participants that are considered less "tech-savvy", the findings are still encouraging. These participants also agreed, although not as strongly, with the ease and clarity of the site.   These results provide us with a positive response to our questions regarding the intuitive nature of the tasks and menu options.

The open-ended questions and think-aloud responses provided us with very valuable feedback and suggestions for improvement. A recurring theme across participants was the need for a better aesthetic and color scheme. The suggestion to add an artistic background is something that our design team will factor into our next prototype. We did get a positive response with the simplicity of the wiki platform and therefore, we are going to ensure that adding artistic elements do not interfere with the simplicity of the function and navigability.

An interesting find was the participant confusion and realization that text edits were automatically synced across the system. Our participants are used to having submit buttons upon completing a task and thus, thought that this feature was needed. This finding is intriguing because it suggests that we, as consumers of web media, are trained by web designers to locate buttons when editing text. In order to accommodate this disconnect, our design team will add a text rollover effect that informs the user of "editing text" and/or "text submitted" during the edit process, thus, eliminating the need for a button.

A non-design suggestion from the think-aloud responses provided us with an opportunity to reflect on our goals and outcomes and realize the potential and excitement that this system could generate. The suggestion was using the wiki platform with another school to collaborate and comment on other University student/artists' artwork. Although we are a few prototypes away from implementing this platform on that scale, this suggestion helps us refocus our design principles and rethink our social problem. By increasing collaboration among Universities, our wiki platform could serve as a solution to the problem of removed art education; removed, as in removed from society.

Implications

In the next phase of our work, we will add in many of the suggestions from this study. We plan to move forward with the prototype and increase the functionality of the wiki, including the amount of tasks that a user can perform without sacrificing its simplicity, clarity, and ease of use. Through this and subsequent usability studies, we hope to create a communication platform that is both highly usable by, and useful for, student-artists who want to engage in enhanced and extended educational experiences around artwork exhibited at the Zoller Gallery.

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APPENDIX A

Power user scale

On a scale of 1 to 10 (1=LEAST AGREE; 10=MOST AGREE), do you:
1. Think most technological gadgets are complicated to use.
2. Love exploring all the features that any technological gadget has to offer.
3. Prefer to ask friends how to use any new technological gadget instead of trying to figure it out myself.
4. In interfaces that you are familiar with, do you get frustrated each time you have to go through basic steps designed for new users.
5. Like to challenge yourself in figuring out how to use any new technology.
6. A little bit of intuition is all that is needed to figure out how to use any new technology.
7. Many of your friends come to you to get help related to technological gadgets.
8. Find yourself using keyboard shortcuts on the computer.
9. Make use of the 'Help' feature available in any software.

APPENDIX B

Task Information
1. Your first task is to enter a description for your artwork *Catching a Bus at PSU*. Update the description with a few phrases. If you are prompted to log in, use the username *mike* and password *mike*. Once you have accomplished this task, briefly discuss the positive and negative aspects of the system during this task.
2. Your second task is to change the Artist Biography Information for your video by going to My Profile. Once you add a few phrases, go back to the initial artwork page ART – ABOUT tabs and comment on what is different. Briefly discuss the positive and negative aspects of the system during this task.
3. Your third task is to provide feedback for the artwork on the ART - discuss tab. If you haven't already, you may watch the video to help with this process. Explore the function of the discussion board and see what you can do. Comment on your experiences including suggestions for improvement.
4. Your final task is to add a question to the Q+A discussion board. Your question can be about the art video or a general question. Once you have accomplished this task, briefly discuss the positive and negative aspects of the system during this task.

Novel Technology-Based Training Solutions for the Health Care Staffing Crisis: A Mentoring Approach

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Abstract

In an attempt to address the limited academic resources many nursing and allied health students face, this project engages healthcare students with mentors via a learning management system. This paper describes a novel preload teaching technique and discusses the use of online social networks for tutoring and mentoring of science students. This article closes with recommendations that can be implemented when academic practitioners employ technology to facilitate mentoring. Further, this paper suggests how the social networking aspects of learning management systems can support student's academic goals outside of the traditional classroom setting.

Introduction

Traditional educational institutions often have limited resources for healthcare students, resulting in student-faculty ratios that are prohibitively large and may inhibit learning (Biemiller, 2009). This paper describes a project that engages nursing and healthcare technology students with academic tutors before their science courses begin and prepares them for learning by addressing the most challenging topics in the subject area. The project also implements a mentoring program, where students of anatomy and physiology courses, and healthcare professionals are connected via a learning management system (LMS) and online social networks during the academic term. The learning management system (LMS) facilitates the use of peripheral participation (Lave and Wagner, 1990) and situated cognition (Brown and Collins, 1989) by mentors and tutors outside of the traditional classroom to achieve the student's academic goals.

Background

The healthcare community is currently facing a shortage of qualified nurses and technical professionals. This is having detrimental impacts on both patient care and financial outcomes. The problem is projected to get much worse between now and 2020 as existing professionals enter retirement (AACN, 2008; Buerhaus, et al., 2009). This project is designed to prepare current clinical and non-clinical health care workers (i.e., licensed vocational nurses (LVNs), phone operators, billing specialists, etc.) and assist/sponsor them in getting their two year Registered Nurse (RN) degree or Allied Health Technology degree. These degree programs typically include one year of prerequisite science courses before degree courses begin. A significant problem arises because many potential students find the demands of the prerequisite courses and subsequent health science courses to be extremely challenging given their adult learner status (i.e., having full- or part-time jobs, family responsibilities, etc.) (Okezie, 2009). Additionally, allied health students often find the technical language and culture of scientific inquiry to be a new challenge that adds significantly to the difficulty of a course (Rogers and Cox, 2009). Analysis shows that a major factor preventing students from enrolling in allied health and nursing programs is failure to complete prerequisite science courses (Blackman and Hall, 2009). Failure to complete prerequisite science courses means lower numbers of qualified applicants for admission. This is having a detrimental effect on the current workforce in two ways. First, failure to enroll in training programs is accentuating the current shortage caused by the increase in demand for nurses and allied health professionals. Second, the future of health care staffing is further challenged as normal attrition of current practitioners continues, there is limited replacement with adequately trained professionals.

Currently, several large entities in the healthcare industry with a vested interest in promotion of a new generation of nurses and allied health practitioners have collaborated to initiate novel training programs. Specifically, Kaiser Permanente (HMO), Service Employees International Union (SEIU), United Health Workers - West (UHW), and the SEIU UHW-West and Joint Employer Education Fund are approaching this problem using technology, tutoring, and mentoring.

Definitions

In order to facilitate discussion, this section defines a number of terms that have specific meanings within the context of this paper that may be slightly different than academic tradition.

- Adult Learner – An adult learner is a mature student enrolled a formal academic program leading towards a degree or professional certification that has distinct motivations and responsibilities outside of the academic setting that sets them apart from a classic academic student.
- Learning Management System – A learning management system is a comprehensive online server and database that serves as a coordinated hub for instructors and students to communicate and use learning tools.
- Short Message Service (SMS) – A text messaging service that allows communication between cell phones, email and LMS.
- Tutor – A tutor is an educator and subject matter expert that is assigned to a student outside of class time to assist them with their learning goals. A tutor may also be a mentor.
- Mentor – A mentor is a subject matter expert that is charged with providing support, context and guidance in a specific community of practice. A mentor may also act as a tutor.
- Preload/frontload – The Preload/frontload teaching model exposes students to the class objectives six weeks before the class starts in order to give them a greater amount of time to achieve competency.
- Online Social Networking - Online Social Networking is the use of electronic and multimedia materials to facilitate quick and effective communication between groups of people.
- Retention – Retention is the ability to keep a person involved and participating in a tracked academic program or professional job.
- Allied Health Care – Allied health care is defined as the numerous technical and clinical professions that act as the backbone of the medical system. Allied health care is distinct from nursing.
- Clinical Sciences – Clinical sciences are the academic and applied scientific disciplines (anatomy, physiology, physics, chemistry, etc…) that are the basis for clinical practice in a healthcare setting.
- Student – A student is a person enrolled in an academic or clinical training program.
- Non-clinical health care workers – Non-clinical health care workers are people that participate in a clinical setting and have direct patient contact, but do not administer therapies or other clinical modalities.
- Educator – The educator is the professional from an academic institution that has been tasked with the responsibility of delivering course content and making sure that the student has achieved their academic and clinical competencies. This person is unique from the mentor or tutor.

Methods

In order to facilitate the nursing and allied health care student's success in prerequisite science courses, the SEIU-UHW Ed Fund used an LMS to preload students in order to connect/facilitate mentors and tutors with students. Traditional education institutions have limited resources (Martinez, 2000) for science students, and these resources are limited to remedial face- to -face tutoring. Additionally, class sizes are very large and instructor-student ratios are prohibitively small (Biemiller, 2009). A classic example of this type of class is anatomy and physiology. The traditional tutoring model most often takes students already behind or struggling and tries to catch them up academically. The novel preload/frontload model proposed in this paper is designed to take students, before the science course starts, and expose them to the core objectives and competencies addressed in the class. Specifically, this preload course engages anatomy and physiology students that have notified their instructors or unions of their intention to apply for a professional nursing or allied health training program.

The preload/frontload model is a preliminary short course of four to six weeks duration that addresses the most challenging topics in the upcoming subject area (anatomy and physiology). This "preload class" is accompanied by a follow-on mentoring program where students are paired with healthcare professionals or academic instructors from other institutions. The mentors are financially compensated for their participation.

Two major factors set this program apart from other tutoring models. The first difference is that mentors are connected to their students via a standard LMS or a social networking site. Specifically, this project offers a Moodle based LMS for the mentors (Branzburg, 2009). This is in addition to any LMS that may be employed by the academic institution. The mentoring employed in this program is distinct from the preload tutoring. The mentors may also perform tutoring services, however what sets mentors apart from tutors is that mentors provide both real world context to the course objectives and provide an opportunity for the students to initiate situated cognition and

legitimate peripheral participation in the nursing and allied health care fields before they are in clinical training. This role stands in contrast to tutors that only give clarification to classroom objectives and are often times little more than advanced upper classmen themselves.

Preload classes are delivered in a classroom. Audio is recorded and recordings are provided via podcast technology from a central campus location. Additionally, these preload lectures are posted on the course LMS, allowing for remote viewing in an online space that supports interaction with mentors and tutors. Students are expected to attend at least 50% of the preload classes in person (in the classroom), but some classes may be "attended" through online asynchronous participation using the prerecorded lectures.

Furthermore, students are given electronic and paper media materials (quick reference guides) to facilitate conceptual understanding of preload topics. The media (interactive test banks, online flash cards, etc.) along with the recorded preload lectures are also available to the students and mentors via the LMS during their anatomy and physiology course. Although not always the case, the instructor of the preload course is encouraged to take on the role of mentor, modifying and using the preloaded online resources to assist the students as they complete the science course. Additionally, this "tutor becomes mentor" transition allows students to centrally locate and interact with the preload instructor and other participating students during the science course. The use of this technology will be continuously made available to the students and is expected to persist through the student's academic career while they are in their professional nursing and allied health programs. Specifically, the LMS tools like blogs, wikis, and online chat functions allow the LMS to becoming a social network and resource that the student can return to and utilize with other courses. Subjective reports and survey results discussed in this paper indicate that the cohort and mentor relationships developed during both stages will persist through the student's professional studies. Because the literature shows that cohort training increases retention (Imel, 2009), the use of the LMS and above mentoring strategies are expected to increase student enrollment and reduce attrition. Additionally, because situated cognition and limited peripheral participation increase student achievement (O'Donnell and Tobbell 2009; Hung, 2009), the ability of the mentor to express how current academic subjects relate to their practice and the student's future professional practice can likewise increase student success.

Students that participated in the mentoring/tutoring program either volunteered through their union or were mandated by their employer to participate.

Students in the mentoring/tutoring program were voluntarily asked to participate in a survey. In order to gain the comparative perspective of students not in the mentoring program, the mentors and tutors also invited students from similar classes that were not enrolled in the mentoring program to participate in the survey. The decision to include non-mentored students in the survey was based on their stated intention to enroll in a professional or technical healthcare training program.

Thirty nine students responded to the survey. Respondents attended several local community colleges and technical schools.

The survey was conducted anonymously and was designed to elicit information about participant history, utilization data and personal satisfaction. A Likert scale was employed to collect subjective student responses. No student demographic data (age, name, etc.) or student achievement data (GPA) was recorded.

Results

The data has been organized into seven areas of interest. These areas of interest are based on the compiled information collected by the survey. Each of the seven areas of interest is summarized in the following analysis. The results are further discussed in the discussion section later in this paper.

1. When questioned about their previous behavior and utilization, students reported that at some time in their adult academic career:
   - 92.3% of respondents had used a free online community or social network to facilitate learning (activities included file sharing, short message services, uploading of audio lectures and lecture transcripts, posting question blogs, class notes, and hyper-linking to graphics and other internet resources)
   - 56.4% of respondents had used Blackboard
   - 25.6% of respondents had used Moodle
   - 20.5% of respondents had used Evolve
   - 10% of respondents had used some other commercial LMS

   Analysis: Free online social networking sites are being used extensively by students to facilitate learning in traditional academic settings.

2. Students reported that of the above learning management tools that they had used in the past, (including social networking sites):
    - 66.7% had stated that the resource was provided by the school
    - 56.4% stated that the resource was provided by the instructor (privately hosted website, or moderated on a social network) outside of the schools
    - 76.9% had used a resource provided by another student
    - 15.4% had implemented the resource for themselves and their friends

    Analysis: If the school or instructor is not providing a forum for internet discussion or exchange of resources, students will use online social networks to do so anyway.

3. With regards to students **currently** enrolled in a science course for the purpose of fulfilling a prerequisite in order to gain admission into a professional or technical health care program (as of the time of the survey):
    - 12.8% were assigned a tutor by their employer
    - 7.7% had chosen to voluntarily participate with a tutor/mentor
    - 30.8% did not use a tutor or mentor or study group
    - 53.8% formed their own study group

    Analysis: Because the sum of the number of students reporting their participation status is greater than 100%, a small percentage of students (5%) that had tutors and mentors must also have been involved in self formed study groups. Also, students more often form their own study group than voluntarily participate with a mentor or tutor.

4. With regards to students **previously** enrolled in clinical science courses for the purpose of fulfilling a prerequisite so as to gain admission into a professional or technical health care program (as of the time of the survey):
    - 17.9% had been assigned a tutor by their employer
    - 15.4% had chosen to voluntarily participate with a tutor/mentor
    - 28.2% had not used a tutor or mentor or study group
    - 56.4% formed their own study group

    Analysis: The rates of students that choose to not use a mentor/tutor/study group and the rates of students that form their own study group appears to be consistent between current class and classes taken in the past.

5. The respondents stated the following with regards to **tutoring or mentoring** participation at any time in the past:
    - 76.9% of students that had participated in a tutoring or mentoring program either this term or in past terms agreed that they would participate in a tutoring/mentoring program again if available.
    - 100% of students that participated in a tutoring or mentoring program either this term or in past terms stated that their participation in the program helped facilitate their academic goals
    - 84.6% of students that participated in a tutoring or mentoring program either this term or in past terms agreed that the use of learning management tools and social networks helped facilitate their group tutoring/mentoring.
    - 51.3% of students that participated in a tutoring or mentoring program agreed that they would likely stay in contact with their peers. This is contrasted with only 33% of students in a tutoring or mentoring program without an LMS agreeing that they would stay in contact with their peers. (No conclusion maybe made from this data alone as the students that had tutors but no LMS availability are most likely students in one to one tutorial sessions, and did not have other students in their tutorial sessions to stay in contact with.)

    Analysis: Students that participate in mentoring and tutoring (not accounting for voluntary vs. mandated participation) have a high degree of subjective satisfaction with their tutoring/mentoring program and feel that using an LMS to facilitate the program was beneficial.

6. The respondents stated the following with regards to study group participation at any time in the past:
    - 72.2% of students that had participated in a study group either this term or in past terms agreed that they would participate in a study group again if available.
    - 81.8% of students that participated in a study group program either this term or in past terms stated that their participation in the program helped facilitate their academic goals
    - 90.9% of students that participated in a study group with an LMS either this term or in past terms agreed that the use of learning management tools (of any sort) helped facilitate their group tutoring/mentoring.

- 68.2% of students that participated in a study group with an LMS agreed that they would likely stay in contact with their peers. As opposed to 27% of students in a study group without an LMS agreeing that they would stay in contact with their peers.

Analysis: Students that participate in study groups have a high degree of subjective satisfaction with their study groups and using an LMS to facilitate their program further adds to this subjective satisfaction. Study group students appear to find greater subjective value in the use of an LMS than do tutored students. Study groups have a lower reported rate of willingness to participate again in a future class than do mentoring/tutoring groups. However, study groups that use an LMS or social network have a higher reported chance of staying in contact with fellow participants than do the mentored students that use an LMS or social network.

7. With regards to learning management systems, students were asked about which resources they used in their currently enrolled class, which resources they were likely to use in the future, and which resources were most effective in helping them achieve their learning goals. The following resources were discussed:
   - Social networking (blog, group email, Twitter) to communicate with students
   - Social networking (blog, group email, Twitter) to communicate with instructors
   - Grade tracking to monitor class performance
   - Database access to share materials (student notes, graphics etc.) with other students
   - Online quizzes/practice tests
   - Prerecorded lectures
   - Instructors notes
   - Interactive modules and tutorials
   - Electronic submission of assignments

Analysis: In general students responded that all of the above resources were both helpful and that they would use them again if provided. It is interesting to note that student responses indicated that the majority of students (64%) found interactive Flash movies very valuable resource with regards to helping them achieve their academic goals, however only 51.2% the students stated that they used them only occasionally when available even though 89.4% of students reported that they would likely choose to use them in the future. In contrast, fewer students (48.7%) reported that they found practice quizzes more helpful than they did the interactive Flash tutorials in achieving their academic goals. However, a high percentage of students (79.5%) reported that they had used practice quizzes very often when they were made available. It is also intriguing to note that only 23% of students reported using prerecorded lectures when available, but 58.9% of students reported that prerecorded lectures were very helpful in helping them achieve their goals, and 64.1% said they would use prerecorded lectures again if made available. Conversely 79.5% of students said that they would use the grade tracking functions again and 71.5% of students said that they would use the online file sharing ability again, but that 28.9% and 38.5% of students respectively stated that they felt grade tracking and file sharing were useful in achieving their academic goals.

Discussion

Because of the high utilization rates of student reported data, students are most likely using social networks even when an LMS is made available to them. Because 15% of students are reporting that they are creating their own online resources, but that 75% are utilizing online resources supplied by other students. Whether this is because a few students have the initiative and skill to setup and manage social networks and collaborative file sharing sites, or it is the case that the first students in a class to create the resource share it with other their classmates remains unknown. In either case, it could be very valuable to instructors and institutions that are less technologically savvy to model the practices of Iowa State University (Beisser, 2000). Beisser suggest that academic organizations identify technologically proficient students and co-opt them into helping the instructors manage electronic resources or act as tutors.

It also remains unexplained why the data here shows that students are far more likely to form study groups than use tutors or mentors. Even though most colleges provide free tutoring centers it might be the case that accessibility and availability with regards to student schedules is a factor. It is also plausible that while tutors and mentors are helpful, having a study group that is focused on the specific class in question and that is available for project collaboration is a big draw. This theory, that increased schedule flexibility and collaborative availability are attractive features to students, can also be applied to why students use social networks at such high rates even when an LMS is available. This hypothesis is further supported by the work of Ciani et al. which shows that self

deterministic learning strategies (students creating their own study cohorts as opposed to being assigned a cohort) positively impact motivation, retention, and subsequently increases achievement.

It should be noted that the reported data comparing the use of tutoring/mentoring and student formed study groups are intertwined with the novel preload approach used in this study, and that it is difficult to make comparative analysis between tutoring/mentoring and study groups and the use of academic LMS. Traditionally, the academic LMS is the purview of classroom academics only. However, the collected subjective data suggests that the use of ether an online social network or an LMS, while not linked to a specific academic class, can be very useful in facilitating both study groups and tutoring/mentoring programs. This paper is recommends that "drop in" college tutorial centers can make use of online social networking to reduce tutoring load and administrative issues. Traditional barriers to online tutoring include excessive amounts of time addressing repetitive issues, and the volume of data entry by keyboard (Fox, Seamus, and MacKeogh, 2009). Reliance on student formed online social networks can eliminate or reduce these barriers by allowing students to post responses to other students questions, and allows the tutor to comment and correct when needed. While online posts and Short Message Services (SMS) will not take the place of traditional face to face tutoring, the use of an LMS for tutoring has advantages. First, the availability of online resources increases accessibility for people that may not be able to otherwise physically get to the tutoring center. Second, it allows more users at the same time to access the tutor's information. Lastly, it is common for tutors to encounter the same questions term after term. With online resources, previous posts can be made available or referenced very easily to for frequently asked questions.

We recommend further research be done to compare the value of academic LMSs versus the value of online social networks. According to the subjective reported data of this paper, the most utilized aspect of a LMS is the ability to upload and download shared data and to communicate and collaborate with other students and instructors. It should be noted that these functions can be managed using online collaboration resources like Google docs and Yahoo groups. Further, even the subjectively most valuable aspects of an LMS reported by students (practice quizzes and online tutorials) can be managed by free online resources.

It is not the intention of this paper to suggest that instructors or academic institutions replace their commercial LMS with free online resources, but free online resources should be reserved as a viable and beneficial option for instructors and tutors that do not have access to their own LMS. The above data can also influence administrators and instructors when choosing to implement and LMS and which LMS features would be most appropriate for their school (Black et al., 2007).

The data presents a striking question: Why do students report great value in resources that they don't utilize, and utilize resources that they say have limited subjective value? It may be the case that the wording of the survey questions skewed the data by asking whether specific functions were "helping students achieve their academic goals". Perhaps surveyed students do not interpret specific resources like uploading of files valuable in achieving mastery subject matter, but find that they save time or are helpful in another manner. Future surveys should make sure to distinguish how these resources are perceived helpful. It is clear, though,that This paper supports the work of Pilarski who suggests that having online lectures available reduces student anxiety. Considering this, it may also be the case that the resources in question are considered vital emergency resources but not useful day- to- day. An appropriate analogy is that of the spare tire in a car. It is not needed often, but when needed it is invaluable. This would certainly be the case for students that missed a vital end of term lecture. Whatever the reason for the low utilization rates but high perceived subjective values reported, instructors should be cautioned to look deeper than simple utilization rates when deciding which resources to put their energy into developing.

It is evident that more rigorous and expanded research is needed to address the question of whether the techniques utilized in this course actually increase student GPA and retention and ultimately impact the number of students applying for admission to professional healthcare programs. It is our position that additional research will show that the use of an LMS, social networking, and mentoring are synergistic in their effects. It is often true that the more resources that are made available to the student, the better their achievement (Martinez, 2000). However, the ease with which instructors can use social networks and file sharing abilities makes these resources of particular value.

Lastly, while the literature shows that tutoring increases achievement (Gibbons and Dixon, 2001), and peer groups influence academic success (Sallee and Tierney, 2009), further research is needed to validate the premise that the use of an LMS increases the chance that students will stay in contact with their tutors and fellow students and thereby increase their retention and GPA.

Conclusions

We close with seven recommendations for practitioners:

1. Students should be encouraged to use social networking features of the existing LMS to form study groups since the LMS can support many varied user group functions and students have shown that they will form support groups with or without an LMS.
2. Instructors should participate in, and make use of, the social networking aspects of their academic institution's LMS (wikis, blogs, etc.) Further, academic institutions should promote and train instructors to become more comfortable with the social networking aspects of the available online networks.
3. Considerations for implementing or adopting an LMS should include an evaluation of its social networking functions.
4. The most commonly used features of a typical and traditional LMS (e.g. file sharing) should be included in popular online social networks.
5. Instructors should think critically when deciding what resources to make available to students. Just because students don't regularly use a resource, doesn't mean they don't need it or want it available.
6. Tutors, mentors, and college tutoring centers should increase their effectiveness and subjective value to students by using online social networks to make themselves more available to students. Additionally, the use of social networking tools, while increasing availability, can also allow the tutor or instructor to set healthy boundaries because the educator can choose when to check their online status and those of the students.
7. Future longitudinal research is needed to show how GPA and retention are affected by the use of LMSs and social networks.

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Flexible Online Learning and Game-based Learning Environments: Do They Make a Happy Marriage?

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Abstract

This literature review and reflection paper explores the potential of online game-based environments to enhance e-learning experiences and suggests a possible marriage between them where gaming environments could serve as a platform for online learning. This is placed within the context of the new directions that learning has to take in order to engage the net generation (Gen-N). It outlines the principles of distance learning and the learning principles that underlie game design to examine their similarities and see if they could make a happy marriage. In conclusion, the paper cites initiatives already taken in this direction of using game based virtual environments in distance education. The paper is based mostly on literature survey of articles and books on gaming and education and on authors' experience in gaming and online learning.

Introduction

With the advent and growing popularity of virtual 3-D worlds and highly graphical, realistic online gaming environments, the opportunities for collaboration in online environments have taken a new direction. . The net generation (Gen-N),   used to instant 'one touch' information access and communication, are learning informally in a variety of ways by creating and collaborating and their brains and thinking processes are also likely to have been shaped by very visual, rapid-moving, hyper-texted environments (Annetta, Murray, Laird, Bohr & Park,2006). Even as schools and teachers struggle to keep up with the changing technology, they are impeded by their adherence to traditional pedagogical beliefs and practices (formal, instructor-controlled, one-to-many, linear, passive learning of facts organized in discrete chunks with no connection to self). Despite several initiatives to incorporate active learning through technology, change in schools is slow to come as teachers fail to relate with computers and ICT (Internet and Communications Technology) in the way their students do. They are uneasy with the change in teacher roles that technology-mediated learning necessitates and fear a loss of control.

In contrast to classroom instruction, distance education, being primarily mediated through electronic forms of communication and access, is uniquely equipped to better integrate new technologies into its design and shape a different learning experience for students. This is also made possible by the underlying philosophy that guides the principles of good practice in flexible distance education which emphasizes multiple modes of communication and

access, responsiveness to student needs and learning preferences, multiple means of content delivery, clear learning objectives, learning in social contexts, social presence, student collaboration and building of learning communities, prompt feedback, reflexivity in learning, self-regulated participation and flexibility, which give the learner more control over the pace, place and time of learning.

However, the promise of distance learning has not been realized and with a few exceptions, e-learning environments continue to be seeped with traditional teaching strategies and have come to replicate the social organization of traditional schooling. Dutton (2004) cites the case of a university where the virtual learning environment was used as nothing more than a replacement for the copy machine and projector, without modifying underlying approaches to teaching and learning for an online environment.

The goal of this study is to provide some insights related to how game-based learning environments can provide a platform for flexible online learning. It provides good recommendations, especially, for online education practitioners who seek new solutions to make online learning more appealing and engaging. Also game-based environment developers could benefit from this reflection on overcoming some challenges when designing games for online learning. This study was the result of a literature review, personal experiences on using games and developing online education, and analysis of game-based and online learning environments.

Flexible Online Learning: A Promise Unrealized

E-learning has become extremely popular with full time working professionals and people who are hard pressed for time to attend a university, and with corporate organizations who see in this a convenient means to deliver training to its employees. The demand for this type of instruction is high and because it can be cheap (an entire course can be delivered via free email), everyone wants to get in the fray and capitalize on it, with little regard to flexible online learning principles. In schooling also, distance learning is sometimes no more than traditional lectures delivered over the webcam.

This has prompted Aldrich (2004) to comment that "So far, e-learning has made about the same contributions to learning as fast food has made to food". He points out that both industries are driven by low-cost, high profit goals. Their products allow for minimal deviation from standards. Development and consumption must be simple and rapid - get in, get something from the standard menu, get out, in a world of 'drive-through content'. In one of the most scathing criticisms of e-learning, Squire (2005, p.5) says that '…as it is currently constituted, e-learning is an evolution in education, not a revolution'.

> "The basic organizing metaphors of traditional education – *knowledge* as discreet and abstract facts, *learning* as the "acquisition" of content, and therefore *instruction* as the organization, dissemination, and management of that content – have gone unchanged. The promise of e-Learning – that it would provide customized, accessible learning experiences – has given way to more mundane pursuits, such as free online content."

Further, he states that:

> "Publishing content online is not synonymous with making learning accessible, or actually ensuring learning. E-Learning educators have focused too much on the "e" – making content electronic (or more accurately, digital) – and not enough on the learning – creating technology enhanced experiences designed to change future understanding and performance. E-learning has become all about replicating traditional education in an electronic format. In short, we have become experts at technology-mediated chalk and talk."

Digital Games in Flexible Online Learning: A New Paradigm?

What has been more difficult to achieve is the effective design of instruction in order to provide the kind of social and material experiences necessary to make sense of that content, and to make it meaningful and useful for future action. Video games designers have been very successful in this aspect. With modest beginnings in two dimensional arcade-type games with rougher graphics and sound, requiring no more skill than just hand-eye co-ordination (called twitch games), game design has progressed to include simulations and three dimensional multi-user role-playing games with strong narratives and character development, which immerse users in rich interactive

digital microworlds (Lim, 2008; Squire, 2003). According to Foreman (2003) this new genre of games provide such engaging, rapid paced, graphically rich and dynamic experiences that they make any sort of conventional schoolwork mediated through lectures or text, seem boring by comparison.

Game-based learning environments have being used to improve students' critical thinking, inquiry skills and communication skills, making them candidates of effective e-learning platforms (BurgosTattersall, and Koper, 2007). The motivation, active participation, sense of community and critical thinking approach possible in game based learning environments could be integrated with content delivery in e-learning. . For instances, Gee's (2003) work on gaming advocates learning as a state of playing where learners work with other, engage in activities, solve problems, share knowledge, and evaluate other and themselves within the learning environment. Dede (2003) predicts that game-based environments will be one of the common interfaces that people will interact with in the upcoming decades. Both scholars present futuristic scenarios in which learning takes place in game-based environments, and the separation between school and home, learning and entertainment vanish. In this line of reasoning, Dede (2005) defines the term "neomillenial" learning style. He argues that although game-based learning environments may not provide real life learning, they can support neomillinial's learning needs by providing opportunities for intense interaction and fostering higher order inquiry skills. To make this integration seamless, some issues should be clarified and some challenges should be considered before proposing a marriage between these two approaches.

The Basis for a Marriage between Flexible Online Learning and Game-based Learning Environments

Game analysis reveals that game designers craft fun, engaging and compelling experiences by balancing several components of the game, namely, characters (fantasy), game rewards (motivation), obstacles (challenge), narrative (curiosity), competition (with self and other humans) and opportunities for collaboration with other players (social recognition) (Annetta et.al, 2006; Squire, 2003) . Protagonists for incorporating games into education find that games embody well established principles and models of learning which are in line with constructivist principles.
One of the principles they identify is "situated cognition" (Van Eck, 2006; Squire, 2005), which emphasizes that for effective learning to happen, it has to be rooted in direct experience and concrete contexts. For example, games give players clear goals that must be achieved and tasks that lead up to it. Thus learning tasks are placed within the meaningful context of the game. Moreover, whatever learning that happens is tied to the achievement of these goals and has to be demonstrated within the game environment. Thus, learning is made relevant with direct practical application. According to Aldrich (2004), games follow the advice that Aristotle dispensed a millennia ago: the only way to learn is by doing. Principles behind immersive gaming experiences clearly show that they are in complete alignment with the principles of constructivist flexible distance learning environments. In the authors' view, it would be easier to integrate game-based learning into something which naturally tries to create an immersive, collaborative environment than a conventional classroom, where the ecology of teaching is contrary to the informal learning through games. For instance, the role of the instructor in flexible online teaching is understood to be more of a facilitator, nudging students to think in different ways and providing for opportunities for collaboration and in a game based environment, this role would remain unchanged. Furthermore, gaming occurs in rich socio-cultural contexts, which is apparent in the several forums and blogs that have sprung up around multi-user games, where gamers share their experiences, strategies that worked, and provide suggestions to each other for improvement, in essence, forming communities of practice, which is also one of the main goals in flexible online learning.

Role playing simulation and strategy games such as Civilization, Sims, Age of Empires, Roller Coaster Tycoon, Dungeons and Dragons (all commercial, off the shelf games or COTS) place players in a problem-solving role that requires them to make frequent important decisions which decides the course of the game and its outcome. For instance, in Dungeons and Dragons the player is sent on a quest to find a cure for a curse which plagues this fantasy land. The players have to gather information from characters by 'talking' to them, and some characters might try to mislead them, so they have to evaluate all the information and take a decision. Players have to acquire objects (spells, swords) and skills and gain training in them and there is action in the form of duels and fights with evil characters. Thus, not only is the game narrative varied and unpredictable, but also encourage inquiry, information gathering and reflection (Lim, 2008) and in multi-user environments, encourages collaboration and information sharing, which is often done through text or voice chat capabilities inbuilt in the gaming environment. According to Van Eck (2006), this whole process engages players in a 'Piagetian' cycle of <u>'assimilation'</u> (fitting new

information into existing slots and categories) and <u>'accommodation'</u> or (modifying understanding to make sense of information that does not fit into existing slots) requiring a constant cycle of hypothesis formulation, testing and revision.

Attempts by educational designers to create games have met with limited success, because they 'smell' too much like school (the educational emphasis being more apparent than the experiential part) and students soon become disenchanted. This has led to the 'serious gaming' movement, where educationists, military, corporations, medical fields and game designers collaborate to creating games to engage players in critical content with experiential, task-based activities situated in multiplayer online 3-D virtual environments rich in graphical representations, objects, tools, avatars (virtual representations of each student) and required instructional content material.

River City, a serious gaming project initiated by Harvard in the Active Worlds Multi-user Virtual Environment incorporates many of the principles of role-playing strategy games mentioned above such as problem solving, information seeking (clues), collaboration, information sharing, assimilation, accommodation, skill development and situated cognition within a rich story-line. The narrative is based on authentic historical conditions where students, working together in small teams, have to discover clues, analyze information, develop hypotheses and test them to propose a solution to the causes of illness in a 19th century town. Thus, in a game-like environment, students learn to carry out an authentic scientific inquiry (Ketelhut, Dede, Clarke & Nelson, 2006) which also helps to enhance communication and problem solving skills (Dieterle & Clarke, 2008). Other game-based learning environments - Quest Atlantis (IndianaUniversity), Environmental Detectives (MIT), Hazmat:Hotzone (Carnegie Mellon), Revolution (MIT) are also good examples to serve constructivist learning environments.

However simply using a simulated environment does not ensure that learners will generate the kinds of understanding that educators might desire. The learning has to be "made visible" to them by providing debriefing and opportunities to reflect on their activities. Instructors play an important role in this process fostering collaboration, promoting reflection and coordinating extension activities. Thus, the potential for structuring educational activities in a manner that generates such a state of engagement along with appropriate scaffolding provides the required direction for using game-based learning in schools.

One of the major challenges in this marriage is to overcome the time and resources investment required for game-based learning environments (Prensky, 2001). Another challenge in integrating games into flexible online learning is putting instructional designers, course instructors and game developers into the same team (Kirkley & Kirkley, 2004). Available instructional design methodologies do not meet the needs of design and development of complex, virtual, game-based environments. As Kirkley & Kirkley (2004) explained a story board might mean different things for instructional designers and game developers. One way to approach this challenge is by promoting the use of games in teacher education programs (Shah, Correia & Karakus, 2009). Course instructors may design instructional activities so that pre-service teachers can better articulate the use of gaming in their own subjects and even create initial prototypes designed for their students in a virtual schooling setting.

Another issue seems to be the students/players' evaluation in game-based learning environments when integrated in online learning. One way to overcome this issue is to embed evaluation systems into the environments that check students/players' cognitive and affective changes while they engage in the learning activities. They can be rewarded and/or given alternative activities to compensate for any mistakes. This might be controlled by agents and avatars. At the same time online logs and records can provide additional evaluative data.

Conclusions

The game-based learning environments described above represent a new paradigm in distance learning and themselves form the platform of delivery, making the important distinction between "using" games (implying that games be present in the course of instruction) and "integrating" them (involving careful analysis and alignment with instructional strategies and learning outcomes and intelligent implementation) into a distance learning environment. Tools such as virtual notebook, text based chat allow students to interact and keep /share notes of their observations and data collection, also providing a place for reflection. Although not perfect, these examples represent important experiments in gaming and online learning and form the foundations which will redefine distance learning along new, exciting lines.

Flexible online learning and game-based learning environments are both based on similar constructivist learning models, and are not antithetical to the purpose of education. Online learning can profit substantially by incorporating the motivational and immersive principles used by game designers. Online learning environments

integrated with game-based learning open up the possibilities of using games as spaces for experiential learning, as contexts for discussion, as tools to think with and as an engaging arena for meaningful, collaborative learning.

As game-based learning environments become more pervasive in children's lives, educators will also have to be prepared to consider the effects of these experiences on children's identities and development, along with organizational, political, economic and cultural obstacles (Dede, 2002) to using game-based learning environments as flexible learning tools.

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Using Activity Theory to Guide E-Learning Initiatives

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Abstract

Activity theory's visual and conceptual representation of activity-in-context provided an analysis and synthesis tool to help department faculty begin to develop an online instructional design and technology (IDT) master's program. Analyzing different activity systems for students, faculty, and administrators revealed that E-Learning goals overlapped, but differences existed in terms of rules-norms, community, and roles. Analysis results were then organized by existing faculty, student, and administrator concerns with potential boundary-crossing actions (Engeström, 2002). This paper first discusses the need for simultaneous E-Learning curriculum and administrative decision-making, then reports progress across four stages of developing the online program. Three implications of activity theory for E-Learning are discussed. Guidelines for using activity theory in program development are described.

Background

Administrators push for E-Learning initiatives, which increase student enrollments but require an increasing amount of faculty and administrative time. Faculty are increasingly called on to revise or develop new programs but also to develop plans to market, recruit, and retain students, tasks that are new and foreign to them. Faculty groups work with little organizational experience to implement E-Learning initiatives. Traditional models of curriculum development take too long and academic organizations are not geared to address immediate needs and understand the complex contexts surrounding fast-changing market conditions that academia finds itself in.

Activity theory has been used to analyze educational settings ranging from computer-based training to better understand the workplace in which the training was used (Pang & Hung, 2001), as well to acknowledge teachers' beliefs about teaching and the power issues between teachers and administrators in public schools (Robertson, 2008). Activity theory has been used in higher education strategic E-Learning initiatives (Salomon, 2005) and to look specifically at asynchronous learning networks (Li & Bratt, 2004).

This paper documents the results of using activity theory to examine the issues of online programs. Viewing E-Learning through "activity" acknowledges the different constituencies that have a stake in such programs, as well as the context of curriculum and organizational needs. Nichols (2008) uses the three activity systems of organizational (management), technological (information specialists), and pedagogical (instructors) to characterize E-Learning. In this paper, the three activity systems are viewed as faculty, administrative (department chairs), and students are analyzed. Faculty members are familiar with the curriculum issues of program objectives, courses, and assessment. Administrators, meanwhile, deal with student recruitment, course staffing, and program coordination and evaluation. E-Learning initiatives suggest the need for both groups to address curriculum and organization simultaneously. From an activity perspective, two activity systems are in play with overlapping goals. A third activity system, that of the students, represents the key stakeholder.

Conceptual Framework for Using Activity Theory

Activity theory is a socio-cultural perspective on understanding the interconnections of people, organizational rules and culture, and mediating tools, all directed to some outcome or goal (Bertelsen & Bodker, 2003; Cole & Engeström, 1993). Activity theory can be used to better understand the goals of E-Learning in an academic setting and in a way that includes all of the major constituents and the influence of social and cultural norms, values, language, and tools (Jonassen, Tessmer, & Hannum, 1999). Representing activity as a collective image of activity (Engeström, 1987, p. 78) includes goals, users, and tools, and the rules and norms, community practices, and division of labor.

Specific components of an activity system model for E-Learning initiatives include the curricular degree-granting program connected to program outcomes (the goal of the activity system); users including students, faculty members, and administrators; the division of labor (i.e., who does what); the rules and norms of that department; the cultural aspect of the department, or unique community of practice; and the specific E-Learning technical systems, known in the theory as mediating artifacts. Specifically, these tools include the online learning management system and the administrative system (see Figure 1).
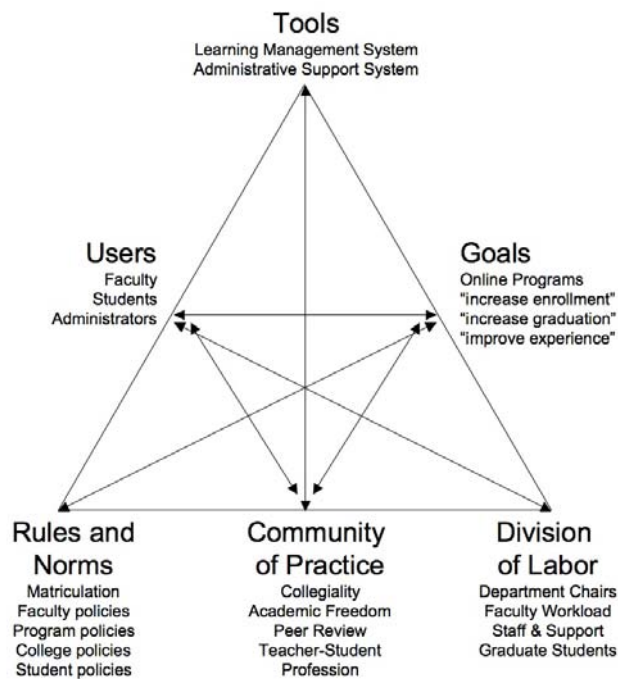
Figure 1. Activity System for E-Learning.

Using Activity Systems for E-Learning Analysis and Synthesis

The activity system visual representation provided both analysis and synthesis opportunities. E-Learning development is summarized across four stages.

Stage 1: Analysis Across Three Activity Systems: Faculty, Students, Administrators

The activity theory conceptual structure was first used to analyze the different activity systems for faculty, students, and administrators (see Figure 2). Data collection occurred during a department meeting where issues were identified and afterwards mapped onto the activity system visual. The analysis identified an overlapping set of goals, which suggested that E-Learning was a mutual concern and that changes to address the needs of one group would impact one or more of the other two groups (see Figure 3). Differences existed in terms of rules-norms, community, and roles. A significant overlap of concerns existed with online courses and advising, meaning that any implemented changes will impact all three groups. One area of less concern for faculty and students, but significant for administrators was in the evaluating and improving the quality of the overall academic programs, including E-Learning components. This analysis revealed to faculty the need to include program evaluation in the design of all features of a program.

Despite overlapping goals, the immediate concerns of faculty, students, and administrators can be regarded as "divided terrain" where these individuals do not always talk or work with each other. The activity system suggested the possibility of analyzing a multitude of relations within the triangular structure of activity, including shared goals and differences in roles, and ways of working together.

The overall advantage to activity theory as an analysis tool is that the model raises awareness of the players to contextual and historical factors that comprise human activity. The different players can then discuss the potential impacts of this context on reaching the goals. Activity theory is not just a front-end analysis tool, as needs assessment is in instructional design, but a "heuristic aid" (Gay & Hembrooke, 2004) for the players to continually evaluate implementation and make revisions, but also to keep the needs and concerns of the interconnecting players in front of everyone.

Tools
Learning Management System
Administrative Support System

Users
Faculty

Goals
Online Programs
Course Preparation
Course Delivery
Course Evaluation
Student Advising

Rules-Norms
Faculty Constitution
Time Limitations
Tenure Expectations
Course Preparation
T-S Expectations
Student Evaluations

Community
Shared Decisions
Teaching Freedom
Staff Expertise
Apprenticeship

Roles
Department Chair
Program Coordinators
Peer Review

Faculty

Tools
Learning Management System
Administrative Support System

Users
Students

Goals
Online Programs
Course Experience
Grades
Advising
Thesis/Dissertation

Rules-Norms
Admissions
Program Requirements
Program of Study
Semester Time Frame
Financial Issues
Advising

Community
Course Enrollment
Study Groups
Faculty - Student
Advising Experiences

Roles
Class Performance
Review of Faculty
Outside Social Roles

Students

Tools
Learning Management System
Administrative Support System

Users
Administrators

Goals
Online Programs
Recruitment
Enrollment
Graduation
Faculty Assignments
Quality Control

Rules-Norms
Hierarchy
Department Policies
Management Norms
Admissions Requirements
Student Financial Support

Community
Leadership Team
Department Culture
Faculty Styles
Faculty Rank
Students

Roles
Faculty Teaching Assignments
Faculty Orientation
Faculty Success
Meetings - Coordination
Office Staff Support

Administrators

Figure 2. Three E-Learning Activity Systems.

Faculty Goals	Student Goals	Administrator Goals
Online course preparation, delivery, and evaluation	**Online course** expectations, grades, and performance	Faculty **teaching** assignments
Student **advising**	Program **advising** online/F2F Thesis/dissertation mentoring	Student **matriculation**: recruitment, enrollment, graduation
		E-Learning program quality control

Figure 3. Goal Overlap.

Stage 2: Synthesis of Decisions for E-Learning

The use of activity theory's conceptual organization has helped our department to organize around a set of discussion points, ones that address the concerns and realities of all three groups. The next stage, currently ongoing through the academic year in the form of an online program working group, is to document issues for action and to make recommendations for different academic programs. Synthesis, in terms of decision-making, is now being facilitated by discussing how the use of E-Learning tools influences or mediates the goals of the three groups and what changes in rules-norms, communities of practice, and roles might be needed.

At this second stage, online courses and E-Learning programs require what Engeström (2002) calls "boundary-crossing" actions, which are two-way collaborative interactions requiring both renegotiation and reorganization decisions (see Figure 4). Both the overlapping and differing analysis results revealed opportunities, which have forced joint responsibility for E-Learning courses and programs on all three groups, that program development in E-Learning, given its uniqueness and newness, requires an ongoing, iterative, and collaborative set of practices (e.g., re-defining student contact hour) quite different from traditional academic courses and programs.

Existing Faculty Concerns	*Faculty - Administrator Boundary Crossing Actions*	Existing Administrator Concerns
Faculty Constitution	*College provides support for graduate programs and E-Learning*	Hierarchical Reporting
Time Limitations	*Department support of E-Learning program development*	Department Policies
Tenure Expectations	*Department support for online course development*	Management Norms
Course Preparation	*Department documentation of a faculty member's online activities for tenure*	Admissions Requirements
Teacher-Student Expectations	*Faculty collaborate on program features, goals, curriculum scope and sequence, student assessment, student advising, program evaluation*	Student Financial Support
Student Evaluations	*Faculty dissemination of online teaching best practices*	
Faculty - Student Boundary Crossing Actions	Existing Student Concerns	*Student - Administrator Boundary Crossing Actions*
Instructor provides clear specifics on student performance in an online course	Admissions	*Department provides clear specifics on online program requirements*
Instructor provides prompt, consistent, and constructive course feedback and student advising	Program Requirements	*Department provides clear policies and availability of financial resources*
Instructor provides flexibility in course delivery features based on students' technological capacity.	Program of Study	*Department examines what a contact-hour means in an online course*
Instructor identifies student differences, including international students, and makes adjustments in course implementation.	Semester Time Frame	*Department solicits data on improving course and program features*
	Financial Issues	*Department identifies program evaluation details*
	Advising	

Figure 4. Boundary-Crossing Opportunities.

Examining potential boundary-crossing issues helped to develop two immediate action steps; namely program focus and marketing, and financial support for further development. In terms of Program Focus and Marketing, faculty identified the need to determine student focus and distinctive program features, and develop recruitment-to-graduation support system ("paying attention to online student needs"). In terms of Financial Support, an internal grant proposal was submitted to support individual faculty development of online courses for IDT Online Master's Program. Priorities included the development of a common "look and feel" across the CMS product, online portfolio, program and course learning outcomes, and appropriate technology tools to support these outcomes.

Stage 3: Action – Grant

By the end of Spring 2009 a proposal for 12 IDT courses was submitted to the institution's Extended Learning Online Program Grants. May 2009 the department was awarded $25,000 for development of 6 courses to

roll out as online courses beginning summer 2010. $4000 was awarded to individual course faculty members after department chair sign-off of course development completed.

Stage 4: Current Status and Action Steps

During the Fall 2009 semester faculty members met with Extended Learning to develop a Memorandum of Understanding that specified activities for Extended Learning staff (e.g., standardized CMS page layout; podcast creation) and individual faculty member (outcomes, assessment, engagement activities). Subsequent Fall 2009 activities included the development of marketing focus, student-centered features. A Faculty Development Guide was developed to orient faculty to working with Extended Learning and goals, features, and needs of the IDT master's program.

A Spring 2010 Faculty Working Group will be convened using the activity analysis discussion list and the boundary crossing opportunities table to discuss program features and development challenges and decisions to be made. Development with Extended Learning for the first courses will occur using an in-house course preparation checklist and the Quality Matters rubric (University of Maryland).

Implications for Using Activity Theory

Three implications of activity theory for E-Learning can be characterizing as (a) making explicit, (b) providing opportunities, and (c) sustaining growth. Activity theory makes explicit program goals and brings to the surface issues and concerns for the different constituents. Using activity theory as both analysis and synthesis tool identifies opportunities for conflict to be addressed, for what Engeström (2002) calls "expansive learning." Whether the scope of program development is viewed as global or local, top-down or bottom-up, activity theory can be useful to keep discussion, designing and trying out, and revision, a process that is proactive, scalable, and self-perpetuating, or sustainable embedding as characterized by Nichols (2007).

Guidelines for Using Activity Theory

Based on what has been accomplished so far the first guideline is to brief as many participants as possible on the purpose on the purpose of the activity systems. In an academic setting this activity demonstrates an attempt to use theory in an actual setting.

A second guideline would be to specify the procedures, although these may have to be adapted to the specific context of the program development. Jonassen, Tessmer, and Hannum (1999) suggest six steps:

1. Clarify the purpose for the activity system
2. Provide a big picture of the overall initiative
3. Specify the activities to be analyzed
4. Examine the role of the tools
5. Address the internal and external context
6. Monitor what is happening and document progress and the process

A third guideline is to collaborate continually and frequently, but take into account the time of faculty, students, and administrators. A fourth guideline stems from the third; namely, to share the results of the activity system approach and results in the decision-making process. A fifth guideline would be to document your activity and to report its results to participants.

A worksheet that provides the activity system visual as an analysis organizer can be found at:
http://web.me.com/nshambaugh/MediaCenter/Uploaded_Files.html

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Scaffolding Higher-Order Thinking during Ill-structured Problem Solving: A Conceptual Framework

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Abstract

Novice and expert problem solvers use different strategies in approaching ill-structured problems, indicating lower-order and higher-order thinking skills respectively. There is a need to guide novices to use better problem-solving strategies through developing their higher-order thinking skills. According to theory and research, analytic, generative, and evaluative thinking skills are essential to successful ill-structured problem solving performance. We propose a framework designed to promote higher-order thinking skills during ill-structured problem-solving. Scaffolding features, types, and functions of an open-ended learning environment can be used as guidelines for creating scaffolds to facilitate the novices' acquisition and utilization of the three fundamental thinking skills. Possible ways of scaffolding novice problem solvers to use higher-order thinking skills are discussed based on the scaffolding design in various ill-structured learning domains.

Problem Area

The real-world problems confronting practitioners are usually saturated with "complexity, uncertainty, instability, uniqueness, and value conflict" and require the practitioner to "choose among multiple approaches to practice or devise his own way of combining them" (Schön, 1993, pp. 17-18). Cognitive psychologists define these problems as *ill-structured* or *ill-defined* because they have unspecified problem space (e.g., elements, goals, constraints, principles, etc.), divergent perspectives, multiple solutions, and unclear evaluation criteria, entailing a dialectic and iterative problem-solving process (Chi & Glaser, 1985; Kitchner, 1983; Sinnott, 1989; Voss & Post, 1989). From constructivism and situated cognition perspectives, educational researchers (e.g., Bransford, Brown, & Cocking, 2000; Bransford & Stein, 1993; Jonassen, 1997) emphasize the importance of engaging students in ill-structured problem solving in order to situate learning in authentic tasks and to develop transferable knowledge and skills.

Ill-structured problem solving is difficult for novices with deficiencies in the prerequisites of this activity. Literature show that the major predictors of ill-structured problem-solving performance include: 1) *domain knowledge* (e.g., Chi & Glaser, 1985; Diakidoy, 2001; Shin, Jonassen, & McGee, 2003), 2) *dispositions and beliefs* (e.g., Mumford, Baughman, Threlfall, & Uhlman, 1993; Schraw, Dunkle, & Bendixen 1995), 3) *higher-order thinking skills* (e.g., Lee & Cho, 2007; Mumford, Baughman, & Threlfall et al., 1996, 1997; Schunn, McGregor, & Saner, 2005; Shin et al., 2003), and 4) *metacognition* (e.g., Brown, 1987; Lin, 2001; Sinnott, 1989). Novices do not possess extensive and well-organized knowledge framework for problem solving. Many of them develop simple epistemological beliefs about the problem domain and take close-minded attitudes toward new ideas. As a result, they tend to apply a single schema to ill-structured problems, preclude exploration of alternative perspectives, and fail to effectively evaluate and justify the proposed solutions. Also, because of limited working memory, few novices are able to consciously regulate their cognitive processing during problem solving.

To address these challenges, more and more educational researchers have realized the need to provide external instructional support to facilitate cognitive and metacognitive processes during ill-structured problem solving. A variety of scaffolds have been implemented to support the aforementioned four predictors by facilitating knowledge integration (e.g., Chen & Bradshaw, 2007; Davis & Linn, 2000), argumentation and justification (e.g., Cho & Jonassen, 2002; Oh & Jonassen, 2007), exploration of alternative ideas or perspectives (e.g., Choi & Lee, 2009; Uribe, Klein, & Sullivan, 2003), and metacognitive regulation of the problem-solving process (e.g., Ge & Land, 2003; Wolf, Brush, & Saye, 2003). According to the findings, although learners' ill-structured problem-solving skills were enhanced to some extent, new challenges emerged as the scaffolding effects were unsatisfactory. For example, learners tended to use the scaffolds superficially and mindlessly; not all learners can benefit from the same scaffolds; multiple types of scaffolds increased cognitive load. This paper aims to develop a theoretical framework to address the original and emerging challenges in the area of scaffolding novices to solve ill-structured problems, with a focus on three particular issues.

First, novices have difficulty applying higher-order thinking skills to ill-structured problem solving. They tend to analyze the complex problems in simplified ways, overlooking the multiple factors and representations (Carrithers, Ling, & Bean, 2008; Powell & Willemain, 2007; Prietual & March, 1991). Moreover, they focus on the fragmented details instead of the meanings and relationships and have difficulty distinguishing the relevant from the irrelevant information (Powell & Willemain, 2007). In generating solutions, novices usually fail to consider alternative ideas and perspectives (Osana, Tucker, & Bennett, 2003; Prietual & March, 1991) or lose their focus in discursive exploration of ideas (Kapur, 2008; Powell & Willemain, 2007). They are likely to build solutions based on available salient information rather than consult and integrate additional resources. Also, it is difficult for novices to determine good criteria for evaluating the solutions and developing strong arguments. They tend to make rapid, uninformed decisions, which in turn cut short their search for alternatives (Osana et al., 2003; Schunn et al., 2005). Studies showed that higher-order thinking skills, which are supported by the other predicting factors mentioned earlier, have significant influence over ill-structured problem-solving performance (Lee & Cho, 2007; Mumford et al., 1996, 1997; Schun et al., 2005; Shin et al., 2003). Inadequate higher-order thinking skills will inevitably limit the solver's cognitive capacities of processing the ill-structured problems.

Second, learners tend to misunderstand, misuse, or ignore the scaffolds and their functions, reducing the scaffolding effectiveness. Frequently, learners fail to reflect on the purposes and strategic functions of the scaffolds and rarely go beyond answering questions to seek further understanding (e.g., Oliver & Hannafin, 2000). They are inclined to use lower-order thinking skills in responding to the scaffolds or simply ignore the opportunities of higher-order thinking (e.g., Davis & Linn, 2000; Land & Zembal-Saul, 2003). They try to solve problems with their presuppositions rather than follow the scaffolds to critically reflect on their own and others' perspectives (e.g., Choi & Lee, 2009; Ge, Chen, & Davis, 2005). Faced with confusions or difficulties, they easily give up using the scaffolds that demand mental efforts, especially when they experience cognitive overload (e.g., Ge et al., 2005; Greene & Land, 2000). These problems are partly due to the learners' lack of prior knowledge, simple epistemological beliefs, and limited higher-order thinking and metacognitive skills. Additionally, the design of the scaffolds may also be responsible. Scaffolds that cannot be easily understood by the learners or fail to support their zones of proximal development are not likely to achieve the intended effects.

Third, despite the positive findings from experimental studies, the learners' skills developed under scaffolding may not be robust enough to support problem solving in new contexts. Many studies examined scaffolding effectiveness based on the comparison between experimental and control groups (e.g., Cho & Jonassen, 2002; Davis & Linn, 2000; Ge & Land, 2003; Manlove, Lazonder, & de Jong, 2007; Oh & Jonassen, 2007). Criteria for assessing problem-solving performance were aligned with the scaffolded skills and processes. They gave the experimental group strong advantages that may have confounded the conclusion that the scaffolds will significantly improve ill-structured problem-solving performance. Moreover, since most studies did not fade the scaffolds, there was little evidence that the improved performance had been internalized by the learners and could be transferred to new situations. A few studies that did fade the scaffolds found partial or even no improvement, which might be explained by the limited period of intervention (Choi & Lee, 2009) and inconsistencies between scaffolded skills and overall problem-solving performance (Cho & Jonassen, 2002; Oh & Jonassen, 2007).

According to the three issues, scaffolding ill-structured problem solving is a pressing yet challenging task, particularly in promoting the novices to use higher-order thinking skills, which are vital for professional development but difficult to obtain without facilitations. Nevertheless, as external supports, scaffolding may not always be effective and can easily lead to lower-order thinking when their functions are not recognized or utilized by the learners. Even though progress in learners' higher-order thinking and problem-solving skills was evidenced by previous studies, it may only occur under certain conditions and cannot be sustained or guaranteed. These issues should be addressed before learners can truly benefit from and gain control over ill-structured problem-solving activities.

Theoretical Framework

To support the design and investigation of scaffolding for ill-structured problem solving, a theoretical framework should be developed to guide the inquiry. Since improving higher-order thinking skills is a critical issue, this framework aims at clarifying the specific higher-order thinking skills involved in ill-structured problem solving and adapting the scaffolding features, types, and functions to promote those skills (see Figure 1).

The idea of higher-order thinking skills has no clear definition; it has, however, functioned as an important reminder that there are more advanced thinking skills that learners should develop beyond the basic cognitive skills such as remembering, comprehension, and application (Bloom, 1956; Ennis, 1987).

Among the literature on higher-order thinking skills, four sources of seminal works stand out, including Dewey's *reflective thinking* (1933), Bloom's *taxonomy of educational objectives* (1956), Guilford's *structure-of-intellect model* (1967), and Ennis's *critical thinking* (1987). These theories and their further development identified specific higher-order thinking skills from different perspectives and converged on the point that higher-order thinking skills are integral to problem-solving skills. Dewey (1933) stressed the idea of problem solving in reflective thinking by highlighting "a state of doubt" and "an act of inquiry to resolve the doubt" (p.12). The three higher-order objectives in Bloom's taxonomy (1956) – analysis, synthesis, and evaluation – are the essential components of what he called "intellectual abilities and skills" and "problem-solving skills" (p. 39). In Guilford's structure-of-intellect model (1967), the three higher-order operations – divergent production, convergent production, and evaluation – provided theoretical ground for creativity which was considered as a "discovered problem-solving process" (Csikszentmihalyi & Getzels, 1971). Ennis (1987) suggested the process of problem solving, which integrated thinking into procedural steps, as one way of organizing critical thinking to decide on an action (p. 23). Although the four theories come from quite different fields, including philosophy, assessment, intelligence, and law, their shared connection with problem solving has made it possible to identify the common higher-order thinking categories and skills as listed in Table 1. Appendix A shows how this classification scheme was identified from the higher-order thinking skills described by each theory.

Figure 1. Framework of scaffolding higher-order thinking in ill-structured problem solving
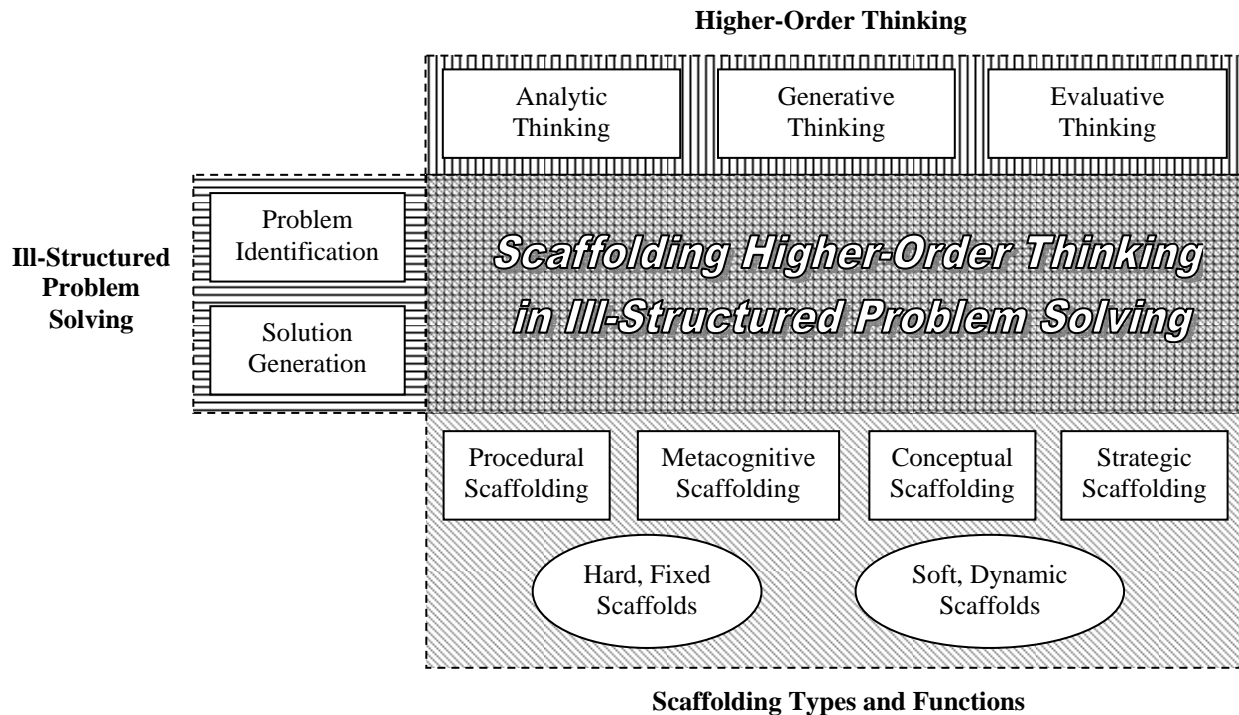
Table 1. Classification of higher-order thinking skills

Analytic Thinking	Generative Thinking	Evaluative Thinking
Identifying relevant facts, evidence, and information. Analyzing given statements, reasons, hypotheses, conclusions etc. Identifying unstated reasons, ideas, statements, assumptions, etc. Analyzing the relationships and inexplicit structures of the elements and parts.	Producing or creating plans, ideas, details, solutions, products, communications, etc. that are divergent and open-ended. Inducing or deducing beliefs, hypotheses, generalizations, conclusions, value judgments, etc. that are convergent and close-ended.	Evaluating the identified information or generated ideas based on correctness, consistencies, reliability, and credibility. Evaluating the identified information or generated ideas based on satisfaction to ultimate goals or appropriateness to the context.

The three major categories of higher-order thinking skills – *analytic thinking*, *generative thinking*, and *evaluative thinking* – are interconnected with one another and align well with the problem-solving process. First of all, analytic thinking serves as the prerequisite of generative and evaluative thinking. It builds upon lower-order skills that bring to bear appropriate principles and emphasizes the detection of elements, parts, and their connections or organizations (Bloom, 1956, p. 144). The goal is to clarify and focus on certain issues (Ennis, 1987, p. 17) and to support or justify the generation of ideas and beliefs (Dewey, 1933, p.9). Both the purpose and function of analytic thinking are consistent with the identification of problems and the search for ideas to generate solutions.

Generative thinking is one step beyond analytic thinking and one step prior to evaluative thinking. With the information identified from analysis, it generates ideas in two different ways: *divergent production* and *convergent production* (Guilford, 1967). The former generates multiple, varied, and elaborated ideas that are integrated with individuals' feelings and experience (Bloom, 1956, p. 169; Guilford, 1956, p. 138). It is best applied to open-ended situations that allow for multiple answers and encourage alternative ideas. The latter generates only one or very limited numbers of ideas through logic-tight inference of the given information (Ennis, 1987; Guilford, 1956). It is most appropriate for situations requiring ideas derived from rigorous reasoning based on evidence, rules, and principles. The two types of generative thinking can be applied selectively to problem construction and solution generation, depending on the situation.

Evaluative thinking assists analytic thinking to distinguish the relevant and credible sources of information and supports generative thinking to make good decisions. The relationship between generative and evaluative thinking, however, is more complicated. Evaluation criteria should be applied not only to evaluate the generated ideas but also to guide idea generation (Baer, 2003). Inappropriate use of criteria would either stifle divergent production or mislead convergent production (Cropley, 2006). Bloom (1956) emphasized the difference between internal and external criteria (p. 186). By assessing the internal correctness, consistencies, reliability, and credibility, evaluative thinking helps making critical judgments about the given information, deductions, and inductions (Ennis, 1987). Moreover, by using external criteria associated with the context and ultimate goals, evaluative thinking informs the generation and selection of appropriate information or ideas (Bloom, 1956; Dewey, 1933; Guilford, 1967). As evaluative thinking is inseparable from analytic and generative thinking, it must be essential to problem construction and solution generation as well.

Theory and research show that higher-order thinking skills, as represented by analytic, generative, and evaluative thinking, are associated with domain knowledge, dispositions, and metacognition. Domain knowledge is necessary for applying general thinking principles and provides the sources of generative thinking (Dewey, 1933; Ennis, 1987; Guildford, 1967). Studies found that in ill-structured situations, domain knowledge facilitated the thinking process of structuralizing and reasoning through the open-ended problem space (e.g., Diakidoy & Constantinou, 2001; Lee & Cho, 2007). Some advocates claimed, however, that teaching higher-order thinking skills enhances the learning of domain knowledge as well (Dewey, 1933; Walsh & Paul, 1985). Furthermore, learners should also have dispositions that encourage them to use higher-order thinking skills (Dewey, 1933; Ennis, 1987), such as being open-minded, seeking clarifications, focusing on the main point, etc. Studies found open-minded attitudes, including openness to new ideas and flexibility with alternatives, enhanced ill-structured problem-solving performance (e.g., Mumford et al., 1993; Shin et al., 2003), presumably through activating higher-order thinking skills. Base on this connection, there is the possibility that intentional use of higher-order thinking skills will help cultivate the learners' dispositions. In addition, studies showed that the ability to regulate cognition through planning, monitoring, and evaluation stimulated learners' conscious consideration of multiple goals, constraints, and solutions in ill-structured problem solving (e.g., Reiter-Palmon, Mumford, O'Connor Boes, & Runco 1997; Shin et al., 2003). From a theoretical perspective, Bloom (1956) argued that by engaging in activities requiring complex intellectual

abilities and skills, learners will become more conscious and aware of the cognitive behavior they exhibit. Similar to domain knowledge and dispositions, metacognition is a contributor to higher-order thinking, and the operation of higher-order thinking skills may in turn increase learners' metacognitive consciousness and awareness.

<center>Higher-Order Thinking in Ill-Structured Problem Solving</center>

As ill-structured problems are characterized by undefined problem space, multiple representations and solutions, and unclear evaluation criteria (Jonassen, 1997), higher-order thinking skills should play a pivotal role in resolving these uncertainties. In order to identify the roles of analytic, generative, and evaluative thinking skills during ill-structured problem-solving process, four types of ill-structured problem-solving models that perceive *ill-structuredness* from different perspectives were reviewed: 1) classic model (Sinnott, 1989; Voss, 1988), 2) instruction-oriented model (Jonassen, 1997), 3) design problem solving model (Geol & Pirolli, 1989, 1992), and 4) creative problem solving model (Mumford, Mobley, Reiter-Palmon, Uhlman, & Doares, 1991; Treffinger, 1995). Additionally, studies that found higher-order thinking skills an important predictor of ill-structured problem-solving performance were also analyzed for corroboration and complementation. Based on analysis, the analytic, generative, and evaluative thinking skills required during problem identification and solution generation were derived (see Appendix B for outline).

Analytic Thinking in Problem Identification

Analyzing the given and hidden information in the problem space is the first step of problem identification. The problem solver should identify not only the surface level elements such as initial state, goals, operators, constraints, etc. (Geol & Pirolli, 1989; Voss, 1988) but also the unstated problems, goals, assumptions, and perspectives (Jonassen, 1997). Relevant schemata or categories should be searched and retrieved from prior knowledge to encode the available information and to guide further data finding (Geol & Pirolli, 1989; Jonassen, 1997; Mumford et al., 1991). Lee & Cho (2007) found that better problem finders tend not to confine themselves to the given information, but try to revive maximum knowledge to structuralize the situation or to search divergently for new information beyond what is suggested, depending on how ill-structured the problem was. In addition, the problem solver should also analyze the relationships among the identified elements, such as causal relationships, classifications, and knowledge-context connections (Jonassen, 1997; Treffinger, 1995; Voss, 1988).

Generative Thinking in Problem Identification

Proposing new operators and constructing problem representations extend analytic thinking by generating new meanings. In addition to encoding information, retrieved schemata or categories can also be instantiated into operators with the contextual information to compensate for the missing elements in the problem space (Geol & Pirolli, 1992). When the perceived problem elements point to one unique direction, the solver can represent and solve the problem through convergent production, as is commonly seen in experts' problem-solving activities (Voss & Post, 1989). However, a more typical way of framing ill-structured problems is to generate multiple, alternative representations from different perspectives and converge on the most appropriate representation (Jonassen, 1997; Sinnott, 1989; Treffinger, 1995; Voss, 1988). Studies on problem construction indicated that solvers who wrote down all possible problem statements and finally reframed the problem were more likely to develop high-quality solutions, especially in working on unfamiliar problems (e.g., Redmon, Mumford, & Teach, 1993; Reiter-Palmon et al., 1997).

Evaluative Thinking in Problem Identification

Evaluative thinking assists analytic thinking during problem analysis and assists generative thinking during problem construction. To efficiently specify the problem space, the solver needs to attend selectively to the available information and the activated schemata by evaluating their internal consistencies and relevance to goals (Jonassen, 1997; Mumford et al., 1991; Sinnott, 1989). Studies found that the problem solver's abilities to distinguish relevant from irrelevant information and to select best-fitting concepts or categories to understand the problem situation are significant predictors of solution quality and originality (e.g., Mumford et al., 1996, 1997). With multiple problem representations, the solver also needs to evaluate and select among the competing options based on his or her

<center>418</center>

perceptions and ultimate goals (Jonassen, 1997; Sinnott, 1989; Treffinger, 1995), and at times to negotiate the problem space boundaries based on the constraints (Geol & Pirolli, 1992). Although there is no clear empirical evidence, the evolving process from divergent to convergent problem representation should involve evaluative thinking.

Analytic Thinking in Solution Generation

To generate high-quality solutions, the solver should use analytic thinking to facilitate ideation and justification. By analyzing links among the selected coding categories and further identifying remotely associated categories, the solver will be inspired to generate better solution ideas (Mumford et al., 1991; Treffinger, 1995). Studies on ill-structured problem-solving strategies found that when solvers were suggested to analyze the categories of potential solutions or to search for remotely associated categories in familiar domains, they tended to produce more high-quality ideas (e.g., Butler & Kline, 1998; Stoyanov & Kirschner, 2007). Moreover, for large-size problems, the solver should decompose the entire problem into components and analyze their connections so as to generate partial solutions and combine them at a later stage (Geol & Pirolli, 1992). Additionally, after generating solutions, it is important for the solver to justify the preferred solutions by identifying relevant facts, evidence, statements, and conjectures to warrant their claims (Jonassen, 1997; Voss & Post, 1989), the analysis of which is essential to ill-structured problem solving (Shin et al., 2003).

Generative Thinking in Solution Generation

All the previous higher-order thinking activities are preparing for applying generative thinking to develop solutions. For highly ill-structured problems with multiple representations, there is the need to generate multiple, alternative solutions through divergent production (Jonassen, 1997; Sinnott, 1989; Treffinger, 1995; Voss & Post, 1989). Although it is difficult to generate fluent solution ideas to complex problems, especially for novices (Jonassen, 1997), two empirically-validated strategies might be used. First, through combining and reorganizing the categories analyzed in the previous stage, the solver may break the fixed paradigms and come up with new categories that support solution generation (Butler & Kline, 1998; Mumford et al., 1991; Stoyanov & Kirschner, 2007). Second, the solver may also generate multiple, better solutions by considering the perspectives of different stakeholders involved in the problem (Butler & Kline, 1998; Choi & Lee, 2009; Jonassen, 1997). However, convergent production is more effective for generating one unique or relatively fewer solutions in problem situations with specific representations (Diakidoy et al., 2001; Voss & Post, 1989). Convergent production should also be used during and after divergent production, as the problem-solving process evolves from exploring divergent ideas to converging on the promising solutions (Jaarsveld et al., 2005), constructing evidence-based arguments to justify decisions (Jonassen, 1997; Shin et al., 2003), and incrementally adding details to refine the final solution (Geol & Pirolli, 1992).

Evaluative Thinking in Solution Generation

Evaluative thinking in solution generation has both formative and summative natures. From the formative sense, the solver should evaluate the interim solution ideas while proposing and refining them to satisfy the goals at hand and to stay within the constraints (Baer, 2003; Mumford et al., 1991). Divergent production using the two strategies mentioned earlier involves evaluative thinking, as the solver needs to generate ideas fitting certain categories or perspectives, leading to more meaningful solutions (Butler & Kline, 1998; Stoyanov & Kirschner, 2007). Also, design problem solving study found that the incremental design process was integrated with generation, evaluation, and modification of design components based on contextual factors (Geol & Pirolli, 1992). From the summative sense, the solver has to either select from or narrow down the multiple solutions by evaluating them with explicit internal and external criteria (Jonassen, 1997; Sinnott, 1989; Treffinger, 1995; Voss, 1988). While moving from divergent to convergent production and justifications, good problem solvers weigh the solution alternatives and their potential outcomes against the internal constraints and ultimate goals to decide on the most defensible and appropriate solutions (Jaarsveld & van Leeuwenb, 2005; Shin et al., 2003).

As can be seen, analytic, generative, and evaluative thinking skills each plays a unique role in problem identification and solution generation. At the same time, they are inseparable and well-integrated into the ill-

structured problem-solving process. Since the sub skills involved in the three types of higher-order thinking are not used sequentially, intelligent problem solvers will apply them flexibly by switching to proper skills within or across the categories and phases based on the situation.

Scaffolding Higher-Order Thinking in Ill-Structured Problem Solving

After instantiating the higher-order thinking skills in ill-structured problem solving, the most important task is to use theory and research on scaffolding to develop those skills in novices so as to improve their problem-solving performance. How can we use scaffolding features, types, and functions to enhance higher-order thinking skills? How can we design the scaffolds to address the challenges reported by previous studies? How can we help learners sustain and transfer the skills developed under scaffolding? These questions could be best answered by design-based research (Barab & Squire, 2004; Brown, 1992). As a beginning, this framework will present some preliminary thoughts based on existing theory and research.

Scaffolding Features

Scaffolding was originally defined as an adult or expert interacts with a child or novice to help him or her achieve a goal beyond his or her unassisted efforts (Wood, Bruner, & Ross, 1976). This metaphor has been generalized to structures that interact with novice learners to help them accomplish tasks beyond their competencies (Puntambekar & Hubscher, 2005; Reiser, 2004). According to Puntambekar and Hubscher (2005), the current notion of scaffolding has the following features: shared understanding, scaffolder, ongoing diagnosis, calibrated support, and fading. These features can delineate the scaffolding for higher-order thinking during ill-structured problem solving at a macro level.

Shared understanding between the learners and the scaffolder regarding the goal of the activity is critical for the learners to gain ownership of the task (Puntambekar & Hubscher, 2005). In the current context, the learners and the scaffolder should have a common understanding of solving ill-structured problems with higher-order thinking skills. Real-world problem situations will establish the overarching goal of problem solving in the learning environment. Moreover, simplified activities of applying higher-order thinking to problem solving might be used for preparing learners with shared understanding (e.g., Kolodner, Crismond, & Fasse et al., 2003; Reiser, Tabak, & Sandoval et al., 2001).

The role of scaffolder has been extended from more knowledgeable others to include technology tools and resources, advancing the techniques of providing instructional supports (Lajoie, 2005; Puntambekar & Hubscher, 2005). Technology and human scaffolds are mutually beneficial because the technology scaffolder can provide routine supports to common learning needs, allowing time and efforts for the human scaffolder to provide on-demand, customized support that may not be easily provided by the technology scaffolder (Saye & Brush, 2002; Sharma & Hannafin, 2007). Because of the complex learning involved in higher-order thinking and ill-structured problem solving, "mixed initiative" designs based on the synergy of technology and human supports might be particularly helpful (Pea, 2004, p. 444).

The process of scaffolding, including ongoing diagnosis, calibrated support, and fading are essential yet largely overlooked in current design and implementation of scaffolding (Pea, 2004; Puntambekar & Hubscher, 2005). The scaffolder should monitor the learners' current levels of understanding in order to provide "graduated assistance" (Stone, 1998) and to gradually fade the scaffolds to let the learners takeover the responsibility, which is a process of "internalization" (Vygotsky, 1978). To compensate the technological limitations in dynamically calibrating and fading supports, redundancies in technology scaffolds can provide graduated assistance (Puntambekar & Hubscher, 2005), and human scaffolders can assess learners' performance to adjust the levels of both human and technology scaffolding (Pea, 2004). Therefore, in designing mixed scaffolds for the current context, technology may create multiple forms and levels of scaffolding to meet learners' developmental needs in higher-order thinking and ill-structured problem solving, and the human scaffolders (e.g., instructor, peers) may select and fade the scaffolds based on ongoing diagnosis of the learners' progress.

Scaffolding Types and Functions

According to the literature, scaffolding types include hard, fixed scaffolds and soft, dynamic scaffolds (Saye & Brush, 2002; Wang & Hannafin, 2008). The former are planned in advance based on the cognitive activities involved in the task and the difficulties learners might encounter. They are usually explicit, non-negotiable, and mediated by technology to constrain learners' actions (Sharma & Hannafin, 2007). The latter are created

dynamically within certain situations. They are more customized and adaptive to individual learners, mainly provided by instructors, experts, or peers through dialogic interactions (Saye & Brush, 2002). The two types of scaffolds parallel the two complimentary scaffolders – technology and human – mentioned earlier.

Hannafin, Land, and Oliver (1999) classified scaffolds into four functions that support student learning in open-ended learning environments: *conceptual* (what knowledge to consider), *metacognitive* (how to think about the problem), *procedural* (how to use learning environment features), and *strategic* (what are the alternative strategies) scaffolds. The procedural scaffolds were later defined as operational steps or cognitive structures for helping students complete a task (Sharma & Hannafin, 2007; Wang & Hannafin, 2008). The above two types and four functions of scaffolding, which emphasize the ways and purposes of creating scaffolds, can guide the micro level conceptualization of instructional support for enhancing the three higher-order thinking skills during ill-structured problem solving.

Conceptual scaffolds. They help learners identify conceptual knowledge related to a problem and create structures of conceptual organization (Hannafin et al., 1999). These functions are consistent with analytic thinking, as the solver has to retrieve relevant schema or categories from prior knowledge for encoding information and to figure out the organization among the problem space elements, sub problems, solution categories, and evidence of claims. Hard conceptual scaffolds such as links to available resources, concept maps, and relationship prompts can facilitate learners' knowledge retrieval and problem analysis. Chen & Bradshaw (2007) and Oliver & Hannafin (2000) used advanced organizers to help students consider the associated knowledge concepts and relationships in solving problems. They both found the students were able to identify and analyze the relevant knowledge but the younger learners have difficulty integrating them into the problem. Soft scaffolds in the form of individualized suggestions, feedback, or questioning on concepts selection and structure analysis may further learners' understanding of knowledge and its applications in problem contexts.

Procedural scaffolds. They provide operational sequences of thinking or completing a task and use structures to focus and sustain learners' activities (Sharma & Hannafin, 2007; Wang & Hannafin, 2008). Ill-structured problem solving contains general procedures of using analytic, generative, and evaluative thinking to identify problems and generate solutions. Procedural scaffolding can guide learners through the problem-solving process integrated with different types of thinking, providing the basis for them to internalize and self-regulate those thinking skills. Hard scaffolds such as question prompts and sentence starters were commonly used for procedural scaffolding. However, they are usually insufficient as they may lead to a piecemeal approach to learning (Davis & Linn, 2000) or induce dependence (Oliver & Hannafin, 2000), and learners with different competencies have different needs for procedural guidance (Ge et al., 2005). Soft scaffolds such as instructor-student interactions should not only attend to the emergent needs for procedural support (Wang & Hannafin, 2008) but also monitor the learners' progress and adjust or fade the hard scaffolds at appropriate times to encourage internalization.

Metacognitive scaffolds. They guide the ways to think about the problem and remind the learners to reflect on the goals and monitor the learning process (Hannafin et al., 1999). In order to use analytic, generative, and evaluative thinking skills purposefully and effectively, novice problem solvers need metacognitive scaffolds to help them understand the role of each type of thinking at different problem-solving stages and consciously use those thinking skills through planning, monitoring, and evaluation, until they achieve automation. Hard metacognitive scaffolds such as question prompts and hints have been frequently integrated into procedural scaffolds to help students regulate their problem-solving process (e.g., Davis & Linn, 2000; Ge et al., 2005). However, studies showed that learners may experience difficulty or show reluctance in using metacognitive scaffolds, which are less prescriptive and require more efforts to grasp (e.g., Oliver & Hannafin, 2000; Manlove et al., 2007). Soft scaffolds based on ongoing diagnosis of learners' performance are more likely to improve achievements (e.g., Azevedo, Cromley, Winters, Moos, & Greene, 2005; Greene & Land, 2000) and may serve as "metascaffolding" of how to use the hard scaffolds (Pea, 2004).

Strategic scaffolds. They suggest alternative approaches to a problem or task and help learners identify and evaluate needed information, resources, or tactics (Hannafin et al., 1999; Wang & Hannafin, 2008). Strategic scaffolds may be particularly useful for generative thinking, as they expose the learners to alternative perspectives or solutions and provide them tactics for divergent and convergent production. It may also assist analytic thinking by recommending useful recourses and support evaluative thinking by suggesting important evaluation criteria. Choi & Lee (2009) provided multiple experts' solutions to facilitate problem solving and found the learners began to acknowledge the different perspectives but still failed to evaluate and integrate them to build their own perspective. Oliver & Hannafin (2000) used strategic scaffolds for helping learners evaluate solutions generated from divergent production, but most students glossed over those scaffolds by selecting a predetermined solution. Soft scaffolds might be used to draw learners' attention to appropriate use of the hard strategic scaffolds as well as to provide dynamic, individualized strategic scaffolds that are tailored to each learner.

Implications

      This framework is designed to guide the inquiry of scaffolding ill-structured problem solving with a focus on 1) learners' difficulties in performing higher-order thinking, 2) their misunderstanding and misuse of the scaffolds, and 3) unsustainable or non-transferable problem-solving skills. The higher-order thinking skills and scaffolding features, types, and functions identified in the framework have the potential to address these major issues.

      Learners' vague ideas about the types of thinking required during ill-structured problem solving may lead to lower-order thinking. By situating analytic, generative, and evaluative thinking skills in ill-structured problem solving and providing procedural and metacognitive scaffolds, the learners will be able to understand why and how to apply the specific skills and to learn to actively regulate their performance. Conceptual and strategic scaffolds may facilitate analytic and generative thinking in particular through activating the learners' prior knowledge and offering resources or tactics. Additionally, guided higher-order thinking may help cultivate desirable dispositions and beliefs in the long term.

      According to previous studies, the scaffolds misunderstood or used superficially by the learners were usually hard, static scaffolds. In order to help learners recognize the scaffolds' strategic functions and benefit from more flexible scaffolding, it would be helpful to integrate soft, dynamic scaffolds provided by human tutors or peers. Scaffolding in the form of social interactions will not only provide adaptive supports based on ongoing diagnosis of the learners' level of understanding, but also promote the learners' appropriate use of hard scaffolds through "metascaffolding" (Pea, 2004).

      Gradually fading the scaffolds is necessary to develop learners' sustainable problem-solving skills and can be best achieved by mixed scaffolding design. Although technology-based hard scaffolds may not fade intelligently, the human scaffolder can accomplish this task by adjusting the functions or levels of hard scaffolds to fit the learners' current zone of proximal development. Moreover, problem-solving skills developed within this framework may have better transferability, because as the essential components of ill-structured problem-solving competencies, the analytic, generative, and evaluative thinking skills can be generalized and reused for different problem contexts.

      Although this framework is grounded in theory and research on higher-order thinking, ill-structured problem solving, and scaffolding, there is still much unknown about the synergy of the three theoretical perspectives and their contribution to facilitating novices' ill-structured problem-solving activities. Therefore, empirical studies should be conducted in ill-structured domains to validate and refine this framework.

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Scaffolding Technology Integration Using Guided Problem-Solving

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Abstract

Computers and Internet have become widely available to teachers and students, yet tomorrow's teachers are not well prepared to effectively use technology in teaching. The author designed problem-based case scenarios and divergent and critical thinking scaffolds to guide preservice teachers' learning to teach with technology. The study conducted an in-depth investigation of the preservice teachers' (n=4) experience and perceptions about this guided problem solving approach by analyzing interview transcriptions and responses to scaffolds with grounded theory methods. Facilitated by the scaffolds, the preservice teachers used divergent and critical thinking skills along with their own strategies in identifying instructional problems, generating and evaluating solutions, and developing lesson plans integrated with technology. However, their personal history based assumptions and strategies tend to lead them toward convergent and uncritical thinking. Finally, the author discussed the ill-structured nature of technology integration problems, the preservice teachers' characteristics in learning, and the value of the guided problem solving approach in preparing tomorrow's teachers to use technology.

Introduction

> Well, I had no idea what *Web 2.0* tool was. I knew I guess Internet sites like *Myspace* and *Facebook*. I knew they were things out there but I didn't know how prevalent they were in the education department. I didn't realize the resources that were available to education majors or educators in general. *Think Finity* was one that we use that I would definitely be interested in using it in the future. The *Delicious Account* we set up, the *Social Book marking* we did, the *Inspiration* things we did, they were all great resources as [for] an educator. And many of them could be used for the students as well. And I look forward to using those in the classroom. (Jason)

Jason kept naming different technology tools when talking about what he learned on the Educational Technology course. His comments not only reflected a beginning preservice teacher's excitement about the variety of available technologies but also indicated his interests of applying those tools in his future class. However, despite the abundant technology resources and the preservice teachers' enthusiasm, research shows that most preservice teachers were not receiving adequate preparation of teaching with technology before entering the field (CEO Forum, 2001; Yildirm, 2000; Kay, 2006). Single educational technology courses usually focus more on training technology skills detached from teaching. Method courses have not been well integrated with technology because many faculty members lack technology skills and cannot provide good examples. Collaborations between preservice and inservice teachers are promising but tend to be constrained by administrative issues. As a result, most preservice teachers are not well prepared to teach with technology when they begin their teaching career. Even though they are more comfortable with technologies, they use it less than experienced teachers in delivering instruction or engaging students in learning activities (Russell, Bebell, O'Dwyer, & O'Connor, 2003).

How can teacher education programs prepare preservice teachers to use technology effectively in their future classroom? Researchers suggest that preservice teachers should be provided with high level learning opportunities that address authentic pedagogical problems (Mishra & Koehler, 2003). They should not only be exposed to examples of classroom use of technology (Russell et al., 2003) but also engage in hands-on activities to develop their technology integration skills by constructing and implementing their own lessons (Dawson, Pringle, & Adams, 2003).

Informed by researchers' suggestions, this study was focused on facilitating preservice teachers' learning to teach with technology through a guided problem solving approach. Case scenarios, embedded with instructional problems that teachers may encounter in real classroom settings, were created to engage preservice teachers in an authentic-oriented learning environment. As the essence of this approach, problem-solving scaffolds with an emphasis on divergent and critical thinking were designed to guide preservice teachers in identifying the ill-structured instructional problems and generating technology-integrated lesson plans and artifacts as solutions. The purpose of this study was to understand the experience and perceptions of the preservice teachers in learning technology integration through this approach, as well as to identify the issues and challenges need to be addressed in

future implementation. Since little is known about using guided problem solving as a strategy for preparing preservice teachers to teach with technology, findings from this study will inform the design of the scaffolds and contribute to the knowledge of researchers and teacher educators in the field of preparing tomorrow's teachers to use technology. Three research questions were posed in this study:

1. What are the roles of the scaffolds in facilitating preservice teachers' problem-solving?
2. What strategies do preservice teachers use during the problem-solving process?
3. How do preservice teachers perceive their problem-solving experience?
4.

Theoretical Framework

Technology Integration as an Ill-structured Problem

Teaching is an ill-structured discipline characterized by the complex concepts and principles, the dynamic nature of the situations, and the variability of features across cases (Mishra, Spiro & Feltovich, 1996; Spiro & Jehng, 1990). Integrating technology into teaching further complicates the domain, because technology brings unprecedented opportunities, affordances, and constraints associated with teaching content and pedagogy, thus expanding the problem space of teaching. Designing and implementing technology integrated lesson is an ill-structured problem-solving process that represents a special challenge to knowledge application in the teaching domain.

The typical characteristics of ill-structured problems, including the lack of prototypic cases, ill-defined elements, multiple domains and solutions (Jonassen, 1997), are evident in technology integration. First of all, technology integration is always situated in a context with specific subject matter, grade level, student backgrounds, and available technologies, etc (Mishra & Koehler, 2006). The way of incorporating technology, pedagogy, and content in teaching vary from case to case. Also, many aspects of technology integration problems are not well specified for the teacher, such as the goal state of using technology, the appropriate pedagogies, the available tools and their functions, the potential constraints, etc. It is clear that the teacher, as the problem solver, needs to clarify the situation before trying to solve the problem. As suggested by the Mishra and Koehler's (2006) technology, pedagogy, and content knowledge (TPCK) framework, teaching with technology requires the integration of three knowledge domains – technology, pedagogy, and content – as well as the complex interplay among them. Technology is not something add-on to pedagogy and content but can raise fundamental questions and initiate reconfiguration of the three components. Most importantly, there is no single right solution to technology integration problems (Mishra & Koehler, 2006). Ways of using technology in teaching are divergent rather than convergent in a given situation, which is the same for solutions to any ill-structured problems. The teacher should consider a variety of solutions and make rational decisions based on their judgments about the context.

Divergent and Critical Thinking in Ill-Structured Problem-Solving

Runco (2003) views problem-solving as a creative critical process, during which creative thinking helps generate ideas for solving the problem, while critical thinking helps to evaluate those ideas and select the best solution. With a close examination of both the creative and critical sides of problem-solving, the essential thinking skills can be identified. The creative side of problem-solving is centered by divergent thinking, which involves thinking of many ideas (fluency), varied ideas (flexibility), new ideas (originality), and adding details to improve the ideas (elaboration) (Guilford, 1967; Basadur et al., 1986). The critical side of problem-solving includes critical thinking skills such as clarifying the situation, making inferences with available information, evaluating sources, assumptions, arguments, and ideas, and monitoring the thinking process and outcomes (Bruning et al., 2004; Ennis, 1987; Halpern, 1997; Perkins, 1986). Thinking skills on both sides play a significant role in ill-structured problem solving such as technology integration, which is an instructional design process that requires a design structure based on diversified perspectives as well as multiple solution ideas and evaluation criteria for reaching the best solution (Jonassen, 1997; Jonassen, 2000).

Preparing Preservice Teachers for Technology Integration

With respect to the ill-structured domain of technology integration, teacher educators and researchers realize that preservice education is a natural and important place to start preparing teaching candidates with necessary skills (Kay, 2006). Various strategies have been created for developing preservice teachers' technology integration skills, such as faculty modeling in method classes (e.g. Vannatta & Beyerbach, 2000), collaboration with mentor teachers

(e.g. Thompson et al., 2003), incorporating technology in field teaching (e.g. Brush et al., 2003). However, evidence suggests that teacher education programs have not been successful in preparing new teachers to use technology effectively in teaching (CEO Forum, 2001; Yildirm, 2000; Kay, 2006). One of the major obstacles is that preservice teachers lack opportunities and supports to inquire into technology integration by designing and implementing lessons for relevant teaching situations (Dawson, Pringle, & Adams, 2003). In other words, they are not receiving enough training for solving ill-structured technology integration problems, which makes them feel unprepared when beginning their teaching career.

However, the complexity of technology integration problems poses challenges to preservice teachers who are novices in teaching. As discussed previously, successful technology integration requires divergent and critical thinking skills, systematic problem-solving skills, and integrated knowledge of technology, pedagogy, and content. Research on preservice teachers' learning shows that they come to teacher education programs with powerful, personal history based theories about good teaching, preventing them from thinking critically about their assumptions (Knowles & Holt-Reynolds, 1991; Schwarz & Gwekwerere, 2006). Also, they recall self experience as a student as a base for generalizing beliefs about students' learning as well as modeling the learning experience they want to provide in their classroom (Holt-Reynolds, 1992). This tendency may conflict with the desired skill of thinking divergently to consider different perspectives and alternative teaching strategies. Moreover, although it may not be difficult for preservice teachers to acquire technology skills, they are not likely to have sufficient technological pedagogical content knowledge, which should be developed from authentic professional practices (Mishra & Koehler, 2006).

Ill-structured problem-solving situates learning in authentic environments and requires the learner to use higher order skills for reasoning and knowledge application (Ge, Chen, & Davis, 2005; Jonassen, 1997). Despite the above challenges, learning to solve technology integration problems with divergent and critical thinking can be a beneficial way for preparing preservice teachers to teach with technology. The essential responsibility of teacher educators is to design learning environments that can provide contexts and scaffolds for ill-structured problem-solving (Hannafin, Land, & Oliver, 1999; Jonassen, 1997; van Merriënboer & Kirschner, 2001) so as to enhance preservice teachers' understanding and practical skills of teaching with technology. According to literature on problem-solving, the core element of the context is the case that involves contextualized problems that the learners must solve (Jonassen, 1997). For technology integration, preservice teachers should be provided with cases centered by instructional problems that can be solved with a variety of technology-integrated teaching strategies. Moreover, procedural, elaborative, and metacognitive scaffolds should be designed to facilitate the ill-structured problem solving process (Ge, Chen, & Davis, 2005).

To sum up, developing lessons incorporating technology into teaching and learning is an ill-structured problem-solving process that requires divergent and critical thinking skills. As novice lesson designers, preservice teachers will encounter challenges in solving technology integration problems and may not use divergent and critical thinking skills automatically. Both problem scenarios and scaffolding strategies are needed to prepare preservice teachers to teach with technology through ill-structured problem solving.

Methods

This study was conducted on an introductory technology integration course at a southeast university for two semesters. The course instructor and the researcher collaborated on developing three case scenarios and the problem solving scaffolds (See Appendix A for example). Each of the cases described instructional dilemmas reflecting a particular purpose of teaching with technology, including promoting communication and collaboration, creativity and innovation, and critical thinking skills. The scaffolds outlined the major steps of the problem-solving process and intended to promote students' divergent and critical thinking skills. For each case project, the students were asked to identify and solve the instructional problems by developing a technology-integrated lesson plan. They were required to strictly follow the scaffolds in case one and were allowed to skip some of the steps in case two and three.

Data Collection

The researcher used a qualitative research design to study preservice teachers' experience and perceptions about the guided problem solving approach. To recruit research participants, the researcher read the students' online autobiography and invited those with a clear goal of becoming school teachers to participate in this study. Four students - two from the first semester and two from the second semester - volunteered to participate in a one-hour semi-structured interview. The interviews were conducted and audio recorded at the end of each semester. The interview questions began with the participants' previous experience with teaching and learning, and then focused

on their scaffolded instructional problem-solving process as well as their perceptions about the problem-solving activities. For this paper, the researcher selected to present an analysis two interviews from each semester. The participants' responses to scaffolds and their lesson plans were also collected for analysis.

Participant description

The four participants came from three different teacher preparing programs. Jason was a junior student in technology education major. He had participated in one practicum, during which he developed and implemented a lesson on engineering design process. Claire was a sophomore student in early childhood education major with a focus on math and science. She had been teaching crafts class to young students in the enrichment program of a local elementary school. Brian was a sophomore student in middle school education major with a focus on math and science. He had not worked with middle school students he wanted to teach but he had been teaching bible studies to youths at the church. Sarah was also a sophomore student in middle school education major, concentrating on language and math. Along with the technology integration course, she was taking another course requiring 48 hours' practicum in a seventh grade math class and a seventh grade language arts class.

Data Analysis

The researcher used grounded theory methods (Glaser & Strauss, 1967) to analyze the data. Strauss and Corbin (1990) believe grounded theory is "discovered, developed, and provisionally verified through systematic data collection and analysis of data pertaining to that phenomenon". The researcher conducted systematic analysis by using techniques such as open coding, focused coding, and theoretical categorizing. She tried to identify inductive codes and categories in analyzing the first two interviews and applied the typical categories to the other interviews as a way of focused coding. Constant comparison was used in both creating and sorting codes to generate categories. Ezzy (2002) describes constant comparison as a process of developing and identifying codes that can be compared for similarities and differences and believes "comparisons allow data to be grouped and differentiated, as categories are identified and various pieces of data are grouped together" (p. 90). With tables of categories and quotations from all four interviews, the researcher searched for common themes across the participants as well as the strong themes within each individual. As themes were identified, the researcher wrote memos to describe them and attached the quotations as evidence for supporting the themes. As Ezzy (2002) argues, "sophisticated use of grounded theory draws on both inductive and deductive methods of theory generation (p. 12)". For the last step of data analysis, relationships among the inductively generated themes and categories were analyzed and connected to the existing knowledge in literature.

Findings

Based on coding the transcriptions and generating categories, six major themes anchored around the three research questions emerged from the data, such as the scaffolds promoted divergent and critical thinking to some extent; the preservice teachers used self-experience and made inference in identifying and solving the problems; although the preservice teachers developed new perceptions about problem solving, their underlying assumptions remained unchallenged. These themes were identified either because they were repeated by more than one participant or because they represent a strong idea throughout one participant's entire interview. Each major theme involved multiple dimensions or sub themes that were closely related to one another. The themes will be presented following the research questions of this study.

Roles of the Scaffolds in Facilitating Problem Solving

Promoting Divergent Thinking to Some Extent

Encouraged by the problem-solving scaffolds to create as many ideas as possible, the preservice teachers were able to use some divergent thinking skills in finding multiple problems and generating alternative solutions. However, their divergent thinking was hindered by the lack of real world experience as a teacher and their focus on previous experience as a student. They also had inadequate understanding of the purpose to use divergent thinking.

Divergent problem-finding promoted the preservice teachers to identify the most essential problem as well as to consider the other possible problems as constraints to be addressed. Sarah said, "I wrote down all of the problems that I could find, just everything I could think of" and then "picked the one that I thought was really the biggest

challenge that would help the biggest number of students." Claire mentioned the problem that she would overlook without brainstorming, "Another detail I would have skipped over like in the challenges was you know there are some take charge students." She realized that she had to "monitor the groups to make sure those students do not dominate the other students". In her final lesson plan, she decided to make groups "according to students' ability and work ethic".

Divergent thinking was evident in generating solutions of teaching with technology, especially in the first case project when they followed the scaffolds strictly. Three preservice teachers considered a variety of technology tools that could be integrated. For example, with the problem that students may have difficulty accessing information for the project of identifying career opportunities, Jason said he

> added in a Delicious Account that would make the student bookmark websites that would be related to the career they chose… required each group to access a set number of Blogs related to the career pathway they choose… I used the Gmail accounts as well within the groups to promote communication and collaboration within the groups.

Along with brainstorming, Jason and Claire took an open attitude toward the divergent solutions they generate. Jason said, "Whether I thought they would be used or not, I wanted to right down and just see if they would be used." Claire also mentioned, "I put down like I was going to do a Photostory… I put this down as a solution but I don't think that's really going to be what I wanted to do." They both reported that they ended up using a better solution different from the one they preferred at the beginning.

However, with insufficient field experience, the preservice teachers had difficulty identifying a variety of "real" challenges they might encounter in a classroom setting. Jason felt "it was actually tougher than I thought would be… I had to think of something to say they are easily getting off task, they are not paying attention to what you do". Brian found his only difficulty was to "get enough challenges", and he actually "started making up different challenges". They were imaging the potential problems based on prior experience. More importantly, they tended to use convergent thinking when relying on critical personal experience relevant to the problem situation. The scaffolds' role in supporting divergent thinking was very limited in such cases. For example, in resolving the second case on communication and collaboration, Brian referred to his experience as a higher-achieving student and believed that the problem in case two was "trying to teach the higher-achieving students and not hold them back, while also teach the lower-achieving students". His solution was to "group them up and have them work together and in hopes that the lower-achieving students will learn from the higher achieving students". With confidence in his ideas, Brian ignored the other problems portrayed in the case scenario and did not consider alternative solutions.

Moreover, the preservice teachers did not fully understand the purpose of brainstorming and regarded it as a course requirement, which was another factor inhibiting divergent thinking. Both Claire and Sarah valued quality over quantity when working on the second and third case. For example, Claire said in case two, "I came up with two, kind of pretty in-depth ones to choose from. I could have expanded them into three or four but I tried to really narrow it into two that I thought would be most applicable." Jason also restrained from divergent thinking because of his initial preference and time limitations.

Although the preservice teachers reported brainstorming ideas in finding problems and generating solutions, particularly in the first case, these actions were not sustainable throughout the three case projects. They regarded divergent thinking as a requirement in the scaffolds and chose to skip over when the scaffolds became optional. They did not realize that the purpose of thinking divergently was to explore even better ideas. Also, as mentioned earlier, excessive reliance on personal experience as a student and the lack of real world teaching experience limited the preservice teachers' ability to think of divergent ideas.

Facilitating Critical Thinking in Problem Solving

The scaffolding steps of identifying challenges, framing problems, and creating criteria to evaluate the solutions facilitated the preservice teachers' critical thinking. However, when the preservice teachers focused their attention on generating solutions only, they were less likely to use critical thinking skills.

The preservice teachers had an initial tendency to overlook the complexity of problem analysis and shift to solution generation rapidly. Brian believed that "it was pretty evident [what] the instructional problem was in the case, so the real big problem is solving it." So he mainly focused on "the way I was going to teach it". Claire also tended to focus on solutions before truly identifying the problems. She said that after reading the first case scenario "I had some ideas… automatically in my head."

However, by following the scaffolds to articulate the challenges and problems before generating solutions, three of the preservice teachers realized the need to clarify the problem space. As Claire was working on her second case project of promoting students' creativity in learning American Revolution, she paid more attention to her problems and goals. After finishing all the cases, Claire believed that

> I can't just say okay this is what I want to do and just go and do it. I have to look at each of these different things I am going to encounter, like the different standards, the different challenges, and think about that and figure out what would be best in the end.

Sarah also found it worthwhile to spend time thinking critically at the beginning stages of problem-solving. She said the scaffolds gave her "a better way to make sure that I am using the right tool to solve the problem".

Metacognition enables the problem solver to actively monitor and control his or her problem-solving performance based on goals. Novice problem solvers usually have limited metacognitive abilities. However, while using the scaffolds, the preservice teachers demonstrated metacognitive thinking skills.

Jason mentioned, in selecting his criteria, he "thought back to what problems were most prevalent" and tried his best to "make sure the criteria fit the lesson [and] the instructional problem". Both Claire and Sarah looked at the curriculum standards they wanted to teach, the characteristics of their students, and their pedagogical goals such as "create enough jobs for everyone involved", "keep the students on task", "encourage critical thinking and problem solving", etc.

Moreover, Jason and Claire talked about using the criteria to monitor and adjust their lesson plans. Considering the criteria that the solution should help "develop appropriate limitations and requirements" for students, Jason refined his solution in designing the lesson plan.

> I had to go back and think well how could this rubric help me with limitations? And I had to reorganize my thoughts on… they [students] are not just going to develop a rubric, they are going to develop a rubric that they believe they can accomplish… they set the task that they are willing to try.

The scaffolding step of using criteria to grade the potential solutions assisted the preservice teachers' decision making process. Three of the preservice teachers critically evaluated their potential solutions and realized the benefits of making decisions based on criteria. Before the evaluation in case one, Jason thought "another one [solution] would win", but as he applied the criteria to the solutions, he found "that's [that solution was] not as good as I thought was going to be" and finally chose a different solution that was "a better fit". Claire described similar experience in case one,

> On my first case, I was like "Oh yeah this is the best solution for this project". But when I really thought about is this really going to meet all of these criteria that I think needs to be met, it ended up being a different one.

Nevertheless, there were cases when the preservice teacher failed to use critical thinking while following the scaffolds ostensibly. As mentioned earlier, Brian focused more on generating solutions to the problem he found. His exclusive emphasis on the solutions also blinded him of the complexity in creating criteria and evaluating solutions. Brian found it "pretty simple" to develop criteria, which were based on the solutions he preferred rather than his goals of solving the instructional problems.

> I decided it [criteria] rather quickly. After I figured out I need to use this kind of learning and this kind of learning. Then I could make my criteria because I could base it on how I am going to teach my kids.

As a result, Brian found all the solutions were satisfying and realized that "I could use all of these". For example, in case one, instead of judging the strength of the solutions, he finally combined all of them into a single one, believing that it would "better aid my students" and could be used in "pretty much any situation". Brian's lack of critical thinking reflected his limited understanding of the purpose for making criteria and evaluating the solutions.

In general, with the assistance of the scaffolds, the preservice teachers were able to thinking critically by clarifying the problem space before generating solution, using metacognitive skills to monitor and control the problem-solving process, and judging the strength of potential solutions based on criteria. However, when the preservice teachers failed to recognize the complexity behind finding problems and selecting solutions, they were less likely to be aware of the need for critical thinking.

Preservice Teachers' Strategies for Solving Problems

Using Self Experience to Identify Problems and Solutions

Because the case scenarios were situated in a generic classroom setting, without specifying grade levels and subject areas, the preservice teachers had to adapt them to their own context while working on the problems. They frequently used their previous experience, mostly as a student and sometimes as a teacher, to help problem solving.

Three of the preservice teachers mainly relied on their experience as a student in K-12 school or college to find the problems they might encounter. When Claire was talking about her potential challenges in teaching the standard on making graphs with data, she said, "I can remember when I was doing graphs… that a lot of students have trouble with it. And I was like is this an area that fourth graders struggle with." In the case of using technology to promote communication and collaboration, Sarah also referred to the problem she experienced in her Freshmen English Writing class.

> We did the peer review but we didn't do it online we just brought our paper in class. And I thought about how it got so messy and it was so confusing for me to see. Are they talking about this in it or are they talking about that in it, so then I used my own problem that I had to figure out a better solution than the one I had experienced.

The problems identified by the preservice teachers based on personal learning experience were related to but different from those described in the case scenarios, such as students' unequal participation, lack of mutual understanding, and diversified learning abilities. Previous experience focused the preservice teachers' attention on the problems they were familiar with as a student, but were unable to support their exploration of the other problems that should also be addressed by the teacher.

Different from the others, Jason related to his practicum experience when looking for instructional problems. As he reported,

> In all three of the cases, I immediately referred back to the practicum I did earlier… I found that a lot of students usually lose focus quickly if they don't have enough things to do. Students didn't have or unable to access stuff on their own.

Jason identified problems not only from his own observation but also from his communication with the mentor teacher, who mentioned the situation that students did not want to explore questions on their own but expected the teacher to give the answer. Jason used this problem in his third case project on critical thinking. Although the instructional problems Jason found were not derived from the case scenarios either, they reflected a teacher's perspective in contrast with the students' perspective adopted by the other preservice teachers.

In terms of generating solutions, previous learning experience played a major role as well. However, since the preservice teachers were not taught with technology when they were in K-12 classroom, they tried to incorporate technology into the learning activities they had experienced. For instance, Sarah adapted the peer review activity in her Freshmen English Writing class to her seventh grade language arts class. She designed the solution of having students write a paper in Google Docs and review partners' writing by "highlighting and adding comments". Because most of the preservice teachers attending the course were at the preliminary stage of their teacher preparation program and had not taken any method courses yet, they lacked pedagogical content knowledge, which was an integral component of successful technology integration. As a result, empirical experience with different learning activities became the major source for them to compensate pedagogical content knowledge.

Nevertheless, both Jason and Sarah, who had been observing real classrooms of their subject area, used their field experience to evaluate the appropriateness of the learning activities for their targeted students. Jason said, in making his lesson plans, he "thought of previous experience with students… what ways did work and what ways didn't work." Sarah also emphasized her strength of using observation experience for making good judgments.

> I can kind of think OK I have seen my teacher do this with seventh graders and they love it, or I have seen my teacher trying to do something like this and they don't even want to try. So just by being in the seventh grade classroom that semester… I think I had a better idea about if the kids would actually want to do it and if it would actually work in a classroom.

Overall, although the preservice teachers can use their own learning experience for identifying instructional problems and designing solutions, the lack of teaching experience was still a big barrier for them to perform in a professional way. The preservice teachers with relevant real world experience showed some advantages, as they were better able to find real problems and judge the feasibility of their solutions.

Making Inferences to Generate and Evaluate Solutions

When the preservice teachers had little direct experience, either as a student or a teacher, to rely on, they tended to make inferences with the information they identified in the problem space. This strategy was most evident as the preservice teachers were generating ideas of teaching with technology or anticipating the effectiveness of their solutions.

As mentioned earlier, the preservice teachers had not used the latest technology tools when they were K-12 students, making it impossible for them to directly use the same learning activities from their classrooms. Based on analyzing the process that the preservice teachers generated technology integration solutions, two major ways of making inferences emerged: activity-based inference and tool-based inference.

While using activity-based inference, the preservice teachers first designed a learning activity, which usually originated from their previous experience, to address their problems or goals and then added some tool(s) to enhance that activity with technology's affordances. Take Brian for example, he designed the group activity involving both higher-achieving and lower-achieving students to solve his problem and incorporated Smart Board, arguing that "it's not like write on chalk board or write and erase board, they can do it on Smart Board and then I can go over and correct it and other students can correct it". Activity-based inference helped the preservice teachers concentrate on the problems and goals of their teaching situation. However, technology was likely to be something dispensable if the match between the pedagogical activity and the technology's affordances was inappropriate.

While using tool-based inference, the preservice teachers first picked a technology tool with functions pertinent to the content they wanted to teach and then designed learning activities based on that connection to address their instructional problems. Claire thought about using Web 2.0 tool to facilitate communication and collaboration in learning to make graph. She said she "researched some different Web 2.0 tools to see if there is something for how to make a graph or ways to find data" and chose to use Delicious Account for students to "find and share research [where they can gather data] they like with their fellow students" and use Mind Meister, a web concept mapping tool, for students to "add information to a collaborative mind map to organize the information". Tool-based inference helped the preservice teachers identify good connections between technology's affordances and the content and ways of learning. However, this strategy tended to focus the preservice teachers' attention on the tool they prefer to use rather than driving them to explore a variety of choices.

Another way of making inferences happened when the preservice teachers were envisioning the results of their solution ideas in order to make decisions. Due to the lack of field experience, the preservice teachers did not have sufficient experiential knowledge to judge the effectiveness of their solutions. Also because of the limitation of the course, they had no chance to test their ideas. Therefore, two preservice teachers made inferences through role playing or imagination to predict the results of implementing the learning activity they designed. Jason positioned himself as a student when reasoning about the benefits of asking students to research their preferred careers online and share the resources using Delicious Account.

> I actually thought back and said well if I was forced to use this as the teacher assigned this to me, would I have done any better? And I believe I would have. I believe the outcome would have been different. I believe I would know more... So I believe the students would be interested in doing this kind of work.

Similarly, Claire gave up her initial idea of asking students to make graphs on "band ticket sales" in case one after imagining the possible consequences.

> It was beneficial for preservice teachers to look ahead by reasoning through the appropriateness of their learning activity design. However, because of limited experience-based evidence, all the three types of inferences - activity-based inference, tool-based inference, and imagination-based inferences - may be inaccurate thus misleading their judgments.

Preservice Teachers' Assumptions and Perceptions about Problem Solving

Assumptions Underlying the Problem Solving Process

The preservice teachers had assumptions and beliefs about themselves and their students, which they took for granted throughout the problem solving and lesson designing process. Originated from their prior experience of learning and teaching, these assumptions and beliefs had become their rationale for using certain strategies to design lesson activities.

The preservice teachers also had assumptions about their content and pedagogical knowledge. Two of the preservice teachers believed that they had sufficient understanding about the teaching content or the pedagogy to be used, so that they did not need to consult additional resources. In designing the lesson on American Revolution, Claire reported that

> I felt a lot of it [information about revolutionary war] came from my mind because I am a huge history buff too. So ((laughing)) I could think of the different events of the war, without necessarily having to go and look at them from different sources.

Brian was very confident in his knowledge about teaching methods as well as his solution for approaching the situations he faced.

Actually a lot of methods just came out of my head, because of my past three educational classes. I just kind of knew that you need to have hands-on learning, just different stuff like that. I just kind of already knew that in my head a little bit. So I didn't have to use the Internet as much to find ways to teach.

Although these assumptions suggested that the preservice teachers had some preparation on content and pedagogy, which was the prerequisite for solving the instructional problems, they blocked their metacognitive awareness of the need to further explore the teaching content and strategies and how to integrate them with technology.

Moreover, the preservice teachers had common assumptions about the students' problem with learning, their preferred activities, and technology's role in learning. They almost reached an agreement on the major instructional problem they would encounter in their class. That was, the students were unable to concentrate on study and would easily get off-task. Jason found that students "usually lose focus quickly if they don't have enough things to do". Claire believed that "students were so easily distracted that they move off task". Brian also mentioned "having trouble keeping the kids' attention". Their assumptions about how this problem could be solved were also quite similar: the students needed interesting and entertaining activities to keep their focus or attention. Jason believed that "the work often times has to be new to them, something different and something interesting". Brian thought "when they [students] are moving around a little more, going outside, coming back in, you could actually teach more". The preservice teachers believed it important to integrate technology mainly for two reasons: students were comfortable with technology and would be more attentive in learning with technology. Claire said, "Since this is a digital age, students are growing up in that, and they will really need some of that incorporated into their learning." Brian assumed that "technology solves the problem getting the curriculum across to the students" because students were "technologically sound". Both Jason and Brian believed that hands-on activities with technology would keep students "on-task and focused" because "they [students] can create things that they wouldn't be able to create otherwise" and "they [students] can see it with their eyes and learn it in that [hands-on] way".

With all these assumptions about their knowledge and the learner characteristics, the preservice teachers were very likely to design a "fun" lesson that would work for them as a student to keep their envisioned students on-task, especially when they failed to consider multiple instructional problems and did not use proper criteria to evaluate their solutions.

Newly Developed Perceptions on Solving Instructional Problems

Although the preservice teachers' assumptions about themselves and their students were not challenged, their perceptions about the instructional problem solving process evolved as they were using the scaffolds, which positively influenced their understandings regarding the ways of designing a better lesson.

The preservice teachers realized the importance of clarifying the problems and goals before setting out to solve the problems. Jason found it necessary to "not only develop a lesson but go through this process to make sure my students are getting the most out of a lesson." Claire also emphasized that "I have to look at each of these different things I am going to encounter, like the different standards, the different challenges, and think about that and figure out what would be best in the end". Both of them were conscious of keeping their goals and problems in mind to adjust their solutions. Claire and Sarah reflected on their tendency of sticking to the initial idea. Claire said, "I can't go straight to the solution any more I have to actually go through and think about the details a little." Sarah found that "it took more time at the beginning to do it all, but every project turned to work exactly how I wanted it to work. So just go through all the steps and not just pick something because it sounded really good to begin with." Their emphasis on analyzing the situation before making a decision reflected their increased awareness of considering alternative choices and environmental constraints in solving problems. Additionally, both Jason and Brian indicated their understanding about the significant efforts needed in lesson design. Jason said, "I should think a lot harder about my lessons when I design them". Brian said he learned that "when I am a teacher it's [the lesson is] not just going to unfold for me. I have to go and research and find out stuff by myself". As novice lesson designers, they began to have a sense of the complexity involved in lesson planning.

The preservice teachers also developed some new perceptions about divergent and critical thinking. They talked about the benefits of thinking divergently and implied the need to be open-minded toward the initial ideas. Jason said, "Before case one I would say there's probably not much need to do a lot of brainstorming." But after working on that case, he realized "if I hadn't done the brainstorming I would have chose a solution that probably wasn't the best one." Therefore, he believed that thinking of "many possible solutions" rather than sticking to a convergent solution, would benefit the teacher and the students. In terms of critical thinking, the preservice teachers pointed out the value of creating and applying criteria. Brain believed that "it's important for us to realize what kind of criteria we had to meet to effectively teach them [the students] in the classroom". Claire stressed that creating criteria helped her "really concentrate and figure out what is the most important overall". The preservice teachers
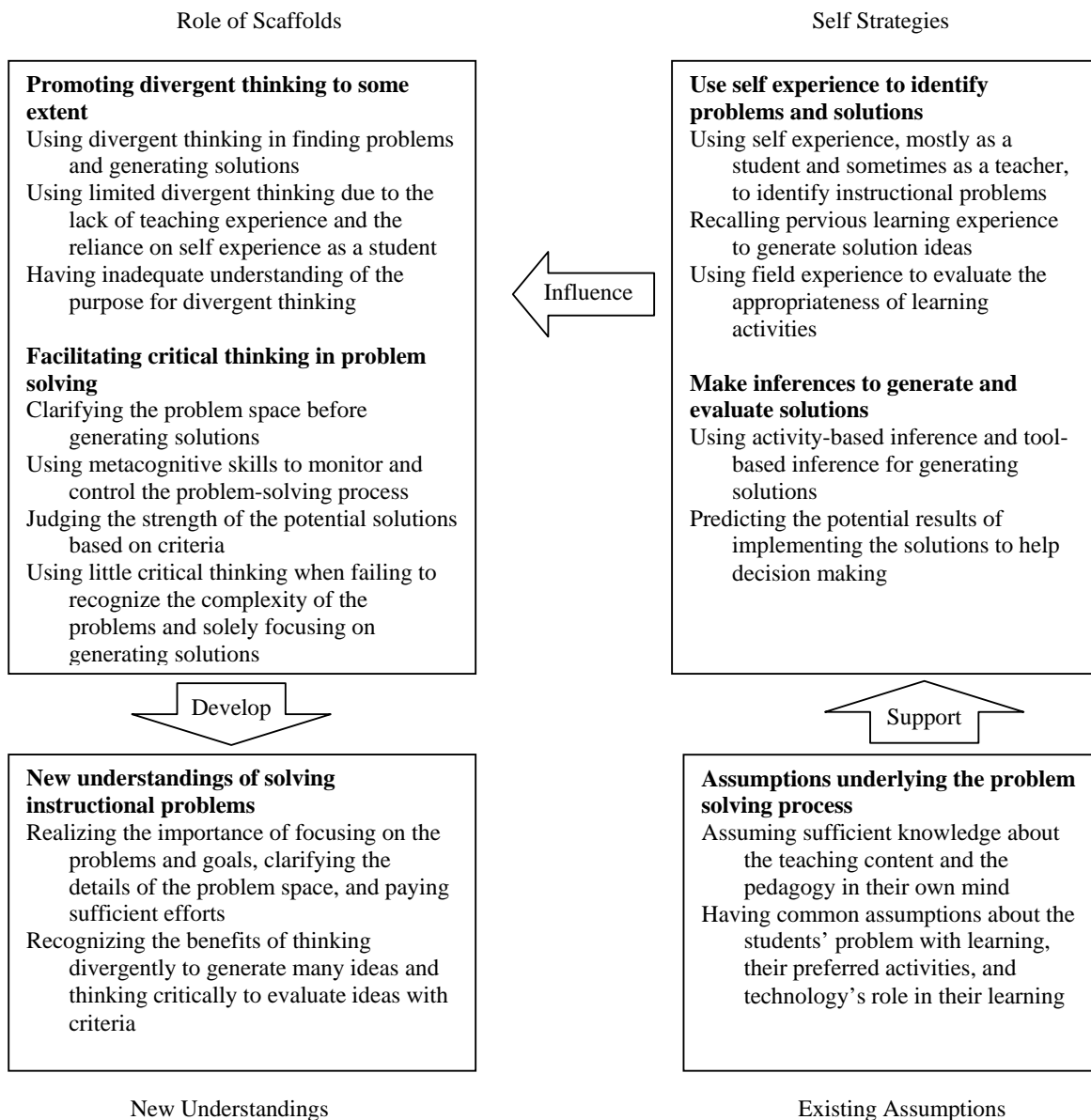
also perceived it as an effective way to distinguish the better solutions based on criteria. Sarah said, "It really helped to be able to see on a scale of one to ten, does this work with what my criteria are." In the second case, when she was not required to follow the scaffolds, she still evaluated the solutions using her two main criteria – being able to solve the problem and using technology integral to the project – indicating her awareness of thinking critically about the potential solutions.

By following the scaffolding procedure, the preservice teachers not only improved their performance but also developed new perspectives and attitudes toward instructional problem solving, which was evidenced by their understanding of identifying details in the problem space, paying efforts to lesson design, thinking divergently about initial ideas, and making decisions based on criteria. However, these new understandings were focusing on the instructional problem solving skills, independent from their assumptions about themselves and their students. The preservice teachers' pedagogical content knowledge may not develop significantly along with the new perceptions.

Discussion

Data analysis revealed that both the problem-solving scaffolds and the preservice teachers' own strategies were influencing the way they addressed the instructional problems with technology integrated lesson plans. Analysis of preservice teachers' perceptions about their problem solving experience indicated two categories respectively associated with the scaffolds and the strategies. Figure 1 summarized the major findings and their connections.

Figure 1. Major Findings of the Study

Role of Scaffolds   Self Strategies

Promoting divergent thinking to some extent
Using divergent thinking in finding problems and generating solutions
Using limited divergent thinking due to the lack of teaching experience and the reliance on self experience as a student
Having inadequate understanding of the purpose for divergent thinking

Facilitating critical thinking in problem solving
Clarifying the problem space before generating solutions
Using metacognitive skills to monitor and control the problem-solving process
Judging the strength of the potential solutions based on criteria
Using little critical thinking when failing to recognize the complexity of the problems and solely focusing on generating solutions

← Influence

Use self experience to identify problems and solutions
Using self experience, mostly as a student and sometimes as a teacher, to identify instructional problems
Recalling pervious learning experience to generate solution ideas
Using field experience to evaluate the appropriateness of learning activities

Make inferences to generate and evaluate solutions
Using activity-based inference and tool-based inference for generating solutions
Predicting the potential results of implementing the solutions to help decision making

↓ Develop   ↑ Support

New understandings of solving instructional problems
Realizing the importance of focusing on the problems and goals, clarifying the details of the problem space, and paying sufficient efforts
Recognizing the benefits of thinking divergently to generate many ideas and thinking critically to evaluate ideas with criteria

Assumptions underlying the problem solving process
Assuming sufficient knowledge about the teaching content and the pedagogy in their own mind
Having common assumptions about the students' problem with learning, their preferred activities, and technology's role in their learning

New Understandings   Existing Assumptions

435

The preservice teachers were able to use divergent and critical thinking skills during problem solving. Some of them carefully explored multiple problems in their teaching situation, and all of them considered different technology tools in generating potential solutions. They also began to think critically by clarifying the details in the problem space as well as monitoring and controlling the problem-solving process with goals and criteria. Compared with the preservice teachers' initial tendency of abiding by convergent solutions, their problem-solving performance had been enhanced by following the scaffolding procedure. As the preservice teachers realized the benefits of thinking divergently and critically, they developed some new perceptions about designing lessons for approaching instructional problems. But due to the inadequate understanding of the purpose of divergent and critical thinking, although the preservice teachers talked about the advantages of using those skills, they did not use them as intended by the scaffolds, especially when they were not required to follow the scaffolds strictly.

Meanwhile, the preservice teachers frequently used their own experience as a student or as a teacher to assist problem solving. They also used activity-based and tool-based inferences for generating solutions and tried to predict the potential results of those solutions as a way of evaluation. These strategies made it possible for the preservice teachers to complete the instructional problem-solving steps, even though they had neither taken any method courses nor started their field teaching. However, to some extent, these strategies also conflicted with the scaffolds and negatively influenced the preservice teachers' divergent and critical thinking performance. Some of the preservice teachers failed to consider alternative problems and solutions in the case scenario when they were exclusively relying on their own experience with similar teaching situations, in which the problem and the solution were evident to them. As they used convergent thinking, they were inclined to underestimate the complexity involved and think less critically about the solutions. The negative aspect of the strategies can be traced back to preservice teachers' underlying assumptions. They did not view themselves as a teacher or a student all the time but switched perspectives on their roles constantly. With the role of a teacher, they tended to assume that they already knew enough about the teaching situation, overlooking the need to further inquire into the problems and solutions by using resources other than their mind. With the role of a student, they tended to assume the equivalence between themselves and their students and to design an optimized version of the learning activities they had experienced for their students.

Implications

Preservice Teachers' Technology Integration

Ill-structured design problems such as technology integration require knowledge from multiple domains and extensive experience in the field. The preservice teachers with deficiencies in both areas used personal history based theories and experience, which were tenacious and powerful (Knowles & Holt-Reynolds, 1991), to help find and solve the design problems. They adapted the case scenario by recreating it exclusively based on what they personally witnessed or experienced. Similar to Knowles and Holt-Reynolds's (1991) findings, the preservice teachers failed to place their experience in a more diverse context and disregarded the problems different from their own. Also, due to the lack of classroom experience as teachers, they tended to recall critical prior experiences as a student to plan their lessons, to predict students' response, and to evaluate certain teaching strategies (Holt-Reynolds, 1992).

In addition to relying on personal history, this study showed that the preservice teachers also used inference strategies to design technology-integrated learning activities that were not available from their own experience. They used activity-based inference to modify and extend previous learning activities by incorporating technology. They also used tool-based inference to create original learning activities by matching technology's affordances with the need of their teaching situations. With these inference strategies, the preservice teachers were likely to go beyond directly applying self learning experience to lesson design, because they had to integrate the technology elements that may give rise to fundamental changes in the lesson structure. However, the preservice teachers' utilization of both prior experience and inference strategies were still supported by their established beliefs and assumptions generalized from personal history.

Scaffolding Divergent and Critical Thinking in Technology Integration

Educational technology courses in teacher preparation programs have been criticized for teaching standalone technology skills rather than cultivating preservice teachers' ability of effective technology integration (Gunter, 2001; Whetstone & Carr-Chellman, 2001). Aside from incorporating technology in method courses and field teaching, some teacher preparation programs have started project-based learning in educational technology courses,

in which the preservice teachers have chance to design technology-infused lessons (e.g. McRobbie et al., 2000). Ill-structured design problem solving activities were involved as well, but they were not situated in a problem-based environment and did not emphasize the systematic problem-solving process and the related thinking skills. Meanwhile, according to literature, problem solving entails a critical creative process that involves divergent thinking, which supports creative ideation, and critical thinking, which ensures goal-directed actions (Mayer & Wittrock, 2006; Runco 2003). This viewpoint fits well with the design aspect of technology integration problems. However, divergent and critical thinking is rarely mentioned in the project-based learning of technology integration.

This study redesigned project-based learning by creating a problem scenario and scaffolding the problem solving process with a focus on divergent and critical thinking, hoping to provide a situated context and more guidance for preservice teachers to integrate technology. Findings from this study indicated that this was a beneficial way for preparing preservice teachers to teach with technology. The problem-based teaching scenario together with the divergent thinking scaffolds promoted the preservice teachers to consider different constraints and challenges before integrating technology and to brainstorm various solutions by inquiring into the possible combinations of technology, pedagogy, and content. The critical thinking scaffolds facilitated them to focus on the important problems to be solved, develop criteria for evaluating the divergent solutions, as well as to monitor and adjust their lesson design. Divergent and critical thinking scaffolds not only enhanced the preservice teachers' performance but also exposed them to the complexity behind solving technology integration problems, from which they began to develop new understandings and skills of teaching with technology.

Nevertheless, problems arising from this study should also be pointed out. Because of the preservice teachers' characteristics as novices, their assumptions and strategies led them toward convergent and uncritical thinking, inhibiting the intended effects of the problem situation and the scaffolds. Although they reported new perceptions about lesson design after completing the projects, their assumptions and strategies remained unchanged and were not integrated with the new understandings emerged from using the scaffolds. In addition, some of the preservice teachers failed to recognize the purpose of divergent and critical thinking, resulting in the lack of motivation and misuse of some scaffolding steps. Future research questions may include how to improve the scaffolds in ways that can encourage the preservice teachers to critically reflect on their underlying assumptions, how to make them understand the point of using divergent and critical thinking in solving technology integration problems, and how to help them develop new strategies that can facilitate divergent and critical thinking.

This study contributed to the field of Preparing Tomorrow's Teachers to use Technology (PT3) by suggesting a new strategy of teaching educational technology course, which paves the way for the preservice teachers to use technology in their method courses, field teaching, and future career. Teacher educators in the field of educational technology may experiment with the guided problem solving approach when using project-based learning in their class, so as to provide more structure for the novice lesson designers and nurture the desirable thinking skills. Teacher educators who wish to integrate technology into method courses or field teaching may also use the divergent and critical thinking scaffolds to help preservice teachers plan for incorporating technology into the pedagogies and content they have learned. This study may also inform educational researchers interested in PT3 about the possibilities and challenges in developing preservice teachers' technological pedagogical content knowledge.

Conclusion

The major purpose of this study was to examine the preservice teachers' experience and perceptions about the guided problem solving process in order to understand the appropriateness of this approach in preparing them to teach with technology. Developing lessons effectively incorporating technology tools is an ill-structured design problem challenging for preservice teachers. Problem-solving scaffolds with an emphasis on divergent and critical thinking have the potential for developing preservice teachers' knowledge and skills in designing technology-integrated lessons. Problems and limitations found in this study reminded the researcher of the preservice teachers' characteristics in learning and also indicated directions for improving the scaffolds. In conclusion, the guided problem solving approach is worthwhile for further study and will become a useful strategy contributing to the research and practice in the PT3 field.

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Appendix A: Sample Case and Scaffolds

Communication and Collaboration

The grant your school applied for was awarded and you have access to several new computers in your classroom. You are excited about the computers and want to use them to support students' communication and collaboration, which are important skills for your students to have. From your previous experience, you know that students are more motivated to learn when they are given the opportunity to collaborate in groups and communicate their ideas to a "real audience". More importantly, they can help each other with difficulties and negotiate conflicting opinions though collaboration, which leads to deeper understanding of course content.

However, you remember that things don't always go smoothly when your class does collaborative projects. You remember that during the last collaborative learning project, students seemed to be actively talking to each other, but not everyone learned as much as they were expected to due to a number of problems. For example, some students contributed a lot and even dominated the teamwork, while some students were not truly engaged and kept talking about irrelevant things. Some groups of students really seemed to respond well from the activity, while others seemed to learn very little. While negotiating different ideas, some students failed to listen to each other carefully before they gave responses, which resulted in unpleasant collaboration that ended up with conflicts, disagreements, and even quarrels.

The current curriculum standard you are planning to teach can best be achieved by using teaching strategies that emphasize peer interaction and collaborative learning. You know from your EDIT 2000 class that technology can provide your students with rich learning resources, productivity tools, and communication tools. You decide to integrate technology with teaching strategies to address the problems you have experienced with communication and collaboration.

Step 1: Select Curriculum Standard
Select a curriculum standard from your subject/grade level that involves or requires communication and collaboration.
1) What curriculum standard will you address in this lesson?

2) Why did you choose this curriculum standard?

Step 2: Identify the Challenges
Situate your the standard that you are going to teach into the case scenario and think about what specific challenges, in terms of communication and collaboration, you might meet in teaching this standard. List your challenges in the following area (Number each challenge).

Step 3: Frame the Instructional Problem
Based on the challenges you listed in Step 2, which one is the biggest issue? This will be your instructional problem. Describe the problem that you want to solve in this case project. Make sure your instructional problem is relevant to communication and collaboration and could benefit from technology integrated teaching and learning.

1) What is your instructional problem?

2) Why is this instructional problem important?

Step 4: Generate Solutions
Think about how you might incorporate technology into teaching and learning to solve your instructional problem. Review Chapter 3 in your textbook to learn about communication and collaboration and the sample lessons while you are working on this step. Consider the different technological tools you have learned either in EDIT 2000 or by yourself and brainstorm as many solution ideas as you can. List your solutions in the following area (Number each solution).

Step 5: Select Criteria
Your task now is to select the most promising solutions from your Step 4. Generate criteria that will help you determine the appropriateness of your solutions. Select and list FIVE criteria that you think are most relevant and important for evaluating your solutions. Each criterion should have a different focus.

Five Criteria

1	
2	
3	
4	
5	

Step 6: Apply Criteria
Apply the criteria to your solutions for the Instructional Problem. Use each criterion to rank the solutions in an evaluation matrix. Use a scale from 1 (poorest) to 10 (best) and enter the numbers in the appropriate columns. Add the ranks you have given to each solution and enter the sums of the TOTAL column.

	Solutions (Summarize your solutions)	Criteria					Total
		1	2	3	4	5	
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

Step 7: Design your Lesson
Turn your most promising solution into a practical lesson plan. Explain more specifically how you will implement your lesson, how you will use technology to support communication and collaboration, and why your lesson activity will solve your the instructional problem. Here is the information you should include:

Lesson Title
Grade/Content Area
Lesson Duration
*State Objectives (these will come directly from the Georgia Performance Standards)
*Select Tools, Materials, and Teaching Methods (what will you use to accomplish this learning activity?)
*List Student Task/Product (what is the specific task you want students to complete? This should be no more than 3 sentences).
*Describe Learner Participation (describe the steps of the learning activity. How will students be divided into groups with specific responsibilities, how will the lesson be introduced, how will you monitor student learning during the activity, what will students be doing during the activity?)
*Evaluate Learner Outcomes (describe how you will know students have achieved your stated learning objectives).
*Create a Student Sample (Provide one sample that you expect your students would create in this lesson.)

Step 8: Reflection
Take a moment to reflect on your performance in case one. This helps you learn from your experience and do a better job in case two.

1) As I worked on case one, I did well in...

2) As I worked on case one, I had difficulties with...

3) As I worked on case one, I wish I had spent more time on...

4) To do a better job in case two, I need to...

Organizational Support for the Adoption of Educational Technology

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Abstract: The selection of educational technology to support student learning in higher education is often implemented as stand alone solutions to individual problems within a university. A systems view of the university's enterprise systems can reduce silos of technology, and that provide economy of scale, both in support costs, as well as in training and management. Acting as an action researcher, with the role as an internal consultant, a technology integrator can help identify efficiencies and solutions to common problems faced by instructors and institutions. Building support structures for faculty to support the adoption of technology, as well as encouraging individual adoption and evaluation of technology by faculty, can help faculty determine the usefulness of technology in education.

Key words: Transformational Change, Management

Introduction

Higher education institutions have moved away from simple on-boarding of a variety of individual tools and systems, and an enterprise approach has begun to take shape at many institutions. Guided by environmental pressures, institutions are seeking to find efficiencies in technology support and deployment on campuses. Combined with internal or governance pressure to link expenditures to strategic initiatives helps to encourage a shift to a high level perspective of technology integration at institutions. As organizations are shaped and adapt to these new pressures, terminology and methodology for describing and measuring this change need to be used to inform the discussion. Existing models for discussing these changes can be found in the literature of organizational development and information systems. As technology integrators seek to move their practice towards a more strategic focus within their institutions, it is worthwhile to consider the concepts from these fields.

Stages of growth

Nolan (1979) described six stages of data processing growth within businesses: I) Initiation, II) Contagion, III) Control, IV) Integration, V) Data Administration VI) Maturity. While Nolan's Stages of Data Processing Growth was developed based on experience with data processing within businesses, it provides a useful framework by which to explore an organization's maturity with technology utilization. The model has been particularly influential in the field of information systems, and while it has some detractors, it does provide a method by which to consider the role that the organizational environment, and organizational learning play in technology utilization in a particular context. If you substitute the innovation of data processing in an organization with the use of educational technology in higher education, Nolan's model provides some affordances for describing the current state of technology integration in our institutions. If you consider the six stages and Nolan's

description, you will find surprising similarities to the challenges facing higher education institutions as technology systems evolve within their organizations. Stage I: Initiation is comprised of the introduction of several systems in a particular group within the organization. Nolan identifies accounting as the point of entry for most of these systems. In stage one, users are not very aware of the technology throughout the organization. Stage 2: Contagion consists of growth and expansion of systems to other areas of the organization, with little centralized control in place to keep costs under control. Stage III: Control is reached in part due to frustration with the explosion of costs and systems in stage II. In stage III cost control measures, professionalization of the systems support activities and end user accountability for systems costs. Stage IV: Integration is reached when the systems and applications provided to users are reliably provided and well organized. This capacity allows end users to take greater advantage of the systems in their activities, and real value is gained from use of the systems. Growth in the number of systems and applications occurs. Stage V: Data Administration consists of the containment of demand from stage IV and Stage VI: Maturity represents a balanced supply and demand for systems. (Nolan, 1979) When viewed through the stages of growth model, the adoption of the use of educational technology within an institution can be categorized by these stages. Stage I would consist of a single department or a group of faculty adopting a particular technology, followed by the proliferation of the technology to multiple departments on a campus in stage 2. As a cost saving measure, and to reduce inefficiencies, the technology support may be centralized or placed under strong controls by a professional technology group within the institution in stage 3. Stage 4 would consist of a view of technology services as application portfolio based, the development of service level agreements within the institution, and planning and control to meet each user group's needs. Stage 4 would lead towards stage 5 when shared data and systems, along with application integration is realized, leading to the mature support model in stage VI. From a pragmatic perspective, you could consider stage 1 technologies to be comprised of tools that individual faculty utilize within their institutions, such as media presentation technology, in-class activities, and systems used to support a limited customer base within the organization. Stage 2 technologies would include things such as shared technology resources, such as a computer lab, a shared classroom equipped with technology, or a shared server. Systems such as course management systems appear to fit the model of the kinds of systems that would appear somewhere around stage 3 or 4 according to the stages of growth model. These systems may become integrated with the institution's student information systems, a campus portal, or other unifying technologies around stage 4. According to McConachie and Danaher (2005), many institutions have moved towards the integration stage for the deployment and support of technology systems on campuses, in order to reduce costs, and to provide efficiencies. Stage 4 appears to be a common stage for many higher education institutions at the time of this paper. While the stages of growth model is a simplification of a complex phenomenon of technology adoption in an organization, it at least provides a method by which to conceptualize the learning on both the part of the technology support functions of an organization, as well as the organization as a whole.

Role of a technology integrator

When moving from the support of single systems or technologies, and towards a systems perspective there is a change in the role of technology professionals who assist others with technology integration. Historically, a large portion of what educational technology professionals have done in higher education has been training and the development of support resources for the use of educational technology tools. While individual technologies may provide solutions for individual problems, or meet the needs of a particular context, the

perspective value of the technology investment and subsequent training must be considered valuable by the host institution or continued support of the activity may diminish. The move from training to performance leads to a more strategic approach for professional activity, and includes the need to work collaboratively and consider the readiness of the organization. (Rossett, 2002). When considering the strategic context of a particular technology or a portfolio of services, the analysis needs to be framed from an organizational perspective. This requires that the scope of the analysis must be adjusted to include broad organizational variables, as well as include an understanding of the strategic directions of the institution. This contextual review allows for the development of resources, including training, that allow faculty to focus on how the technology will allow them to solve problems either in their face to face courses, or those caused by being separated from their students by either space or time. When the level of analysis is broadened, there may be additional challenges or variables within the organization that may be identified as barriers for reaching the desired performance. As professionals in a performance focused world, a systems view of higher education institutions can assist with analysis and performance diagnosis. Furthermore, the tools and literature of organizational development provide a framework for investigating the variables that may inhibit change. The utilization of these tools require both access and capability to enact change or advocate for change where needed. Facilitating the development of efficient and effective solutions for technology integration that are designed to support faculty across the entire institution supports the evolution of institutions from Nolan level 3 institutions to Nolan level 4 institutions. The development of reliable and cost effective solutions to meet the needs of multiple groups of faculty within an institution can help further the adoption and growth of the solutions within an institutions. If these solutions fit closely with faculty responsibilities and needs, as well as institutional strategies, then both the systems and the social systems are closely aligned. The use of integrated systems that interface with existing student information systems, and are common across students' experience, allow for the technology to become a facilitator, rather than a distraction for instruction. New educational systems provide greater opportunities to rapidly categorize, capture, and access instructional content with a greater degree of automation. These tools can help reduce the barriers to entry and improve the relative advantage perceived by the faculty considering adopting a new technology. As institutions identify new technologies for faculty to use in the support of their instruction, a balance between individual faculty freedom of control over the conditions of the classroom technology and the need for the technology administrators to provide reliable support for the broader campus. These competing interests provide for conflict within institutions of higher education. Faculty often view technology integration within their teaching as a issue of academic freedom, and systems control imposed by technology administrators creates mistrust from faculty, and can limit individual faculty experimentation The balancing and managing of expectations and responsibilities are continually renegotiated within any organization using new forms of technology in the operation of an enterprise. Rogers (1995) Diffusion of Innovation theory provides a model for the individual adoption of innovations. This model includes a component of experimentation and evaluation of the technology by faculty. Providing a safe harbor for faculty to experiment with technology is critical for their individual adoption of technology. However, faculty do not operate independently when they work within an institutional context. The environment that they are given to integrate technology within their instructional methods contains a mixture of policies, rules, and technical limitations that restricts the freedom of faculty to freely implement systems based on their own vision of efficiency.

Online learning from a systems perspective

When institutions do become focused on a strategic change in direction for the use of technology within instruction, such as the case of online learning, the process by which the rules and conditions of the organizational operation are renegotiated is important. One method by which organizations can review the nature of the education environment is via a model called parallel learning structure (Bushe and Shani, 1991). In this model an internal organizational structure is created that helps the organization review the processes and conditions of production from a new perspective. This group is similar to the traditional model of committees that are used to discuss changes to policies or particular issues on a university campus, but for distance education, this includes additional functional representatives from administrative and service organizations in the university. These other groups involved in the process include the student services, technology support, and general administrative support areas that form the processes of the organization's business function. As the parallel learning structure discusses and plans out the organization's operation of distance learning on the campus, the group?s ability to identify and address process issues grows. The creation of a separate functional group from a cross section of the campus provides an opportunity for these individuals with varying areas of expertise to consider the immediate issue of distance learning, outside of the normal distractions of daily business operation. The result of such a process is the ability of the institution to consider and develop new processes of operation that are organized based on the strategic objective of distance education.

Conclusion

Institutions should seek to develop structures and roles that enable organizational learning. Organizational learning is defined by Robey et al. 2000, as: "an organizational process, both intentional and unintentional, enabling the acquisition of, access to, and revision of organizational memory, thereby providing direction to organizational action." (p 130). The structures that support this capacity to learn within an institution include structures such as parallel learning structures, faculty teaching and learning centers, as well as internal consultants that help facilitate faculty adoption of new technology. Utilizing a mixture of systems theory, information systems perspectives, organizational development methodology, and a focus on performance allows for the analysis of problems outside the limited scope of training development. This focus on the entire system, along with a strategic focus for activities allows for the alignment of development activities with the organization's goals, and most likely, funding. While researching how changes occur within a higher education institution at a high level is complicated, research in this area is necessary if we are to realize strategic goals for technology integration within our institutions of higher education, rather than isolated competencies in particular technology systems or individual technologies.

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What Is The Real Situation In Practice Despite The Many Action Plans Implemented For Technology Integration Process In Education?

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Abstract: There is a trend in Turkish educational system to integrate technology into all levels of education. For example, with the admission of the Basic Education Law in 1997, computer and instructional technology related courses have been included in teacher education curricula since 1998 in Turkey. The main aim of this study was to investigate the secondary school English teachers' perceptions of technology and technology integration processes into their lessons. Graduating in 2002 or after from teacher education institution was a criterion for selection of these teachers. The purpose of using this criterion was to investigate the technology perceptions and technology integration of teachers who had taken computer and instructional technology related courses in their undergraduate education.

1. Introduction

Parallel to Worldwide developments, through the 'National Education Development Project', the Higher Education Council (HEC) in Turkey redesigned the teacher education programs' curricula to improve the quality of and to integrate ICT into teacher education programs (Akkoyunlu & Orhan, 2001). One of the implications of this project was to integrate computer and instructional technology related courses into teacher education curricula (HEC, 1998). By integrating these courses, HEC were planning to have teachers who "know the technology and apply it efficiently in instructional settings" (Akkoyunlu & Orhan, 2001, p. 30-31).

Many actions have been taken since 1984 to the present to integrate technology in instructional environments in Turkey. Some of the efforts are as follows;

- To keep up with the latest trends in education MoNE started a project by establishing a committee related to computer education in1984. . In accordance with the committee's report, MoNE supplied 100 schools from 67 cities with hardware, and provided computer literacy and basic programming language training programs for the teachers during the same year.
- In 1987, context of the training was expanded, and computer-aided instruction was included for the first time in teacher training programs.
- In 1990, MoNE decided to include computer related courses in the curriculum of teacher training institutions.
- Since 1991, MoNE has been working in cooperation with universities and TUBITAK (The Scientific and Technological Research Council of Turkey) to integrate educational technology into instruction.
- In 1998, with the acceptance of the Basic Education Law, computer related courses in teacher training institutions were implemented and the compulsory education in Turkey was extended to eight years.
- In 1998, under the supervision of MoNE, General Directorate of Educational Technologies (EgiTek) was founded to carry out the necessary issues in developing and producing any kind of audio visual and computer based materials to use in educational settings (Egitek, n.d.).
- In 2003, an arrangement was made for 20.000 schools' Internet connection with an Internet service provider. At the end of 2008, there were high band ADSL connections in 33.018 schools/institutions and wireless internet connections in 4.870 schools/institutions (MEB, 2009).

- In 2006, HEC formed a study group (constituting 25 academicians) to refine the teacher education curricula designed in 1998 According to this group reports, HEC (2006) promulgated changes in teacher education programs.
- In 2009, 100 % of the high schools and 94 % of the primary schools with approximately 12 million students had access to Internet with 621.000 computers in Turkey (MEB, 2009).

There are many research studies related with the teachers usage of technology in education in Turkey. For example, Top's (2003) study showed that preservice teachers' perceptions of their competencies with regard to technology standard were found quite high. Similarly, Toker's (2004) study indicated that, most of the pre-service teachers see themselves as intermediate technology users. On the other hand, Akkoyunlu and Kurbanoglu (2004) carried out a study indicating that teachers' information literacy self-efficacy level was generally low. In another study, Usluel and Haslaman (2003) revealed that teachers' present situation scores were lower than their preferred situation scores related to computer technology usage, impact on students and purpose of usage. Correspondingly, Askar and Usluel (2003) showed that teachers favored to use computers for administrative purposes rather than educational purposes. Moreover, Askar and Usluel (2002) stated that, teachers found computers as advantageous, compatible, and observable in management and personal issues. On the other hand, teachers have doubt in using computers as an instructional tool. Similarly, Cagiltay et al. (2001) conducted a study on teachers' perspectives about the use of computers in education. They find out that teachers have positive beliefs on the usage of computers in classes and many of the teachers desire to learn things related to the usage of computers in classes.

Although there are many research studies related with teachers' technology skills and knowledge in Turkey, the field lacks of the research study which is conducted especially to investigate in-service English teachers', who graduated from the faculty of education and took the compulsory computer and instructional technology related courses in their teacher education period, instructional technology usage in their teaching and professional environment. Additionally, there is no study that that focuses on the observation and interview as analysis of these teachers could be found in the literature. It can be said that there is a need to reveal these teachers technology usage in their teaching environment.

The purpose of this study is (1) to reveal how high school English teachers perceive variety of instructional technologies, and (2) to investigate how high school English teachers integrate instructional technology into their courses. The following research questions guided this study:
- What are high school English teachers' perceived competency levels in instructional technology?
- How do they plan to use or integrate instructional technologies in their courses?
- For what purposes and how do they use instructional technologies in their courses?
- How and for what purposes do they use instructional technologies in assessment and evaluation process?
- How do they use technology for professional development purpose?
- What do they consider about social, ethical, legal, and human issues while using instructional technologies?

2. Research Design and Method

Qualitative approach is used in this study. Observations, document analysis, and interviews were used to collect the data. Graduating 2002 or after from the university was a criterion for the selection of the teachers participated in this study. The aim of having this criterion was choosing teachers who had taken the computer and instructional technology related courses during their undergraduate education. To be able to represent the population as much as possible, another criterion used in selection of the participants was the schools types (private, Anatolian, vocational, regular high schools) that the teachers were teaching in. For this study, from four types high schools (private, Anatolian, vocational, and regular high schools)), 17 high schools, and an English teacher from each selected school were chosen in Ankara, Turkey.

The data were collected through observation, document analysis and interviews. Observations were conducted based on a pre-prepared observation guide. Teachers were observed in their courses during a whole day. The purpose of observation was to describe the high school English teachers', use of instructional technologies in their courses to provide triangulation for the interview data and to provide basis for the interview schedule development. From each teacher, their course annual/lesson plans were obtained to clarify their instructional technology knowledge, to show how they plan to use instructional technologies in their courses, to explain how they use instructional technologies in their courses, and to understand what they consider while using instructional technologies. The interview protocol was developed based on National Educational Technology Standards for Teachers (NETS-T, 2000) indicators. and consisted of eight main categories: (1) teachers' educational background,

(2) teachers' basic technology knowledge, (3) teachers' knowledge about the use of technology in planning and designing learning environments and experiences, (4) teachers' knowledge about the use of technology in teaching, learning, and the curriculum, (5) teachers' knowledge about the application of technology in assessment and evaluation, (6) teachers' knowledge about the ways of using technology for their productivity and professional practice, (7) teachers' knowledge about the use of technology for social, ethical, legal, and human issues, and (8) the accessibility of the available technologies for the use of teachers in schools. Interviews were conducted on a voluntary basis with the 17 high school English teachers. The interviews were semi-structured in nature. Before the interviews, the observation notes and annual/lesson plans were analyzed to be able to ask exploring and relevant questions.

In this study, basically content analysis was used to analyze the data. The interviews were transcribed, typed and coded as to the main data sources. In determining the coding categories the NETS-T (2000) categories were considered. Before creating coding schema, all of the studied teachers were analyzed by using this standard's indicators by finding evidences from observation data, annual/lesson plans, and interview transcripts. While categorizing the teachers, International Society for Technology in Education's "General Preparation Performance Profile Test" (Kelly, 2002) indicators were used.

3. Findings

It is found that, even though the investigated teachers' perceived *basic technology knowledge* level could be accepted as average, they have different levels of basic technology knowledge. When schools are compared, private high schools teachers' perceived competency level is higher than that of public high school (Anatolian, regular, and vocational) English teachers. At the same time, private high school English teachers are more eager to learn things on current and emerging technologies.

The study showed that almost all of the teachers included in the study have enough knowledge on *where and when to use technology*. Almost all of them have the necessary qualifications to plan technology usage in their classrooms according the NETS-T's indicators.

The teachers' use of technology knowledge were investigated by using NETS-T "*Teaching, Learning, and the Curriculum*" indicators. The results showed that while private high school English teachers did not have problems on most of these indicators, Anatolian high school English teachers had trivial problems and regular and vocational high school English teachers had severe problems on some of these indicators.

The findings indicated that there were differences in technology integration between private and public high school English teachers on NETS-T "*Evaluation and Assessment*" indicators. Although, three out of four private school teachers have knowledge on these indicators, only one out of 13 public school teacher has knowledge on them.

There were big differences on the NETS-T "*Productivity and Professional Practice*" indicators between private and public high school English teachers in favor of private high school teachers. The findings of the study also showed that, only nine out of 17 teachers stated formal education contributed to their professional development in integration of technologies.

The investigated teachers mentioned various purposes of using technologies in English teaching. Some of the mentioned purposes are as follows from most frequently stated to least frequently stated; to provide visual help, to get students' attention, to create a learner centered environment, to enable students to speak, to give more than one stimulant, to enable them to practice, to improve students' listening, to encourage students, to develop students' pronunciation, to show daily usage of English, and to have audio familiarity with some language items. The mentioned purposes of using technologies show variations among school types. For example, "to develop students' pronunciations" and "to show daily usage of English" were stated by only public high school English teachers as purpose of using technologies. In addition, "to enable students to learn by doing" were stated by all of the private high school English teachers and only two of the 13 public high school English teachers. From these findings it can be said that private high school English teachers are using technologies by aiming student-centered teaching and public high school English teachers are using technologies mainly to develop students' basic facts or skills. This was partially observed during the observed lessons, and also the public high school English teachers accepted that they are teaching grammar and they try to teach basic knowledge.

In this study, the findings also showed that most of the public high school English teachers have inadequacy of knowledge on NETS-T's "*Social, Ethical, Legal, and Human Issues*" indicators. However, most of the private high school English teachers have lack of knowledge on only one these five indicators.

4. Discussion

Technical skills is mainly accepted as a necessary first step in moving towards using technology in educational settings in national technology standards, textbooks, and training programs for teachers (Sandholtz & Reilly, 2004). Even though the investigated teachers' perceived basic technology knowledge level could be accepted as average, they have different levels of basic technology knowledge. Indeed, this study revealed that most of the public high school English teachers included in this study were in need of developing their basic technology operations and concepts. Sandholtz and Reilly (2004) stated that "if we take away expectations for technical skills and allow teachers to focus on developing curriculum, evaluating learning materials, and thinking about how to provide better learning opportunities for their students, teachers are likely to use technology more effectively and creatively in their teaching" (p.488). Sandholtz and Reilly's proposal may work under the conditions where teachers have basic computer usage competency. In this study, however, there were teachers who even did not use e-mail at all or rarely used it. Given that these teachers have taken technology courses in their teacher education programs, they could be expected to have the basic technology knowledge but that is not the case for some of them. This might indicate that, the computer and instructional technology related courses might not be as effective as they were planned.

The study showed that almost all of the teachers included in the study have enough knowledge on where and when to use technology. Even though most of the public high school teachers in need of developing their basic technology operations and concepts knowledge, almost all of the teachers in this study have the necessary qualifications to plan technology usage in their classrooms according the NETS-T's indicators. From these findings it might be said that the studied teachers were aware of the use of educational technologies in teaching environment but they were not practicing technologies in their teaching. One of the reasons for that situation might be lack of incentives, enforcements or technological infrastructure to use technologies in their teaching. Technology usage in classrooms requires special strategies and preparation of teachers to get the intended benefit. As Becker (2000) pointed out, the exemplary computer-user teachers are preparing themselves to use computers well in their teaching. The strategies show variations depend on various factors such as the used educational materials. Similarly, the teachers included in the study also mentioned different strategies while using technologies in their classrooms. Some of the pointed strategies from most frequently stated to least frequently stated are as follows; creating student-centered environment, following course books, using intervals for elaborations, creating practice opportunities for students, using indirect methods, making preparation then letting students perform, considering multiple intelligence theory, controlling students' understandings through applications, and using the available sources.

Tools improve our cognition and the current technology industry provides continuously new tools (Young & Bush, 2004). In addition, some of the tools have proved to be successful and effective in the learning contexts and processes. The technologies that could be used in education by studied teachers are general tools (cassette player, CD player, projection, video, OHP, etc…), visuals, and audio-visual materials. However, private high school English teachers mentioned more technologies that could be used in educational settings than public high school English teachers. Only six of the investigated teachers mentioned about computer applications. One reason for not mentioning about computer applications may be that teachers do not use computers in their lessons and personal life much. Another reason might be insufficient technological infrastructure in the school.

The use of technologies in classroom affects students on various ways. For example, in technology rich classrooms, students become more motivated (Schacter, 1999; Ringstaff & Kelley, 2002; Kleiman, 20004), become more active learners (Ringstaff & Kelley, 2002; Kleiman, 2004), have better confidence (Ertmer & Hruskocy, 1999; Ringstaff & Kelley, 2002), like their classes more (Schacter, 1999), develop more positive attitudes (Schacter, 1999), have better self-esteem (Ertmer & Hruskocy, 1999), improve their reflection (Schacter, 1999), learn multiple perspectives (Schacter, 1999), increase their level of independent thinking (Schacter, 1999; Ringstaff & Kelley, 2002), improve their higher order thinking skills (Ringstaff & Kelley, 2002), improve their basic computer abilities (Ertmer & Hruskocy, 1999; Kleiman, 2004), and improve their achievement. Similarly, technology usage in lessons has various effects on students according to the teachers included in the study. The effects of these technologies on students are generally positive and in accordance with the related literature. Some of the positive effects are; increasing students' motivation, liking the usage of technology, helping students to develop their English, giving

positive responses, becoming more active in lessons, and gaining self awareness. Although most of the studied teachers have admitted the positive effects of technology usage on students in teaching environment, most of them especially public high school teachers did not use technologies in their teaching.

There may be a great number of excuses stated by the teachers for the ignorance of the use of technology in teaching environments. For example, Ertmer et al. (1999) found that lack of equipment, lack of time, lack of classroom help, lack of relevance, mismatch with classroom management style, and lack of confidence are barriers to technology integration. Similarly, the studied teachers (both the ones who use technology in their classroom and the ones who do not) also put forward various reasons for not using technologies in their lessons. For instance 16 of 17 teachers emphasized that inadequacy of tools in classroom and time were the reasons for not using technologies in their lessons. Likewise, Ringstaff and Kelley (2002) expressed that "without sufficient access to technology, of course, even well-trained, highly motivated teachers will not be able to integrate technology effectively into instruction" (p.17). Becker (2000) also found insufficient access and not having enough instructional software as major reasons for not using technologies in educational settings.

Some of the other stated reasons from the most frequently stated to the less frequently stated are; inadequacy of contemporary tools, overloaded curriculum, difficulty in classroom management, feeling difficulty of arranging available technologies, unsuitability of the students level, difficulty in finding suitable materials, students' not having future plans with English, and having no culture on using technology in school. Similarly, Zhao et al. (2002) proposed some explanations such as, the incompatibility between technology and the current culture of schooling, natural unreliability of technology, ill-preparedness of teachers, poor quality of educational software, the predominance of conservative pedagogy, and the power of standardized assessment. Likewise, about the importance of school culture, Zhao et al. (2002) emphasized that "[t]eachers need to look carefully, not only within themselves but also at their technological and social environments before they begin to implement innovative uses of technology in their own classrooms and teaching" (p.511). Some of the stated reasons could be accepted as general problems of Turkish education system. For instance, Cakiroglu and Cakiroglu (2003) pointed out some of the problems as inadequacy of "professional skills and knowledge to cope with the educational goals of today's society, low salary, low status, heavy demands upon time, heavy workload, lack of opportunities to improve professional knowledge and effective performance and, finally, lack of job security" (p.257).

Using appropriate assessment strategies allows teachers to look for evidence of deeper understanding, synthesis, statements of relationships, and generalization of ideas to new domains (Dwyer, 1994). In the study, it seems that there are differences between private and public high school English teachers on NETS-T "Evaluation and Assessment" indicators. For instance, private high school English teachers have quite much knowledge about NETS-T "Evaluation and Assessment" indicators while public high school English teachers have limited knowledge on them. Using technologies in their lessons in private high schools may be a cause of these differences. Another reasons may be private high schools have more technology facilities than public high schools.

Technology helps teachers in breaking out of their traditional isolation, communicating with their peers (e.g. through online forums) and outside content experts about the instructional content and pedagogical issues, and communicating with parents about their expectations, activities, assignments, and student progress (Glennan & Melmed, 1996). However, there were big differences on the NETS-T "Productivity and Professional Practice" indicators between private and public high school English teachers. Private high school English teachers had far more knowledge on the NETS-T "Productivity and Professional Practice" indicators than public high school English teachers. Private high school English teachers were using technologies in their teaching more than public high school English teachers. Being effective in their teaching and holding the job in private schools may require teachers to develop themselves rapidly and continuously. Moreover, private high school administrators may be demanding teachers following and applying technological developments to their teaching. In addition, some of them were also providing training opportunities for their previous and new teachers. The findings showed that public high school English teachers had more teaching hours in a week than private high school English teachers and this could be another reason for public high school teachers' not sparing time for their own professional development.

The findings of the study also showed that, only nine out of 17 teachers stated formal education contributed to their professional development in integration of technologies. Even though the findings of this cannot be generalized, more studies should be conducted to examine the effectiveness of technology integration courses in teacher education curricula in different subject areas and levels, and those courses need to be in line with the subject area teaching rather than being isolated.

Teachers should consider various factors related with the social, ethical, legal, and human issues. For example, Swenson et al. (2005) stated that instruction and homework assignments must be suitable to the students' technological access and expertise, so that each student, regardless of gender, economic, social, ethnic, or linguistic backgrounds, could have equal learning opportunities. However, in this study, it can be said that on the three NETS-

T's "Social, Ethical, Legal, and Human Issues" indicators, most of the public high school English teachers have inadequacy of knowledge. However, most of the private high school English teachers have lack of knowledge on only one indicator. Similarly, Akbaba-Altun (2004) conducted a study in Turkey and found that although school principals should know how to deal with ethical issues emerging with IT classrooms; neither school principals nor computer coordinators mentioned any expected roles about ethics.

To conclude as Baran (2007) pointed out "history of teacher education in Turkey and new changes in educational system showed that teacher education needed more technology based solutions" (p.26). The teachers also should be provided with inservice training, appropriate work load, appropriate technological infrastructure in schools, and technical and material support to have them integrate the current technology in their teaching.

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Examining the Foundations of Educational Technology Course in 2009

Jeremy Tutty, Florence Martin and Zachary McLaren

Introduction

The introductory course or course sequence is common among educational technology programs as the means to provide students general knowledge of instructional design and technology. Often, this course or courses provides entry-level students with their first exposure to both historical and recent developments in the field (Klein, et al, 2002; Reiser & Dempsey, 2007). One such recent development is the 2007 revision of the Association for Educational Communications and Technology (AECT) definition of educational technology. The study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources (Januszewski & Molenda, 2007).

In 2002, a needs assessment was conducted by researchers from Arizona State University to identify optimal instructional content for a foundations course in Educational Technology (Klein, et al, 2002). Among their findings, they concluded that introductory courses should provide more opportunity to learn about contemporary issues (Klein, et al, 2002). Seven years later, we repeatedly encounter evidence of the field being influenced by growth and change in both theoretical and technological advances. According to Januszewski and Molenda (2007), "These theoretical shifts have changed the orientation of the field dramatically, from a field driven by the design of instruction to be delivered in a variety of formats to a field which seeks to create learning environments in which learners can explore often assisted by electronic support systems in order to arrive at meaningful understanding." (p. 2)

In light of these recent advances, the purpose of this study is to follow the admonition of Klein, et al (2002) to collect additional data to determine the optimal instructional content and delivery method for the foundations of educational technology course. In this current needs assessment the following questions will be addressed.

1) What is the optimal instructional content for a foundations course in Educational Technology?

2) What is the optimal delivery method for a foundations course in Educational technology?

3) What feelings do respondents have about the new technologies available for the delivery of a foundations course?

Method

Phase I of the study – Syllabi Analysis

Faculty who prepare instructional design and technology students have to be competent practitioners, prepared to update curriculum based on the changing nature of the field. This study investigated the extent to which the foundations course should remain a static set of topics, or evolve over time. This study follows the design of a similar study examining research courses in educational technology programs (Klein, Martin, Tutty, & Su, 2005). In the first phase, syllabi from a number of universities and the topics from the 2002 needs assessment were analyzed for inclusion in a survey instrument.

Introductory course syllabi were collected from several leading educational technology programs to determine what content is currently being taught to graduate students in the field. Our sample included eight programs: Arizona State University, Florida State University, University of Georgia, Indiana University, Purdue University, San Diego State University, Syracuse University, and Wayne State University. The syllabi were either downloaded from course websites, or requested from the instructors teaching the course. A content analysis of the introductory course syllabi was conducted. Each syllabus was examined for course title, objectives, instructional activities, and topics covered.

Phase II of the study - Survey

A survey instrument was then developed to address issues related to the content, use of technologies, and delivery method of introductory courses in educational technology. Fifteen course topics that were addressed in two or more programs as indicated by the course syllabi were identified and included on the survey. In addition, five topics identified by Klein, et al. (2002) that did not appear on two or more of the syllabi were included. A number of open ended questions were added to the survey.

This study focused on the optimal instructional content, delivery method, and emergent technologies for a foundations course in Instructional Technology. A survey was created and disseminated to various higher educational listserv on in Fall 2009.

The survey consists of eight total questions; five required questions and three short answer questions which were not required for survey completion. The survey measured the optimal content delivery method, and emergent technologies for an Instructional Technology foundations course. The questions were grouped into four categories: personal background information, important topics in an Instructional Technology foundations course, delivery methods in an Instructional Technology foundations course, and contributions of emergent technologies to an Instructional Technology foundations course.

The survey created using Select Survey, had the corresponding link distributed through email to the following institutions with higher educational Instructional Technology listservs: University of North Carolina Wilmington, University of South Alabama, Arizona State University, University of North Dakota, Syracuse University, University of Winnipeg, and Indiana University.
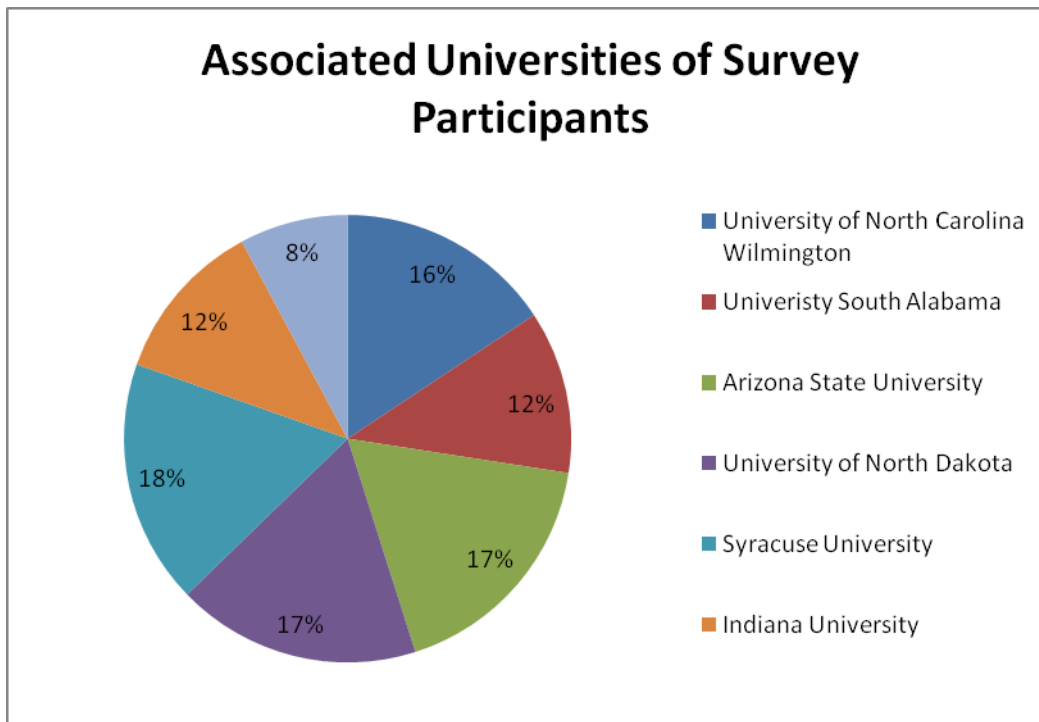

Figure 1. Associated Universities of Survey Participants

Participants

Fifty-one individuals took the survey. Nineteen participants (37%) were Instructional Technology master students, 11 participants (22%) were Instructional Technology doctoral students, 8 participants (16%) did not fit within the given descriptions and are listed as other, 5 Participants (10%) were Instructional Technology practioners in the K-12 range, 3 participants (6%) were Instructional Technology practioners in the Business and Industry sector, 2 participants (4%) were Instructional Technology Faculty, another 2 participants (4%) were Instructional Technology practioners in Higher Education and 1 participant (2%) was an Instructional Technology practioner for the government.

Results

The results of the survey are reported in Table 1. The overall mean of all items was (M=4.23) on a scale of 1 – Very Unimportant to 5 Very Important. Ten topic items were rated above the mean and were considered important to very important for Instructional Technology foundation courses. Among these ten topics the five most important were: Systematic Instructional Design (M= 4.75), Instructional Design Models (M= 4.75), Learning Theories (M= 4.61), Instructional Theories (M= 4.59), and Instructional Media Design (M= 4.45). Though the remaining 10 topics were below the overall mean of (M= 4.23), they were all rated as important with their means ranging from (M= 4.22) to (M= 3.75). History of educational technology and professional competencies (IBSTPI) were rated the lowest at (M=3.75).

Instructional Design Foundations Survey

Table 1
Topics in an Instructional Technology Foundations Course

	Topics in Foundation Instructional Technology *(5= Very Important, 4= Important, 3= Neutral, 2= Unimportant, 1= Very Unimportant*	**Average** **Response**
1	Instructional Design Models	4.75
2	Systematic Instructional Design	4.75
3	Learning Theories	4.61
4	Instructional Theories	4.59
5	Instructional Media Design	4.45
6	Needs Assessment	4.43
7	Evaluation	4.39
8	Definitions of Educational Technology	4.37
9	Trends in Educational Technology	4.33
10	Gagne's Events of Instruction	4.29
11	Using Professional Resources	4.22
12	Human Performance Technology	4.06
13	Innovation & Change	4.06
14	Technology Integration	4.02
15	Media Selection	4.00
16	Adoption & Diffusion	3.98
17	Distance Education	3.96
18	Technology Standards (ISTE)	3.84
19	History of Educational Technology	3.75
20	Professional Competencies (IBSTPI)	3.75

The results for delivery methods are reported in Table 2. Course Websites were rated the most appropriate delivery method (M= 4.47) on a scale of 1- Very Inappropriate to 5 Very Appropriate. Learning Management Systems (Eg. Blackboard, Moodle) and Virtual Classrooms (Eg. Wimba, Elluminate, Connect) were rated the next most appropriate delivery method with means above (M=3.35). Slightly lower in the middle of the results were Video Podcasts (M= 4.12), Audio Podcasts (M= 3.84), Wikis (M= 3.80), and Blogs (M= 3.67) all deemed appropriate delivery methods. Rounding out the bottom of the results were Social Networking Sites (Eg. Ning) (M= 3.53), Mobile Devices (Eg. iphone, Blackberry) (M= 3.31), and Virtual Environments (Eg. Second Life) (M= 3.18) all being deemed as slightly appropriate delivery methods for blended online foundations course in Instructional Technology.

Table 2
Delivery methods for a blended or an online foundations course in Instructional technology

	Delivery methods for a blended or an online foundations course in Instructional Technology *(5= Very Appropriate, 4= Appropriate, 3= Neutral, 2= Inappropriate, 1= Very Inappropriate)*	**Average** **Response**
1	Course Websites	4.47
2	Learning Management Systems (Eg. Blackboard, Moodle)	4.41
3	Virtual Classrooms (Eg. Wimba, Elluminate, Connect)	4.39
4	Video Podcasts	4.12
5	Audio Podcasts	3.84
6	Wikis	3.80
7	Blogs	3.67
8	Social Networking Sites (Eg. Ning)	3.53
9	Mobile Devices (Eg. iphone, Blackberry)	3.31
10	Virtual Environments (Eg. Second Life)	3.18

The results for the contribution of emergent technologies within a blended online foundations course in Instructional Technology are reported in Table 3. Contributions were rated on a scale of 1 – Not at all Significant to 5 – Very Significant. Among the ten items in this category, the item, Help students stay current with technology

(M= 4.41) was reported to be the most significant contribution of emergent technologies to Instructional Technology Foundation courses. The items: Provides student with the flexibility in time, Prepare students for the job market, Provides student with the flexibility in space, and Encourage student-student interaction were rated above (M=3.95) and are also considered significant reasons for the use of emergent technologies in Instructional Technology foundation courses. The remaining 5 items rated below (m=3.95) which were still considered significant were: Encourage faculty-student interaction (M=3.90), Provides students a sense of community (M=3.67), It enhances student effectiveness (M=3.67), Help students succeed in the course (M=3.65), and It increases student performance (M=3.49). There were no ratings below (M=3.0) which could have been considered insignificant.

Table 3.
Contributions of Emergent Technologies

	Emergent Technologies *(5= Very Significant, 4= Significant, 3= Neutral, 2= Insignificantly, 1= Not at all)*	*Average* *Response*
1	Help students stay current with technology	4.41
2	Provides student with the flexibility in time	4.29
3	Prepare students for the job market	4.24
4	Provides student with the flexibility in space	4.04
5	Encourage student-student interaction	3.98
6	Encourage faculty-student interaction	3.90
7	Provides students a sense of community	3.67
8	It enhances student effectiveness	3.67
9	Help students succeed in the course	3.65
10	It increases student performance	3.49

Twenty of the 51 respondents completed at least one of the three open-ended survey items. When asked what additional topics or trends not identified in the survey should be covered in the foundations course, responses reflected a desire for increased practical application of the topics indicated in the survey. When asked about preference for other methods of delivering the foundations course, 8 of 14 (57%) respondents indicated they had no preference for additional delivery methods, 4 of 14 (29%) respondents indicated a preference for social networking tools, and the remaining two respondents complained about course management systems. When asked to identify additional benefits of using emergent delivery methods, 13 of 20 (65%) respondents identified increased access and engagement. The remaining responses did not address the item.

Discussion
According to Januszewski and Molenda (2007), "Theoretical shifts [in instructional technology] have changed the orientation of the field dramatically, from a field driven by the design of instruction to be delivered in a variety of formats to a field which seeks to create learning environments in which learners can explore often assisted by electronic support systems in order to arrive at meaningful understanding." (p. 2).

The results of this study seem to fall short of fully endorsing the assertions by Januszewski and Molenda. Our findings certainly do place a high value on the communicative and collaborative benefits of electronic support systems. Furthermore, respondents recognized the importance of fluency with technological tools, rating items related to staying current with technology consistently high. Delivery mode appears to be driven by convenience not a particular advantage of one mode or another.

However, results also reinforce the need to maintain sound instructional design practices in the face of emergent technological demands. It maybe argued to the extent that such practices remain the driving force in the field. Respondents placed the greatest value on the topics of Systematic Instructional Design, Instructional Design Models, Learning Theories, and Instructional Theories; not social networking or virtual environments. It would seem that even in this current age of unparalled technological advance, the historical foundations of the field still belong in the foundations course.

It may be somewhat presumptive to challenge to driving force of the field based upon the content of a foundations course, but As one respondent indicated, "It is not the technology that does all these things. It is the instruction behind how the technology is used to facilitate and support learning and instruction. All of these things can be enhanced or distracted by technology used."

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Bridging Two Continents in a Virtual World: Integrate Second Life into an EFL Program in China

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Abstract: To explore potential applications of Second Life (SL) for language learning and instruction, researchers from an American university and a Chinese university took an evaluation research approach to identify appropriate ways to integrate SL into an EFL (English as a Foreign Language) program in China. The paper reports the research efforts in the two pilot EFL Programs implemented online in SL (spring 2008 and spring 2009), the program evaluation framework. It also makes suggestions for implementing international research collaboration for similar EFL programs in SL based on preliminary analysis of the data.

Key words: International research collaboration, Second Life, design-based research, EFL learning.

Introduction

Educational researchers and practitioners have paid considerable attention to the use of multiuser virtual environments (MUVEs) in recent years in order to support learning across curricula. According to Nelson and Ketelhut: "Educational MUVEs have emerged in recent years as a form of socio-constructivist and situated cognition-based educational software" (2007, p. 269). Among MUVEs, Second Life (SL) is one of the most popular environments, with over 18 million registered users as of May 2008 (Second Life Economic Statistics, May 2008). This paper reports a recent endeavor of research collaboration between an American university and a Chinese university to explore various facets of EFL (English as a Foreign Language) learning within SL. The ultimate purpose of this collaboration is to find appropriate ways to integrate SL into EFL programs in China.

The exploration and research used in this project were informed by social constructivist principles applied to the context of EFL learning. The approach used to investigate related issues and problems for practical solutions is evaluation research (Krathwohl, 1998; McMillan & Schumacher, 1997). In spring 2008 and spring 2009, two pilot programs of the EFL program in SL were completed online with participants from both universities. Our efforts to this point have been to explore (a) how the affordances of SL might be a useful tool that can mediate EFL learning, (b) the effects of the EFL Program in SL on Chinese students' oral proficiency, (c) the Chinese students' perceived technology readiness for using SL, and (4) the Chinese students' perceptions of SL and the EFL Program

implemented in SL. The paper provides background information on the research collaboration, the methods used in the EFL program conducted with SL and suggestions for implementing the similar programs for international collaboration.

The Research Project Background

The research collaboration was initiated when two faculty members from the American university and the Chinese university met through the Summer Fellowship Program of the Society of International Chinese in Educational Technology (SICET). SICET is a nonpolitical, non-profit academic organization affiliated with Association for Educational Communications and Technology (AECT). The mission of SICET is to establish and strengthen academic international connections, exchanges, research, and studies in educational technology for teaching and learning, as well as to promote the application of educational technology in Chinese education (SICET, 2009). The SICET Summer Fellowship Program offers opportunities for SICET members to visit Chinese universities and to share their research findings with their Chinese counterparts through conference presentations, guest lectures, and seminars at the host institutes in China. Nearly ten universities and institutes in China have hosted SICET Summer Fellowship Program events as of May 2009.

In addition to the common research interests shared by these two researchers, two major factors informed this research collaboration. First, there was the need for EFL programs in China to find appropriate ways to integrate new technologies to their programs. Second, there has also been an emerging discussion about the use of multi-user virtual environments (MUVEs) as tools for second and foreign language instruction (Cooke-Plagwitz, 2008). This phenomenon may have evolved from two language research areas: Computer Assisted Language Learning (CALL) and Computer Mediated Communication (CMC) (Lam, 2000; Shei, 2005). Yet, little is known about how MUVEs, Second Life (SL) in particular, impact the ways in which language learners improve their language proficiency. Despite its great potentials to augment language instruction, very little research has been conducted on the use of SL in the context of learning English as a Foreign Language (EFL) - specifically in contexts where English is not spoken in everyday life, but is often limited to the classroom (e.g., learning English in China).

The EFL Programs in Second Life

During spring 2008 and spring 2009, two pilot EFL programs were implemented in SL with participants from both universities. The American university, founded in 1913, is the Southeast's leading urban research institution. It offers 52 degree programs with 250 fields of study through six colleges with nearly 30, 000 undergraduate and graduate students. The Chinese university, founded in 1984, is a key provincial university in eastern China. It is a comprehensive university with twenty one academic colleges and schools and 31 research institutes and centers. It offers 49 degree programs and has an enrollment of nearly 29,000 undergraduate and graduate students.

The first EFL Program in SL (spring 2008)

For the first pilot EFL Program in SL (spring 2008), five American graduate students participated. Three of the graduate students were doctoral students in the Instructional Design and Technology program and the other two were graduate students of the Applied Linguistics program. The American participants were proficient in SL and were prepared to interact with their Chinese counterparts in SL through participation in a short workshop.

The Chinese participants consisted of 31 English major sophomores from the English Department at Schools of Foreign Languages. The program in SL was implemented as part of a two-hour weekly speaking class in the English Department. The instructor of the course designed activities centered on topics which included the topic of globalization as a context for improving students' English speaking skills through reading and discussion. A set of SL learning activities were designed by researchers as part of guided practice as well as a means for the students to interact with American students.

The Chinese participants first completed a survey designed to gauge their technology readiness for using SL for EFL learning. Immediately after the survey, they participated in a one-hour workshop designed to familiarize them with basic navigational and communication functions of SL. After the workshop, participants interacted with their Chinese peers in SL to both familiarize themselves with the environment and to prepare a list of questions about globalization to guide the interview with the American participants.

Next, the Chinese participants were divided into two groups. In the first group, sixteen participants interacted one-on-one with an American participant to complete the given tasks in SL. In the second group, fifteen Chinese participants formed three sub-groups of five to interact with other American participants. All of the participants (both the American and the Chinese) logged into SL using preconfigured avatars. The avatars had been placed in predetermined locations within SL. Chinese participants and their American counterparts were given two language tasks. The first task for Chinese participants was to interview an American student about his/her perspectives on globalization with the goal of writing an article for their university newsletter. The second task was for the American participants to interview the Chinese participants about university student life in China. The first task was designed to help Chinese students practice oral skills such as questioning and clarification (or information seeking). The second task was designed to help Chinese participants practice answering questions in English. The participants' language performances were recorded using screen recording software in the language labs at both universities. The Chinese participants also completed post program survey followed by a focus group interviews.

The second EFL Program in SL (Spring 2009)

The second EFL Program in SL was implemented in spring 2009. The participants from the American university were 20 undergraduate students who were taking the course *IT 2010: Computer Skills for Information Age*. Their participation in the study was part of their course work requirement. The American students had a two hour workshop on SL before they engaged in learning activities with their Chinese counterparts in SL.

61 full time English majored sophomores at the Chinese university completed a study survey of technology readiness for using SL for EFL learning. From the 61 Chinese students, 20 were selected to participate in the EFL Program in SL including seven female students (35%) and 13 male students (65%). Their ages ranged from 19 to 23 with an average of 21. The participants were selected on a voluntary basis and according to their comprehensive

evaluation scores of the previous academic semester (fall 2008). The comprehensive evaluation consisted of the evaluation on students' listening comprehension, speaking proficiency, reading and writing abilities. The evaluation was done by professors at the university on a semester basis to assess students' academic performance.

The second EFL Program in SL lasted five weeks, from March 24 to April 26, 2009. The program provided the participants with opportunities to interact with American students synchronously online in SL. The learning tasks for each week consisted of: (1) one hour of learning activities in SL, (2) blog writing on the learning experiences in SL, and (3) language preparation for learning activities in SL for the next week. The learning activities in SL included a SL workshop in a lecture format, virtual tours in groups and one-on-one with SL partners, small group discussions, one-on-one interview with the American partners, and individual presentations. A Google Sites website was created to give detailed instructions on how to complete the tasks for each week. Following given instructions on the web site, the Chinese participants completed their tasks at an Internet Center on the Chinese university campus. Two Chinese research assistants were present at the site providing necessary technical support. Figure 1 is the screenshots of the participants completing different learning tasks in SL and Table 1 summarizes the tasks for the EFL Program participants at the Chinese university.

One-on-one Interview   Group Discussion

Virtual Tour   Presentation

Figure 1: Different Learning Tasks in SL

For both the formative and summative evaluation of the 2008 and 2009 pilot EFL Programs, qualitative and quantitative analyses (Creswell, 2008) were used in order to improve the EFL Program in SL. Our evaluation framework is detailed in Table 1 below.

Table 1: Evaluation Framework for the Pilot EFL Programs in Second Life

Major Evaluation Question: What should we do to improve the EFL Program in SL?	
Evaluation Contents and Questions	**Methods & Data Sources**
Technology readiness: • Are computers in the language lab ready to use SL for language learning? o SL use with American students o Video recording and data saving	• Site testing at both the American university and the Chinese university
Instruments: • Are the surveys clear to the Chinese students? • Are the instructions on learning activities appropriate for the Chinese students in terms of language level and activity contents?	• Subject Matter Expert reviews • Target student tests and comments
The Chinese students' technology readiness for using SL for learning: • Are the Chinese students technologically ready to use SL for EFL learning? • What are the self-perceived readiness of the Chinese students for perform language tasks in SL?	• Pre-program and post program surveys • Interviews • Blog posting • Site observation
The Chinese students' attitude: • What are the Chinese students' attitudes toward using SL for EFL learning?	• Post program Survey • Interviews • Blog posting
Effects on learning: • What are the Chinese EFL students' language performances in SL? • What are major benefits of SL perceived by the Chinese students for language learning? • What are major barriers in using SL for language	• Pre and post oral tests • Assessment rubrics for oral tests o Accuracy o Fluency o Language complexity

learning perceived by the Chinese students? • What are the suggestions from the Chinese students for program improvement?	○ Language appropriateness • Recorded language performances in SL • Interviews • Blog posting
The American students comments: • What comments do American students made on the Chinese students' language performances in SL?	• Post program written report

The second EFL Program generated a vast amount of data that are currently under analysis and will be summarized in a written report. These data include 94 recorded oral tests, 99 video clips of students' language performance in SL, 18 recorded interviews, 77 blog postings, as well as over 77 pre and post program surveys.

Recommendations

Evaluation is a systemic approach to program improvement, and program improvement should lead to improved student learning. Evaluation should lead to recommendations intended to optimize the program in relation to its intended purposes (Fitzpatrick, Sanders, & Worthen, 2004). According to the program evaluation results, we recommend the following for designing and implementation of similar future research program.

1.   Create multiple channels for online communications among research team members. Due to the nature of the research collaboration, the exchanges of ideas and documents are frequent and common. The research team should establish and use a file sharing system (e.g. Google docs.), and an online chat medium (e.g. QQ, Skype) that includes both audio and video chat capability for international communications.

2.   Test the technology at the site. From the pilot EFL Programs, we came to see both successes and failures that technology may bring to the EFL Programs in SL. We recommend that researchers test the technology prior to the start of each EFL program activity at each of the sites.

3.   Involve graduate students at both sides of the international border in the collaboration. Research collaboration on such a scale requires a lot of detail-oriented work. Involving graduate students on both sides not only makes it possible to collect and analyze the data effectively and efficiently but also help the graduate students learn and grow as educational researchers.

4.   Use a wide array of learning tasks. We suggest that the future EFL programs use a wide array of tasks that can elicit structured interactions (e.g., interviewing native speakers) as well as semi-structured or improvised interactions (e.g. virtual field trips to historically significant place, visits to virtual museums, organizing and participating in virtual conferences, designing and constructing cultural centers, and creating virtual art shows, etc.). Meaningful interactions in SL would not only equip the EFL students with knowledge about English speaking cultures but also provide them with appropriate ways of expressing themselves under certain social circumstances.

5.   Be careful in the site selection. The selection of virtual environments needs to be carefully considered. There are many objects in SL that could interfere and disrupt students when attempting to complete given tasks. For

example, it may not be appropriate to select a seashore site in SL where, among other things, several dolphins regularly jump off the sea when the students need to concentrate on their discussion that are not related to dolphins.

6.   Integrate multiple learning formats into the EFL Program in SL. The ultimate purpose of the research collaboration is to help the Chinese students with EFL learning with a focus on speaking. However, EFL learning should not be just limited to speaking in SL. Creating other channels of communication (such as email, blog writing, Facebook, and etc.) with American students and engaging students in writing are also beneficial to EFL learning.

The rapid evolution of digital media has afforded us the opportunity to assimilate new technologies while exploring new pedagogies in EFL language learning. We believe that our work described herein has barely touched upon this potential and we are excited about what the future may bring. Synchronous and asynchronous information and communications technology (ICT) provides opportunities for research collaboration across international borders. The ability to communicate at large distances provides both the opportunity for the sharing of culture and language, and increased opportunity for collaborative research projects. While there are many challenges associated with collaborative projects across international borders, there are tremendous opportunities for both the participants and the researchers on both sides of border. The potential for ICT and MUVE to improve communication between students from different languages and cultures is an area in which further research is needed.

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Acknowledgements

Mentoring Student Teachers as They Form Communities of Practice: An Analysis of Online Discussion Groups

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The Teachers Learning in Networked Communities (TLINC) project was developed by the National Commission on Teaching and America's Future (NCTAF) with the goals of improved teacher retention and accelerated teaching proficiency for new teachers. The goal of the TLINC project is to reduce the professional and personal isolation experienced by preservice and early-career teachers. NCTAF has partnered with three universities (and their affiliated school districts) in the United States to create and sustain online communities of teachers via the TLINC project. The three universities are the University of Memphis, the University of Colorado Denver, and the University of Washington.

Early-career teacher attrition is a significant and costly problem facing America's schools. One reason for teacher attrition is the isolation experienced by educators beginning their careers. In a teacher education program (TEP), students are prepared apart from the schools where they will serve. They are then placed as stand-alone teachers in self-contained classrooms (NCTAF, 2006). When a teacher candidate leaves the TEP, he or she leaves behind a support system of teacher educators and peers. TLINC seeks to address this isolation by focusing on three areas of need identified by novice teachers: access to high-quality teaching resources, frequent access to experts (mentors and coaches), and ongoing peer support (Silberstein, Martindale, & Young, 2007).

These three areas of need can be met through the implementation of collaborative mentoring groups. Face-to-face groups have frequently been used to meet these needs. However with the many responsibilities teachers have to fulfill and the sprawling geography of some school districts, face-to-face meetings are not always feasible. In these situations, online meetings are a viable substitute. They can enhance the benefits of collaborative groups by overcoming the limitations of fixed locations and schedules..

The TLINC project is working to implement online collaborative groups by using the Tapped In online platform (www.tappedin.org) with each of its three partner sites. The TLINC project seeks to achieve the five following outcomes through these networked communities: 1) improved teacher retention; 2) accelerated proficiency for new teachers; 3) opportunities for all teachers, administrators, and university faculty to become engaged in a learning community that continues to evolve; 4) establishment of partnership capacity-building structures and processes that assure sustainability; 5) identification of the elements of TLINC that are the source of its power, to identify the essentials for replication and scaling.

At the University of Memphis, students are assigned to small groups and a mentor during their semester of student teaching. The goal of the Memphis TLINC Project is that all student teachers would form online communities of practice. The purpose of forming these small groups is to allow student teachers to become a part of a group that will lessen their feelings of isolation and improve their professional expertise. The TLINC project is designed to provide early-career teachers with skills, tools, and support.

Review of Literature

Beginning teacher attrition is a serious problem facing America's schools. Up to 1/3 of all new teachers leave the profession within three years of teaching, and 46% of teachers leave the profession after five years of teaching. The number of teachers leaving the profession has been steadily rising since 1991 and has surpassed the number of new entrants since 1992 (Fulton, Yoon, & Lee, 2005; Silberstein, Martindale, & Young, 2007).

Teacher attrition is not isolated to any specific region. The high rate of teacher turnover can be observed across all sectors of education. The effect of this mass departure from teaching means that in the average school, almost half of the teachers have less than three years of experience (Fulton, Yoon, & Lee, 2005; Silberstein, Martindale, & Young, 2007).

One cause of beginning teacher attrition is the reported isolation felt by new teachers. New teachers are placed in stand-alone classrooms and work independently from their peers (Fulton, et al., 2005). Teacher induction programs and professional development are being used to lessen this feeling of isolation in an attempt to reduce teacher attrition. There has been much research on teacher induction and professional development programs for teachers (see e.g., Alavarado, 2006; Corcoran, Shields, & Zucker, 1998; Darling-Hammond, Lieberman, & Mclaughlin, 1995; Fulton, et al., 2005; Schlager & Fusco, 2004; Schlager, Fusco, & Schank, 1998; Smith & Ingersoll, 2004). Two possible solutions to the problem of attrition for early career educators are explored: teacher induction programs and professional development.

Teacher Induction

The number of teacher induction programs has been on the rise in recent years. These programs seek to offer support and guidance for beginning teachers in their new profession. In this study, we will use the term induction as described by Smith and Ingersoll (2004). Induction programs are not additional teacher training, but rather designed for educators who have completed their teacher training. "These programs are often conceived as a bridge, enabling the 'student of teaching' to become a 'teacher of students'" (p. 683). Researchers have shown the importance of beginning this process during a potential teacher's preservice years (Boreen & Niday, 2000; Gutierrez & Basile, 2007). We recognize the relevance of starting these programs during preservice; however, to stay true to the description set forth by Smith and Ingersoll, we will only examine preservice teachers who have completed all coursework and have begun the clinical experience of student teaching.

When discussing teacher induction, it is important to explore the effective delivery of the programs. Schlager, Fusco, Koch, Crawford, and Philips (2003) give three components of programs aiming to reduce the attrition rate are: (1) access to high-quality teaching resources, (2) frequent access to experts (i.e., mentors and coaches), and (3) ongoing peer support.

While induction programs vary in their depth and duration, almost all involve mentoring. For the purposes of this study, the mentoring component of teacher induction will be our focus. Again, we will use the Smith and Ingersoll (2004) definition of mentoring, "Mentoring is the personal guidance provided, usually by seasoned veterans, to beginning teachers in schools" (p. 683). It is important to keep in mind that while most induction programs involve mentoring, mentoring is not the only component and the two are not synonymous (Fulton, et al., 2005).

Some school systems offer mentoring programs to all teachers new to a particular school and others offer them only to those teachers who are new to the profession (Smith & Ingersoll, 2004). No matter how the program is structured, providing access to mentors to all teachers can be problematic. Providing an appropriate match of novice and mentor can pose a challenge. These programs can also be a great strain on a system's resources (Schlager, Fusco, Koch, Crawford, & Phillips, 2003).

Despite the challenges, the efforts are worthwhile. Smith and Ingersoll (2004) found that the largest reductions in attrition were connected to schools that provided activities that put new teachers in collaborative networks with more experienced peers.

Teacher Professional Development

Teacher professional development differs from professional development found in other fields. Schlager, Fusco, & Schank (1998) credit this to the circumstances that (a) teachers are isolated, (b) teacher professional development takes place as formal, highly-structured activities that are not relevant to the daily work of teachers, and (c) often uses the "train-the-trainer" model which often does not meet the needs of most teachers. Most teacher professional development activities are conducted as inservice days or workshops. This piecemeal approach does not allow for a continuous and customized plan for effective teacher professional development (Schlager, Fusco, & Schank, 2002).

For this study we choose to view professional development as a holistic process. We have chosen to adopt the definition given by Schlager and Fusco (2004), "Professional development is viewed as a career-long, context-specific, continuous endeavor that is guided by standards, grounded in the teacher's own work, focused on student learning, and tailored to the teacher's stage of career development" (p. 5).

Providing a holistic professional development program can pose challenges for districts. Teachers have reported that they do not value being taken away from time with their students to attend workshops that are not content-specific enough to be meaningful (Alvarado, 2006). Because time is often taken away from instruction to conduct professional development activities, school systems should make every effort to ensure those activities are high quality.

Corcoran, Shields, and Zucker (1998), suggest that if professional development programs are left unchanged, districts will have to make a trade-off: either work with large numbers of teachers superficially or small numbers intensively. They pose 10 dimensions that exemplify high quality professional development:

- Put the emphasis on teacher knowledge of subject matter.
- Draw on the knowledge base about teaching.
- Make a coherent, sustained effort.
- Have a provision of sufficient time and intensity.
- Make opportunities for teachers to be active learners.
- Help teachers make meaningful intellectual, social, and emotional engagement with ideas, materials, and colleagues.
- Engage teachers in planning, design, and delivery of professional development activities.
- Recognize teachers varying expertise, experience, and beliefs.
- Make activities accessible and inclusive.
- Provide incentives for participation. (p. 15-18)

Darling-Hammond, Lieberman, and McLaughlin (1995) agree that the current professional development process is in need of restructuring. They also view the process not as a series of workshops and inservice days, but as one of building reflective communities. They suggest that traditional inservice be replaced by opportunities for knowledge sharing. These opportunities should be afforded by blocks of time being set aside specifically for this purpose. They also suggest that these knowledge sharing times be encouraged by district leadership and that the leadership provide the resources necessary to accomplish this form of professional development.

These collaborative forms of professional development facilitate teachers becoming leaders. Riel and Becker (2000) and Gutierrez and Basile (2007) describe strong teacher relationships as being essential to teacher leadership. This transformation to leadership embodies the transition to holistic, collaborative professional development by allowing teachers to provide guidance to their peers.

This reformed version of professional development can aid in teacher retention by giving teachers an equitable voice (Gutierrez & Basile, 2007). The collaborative process can help reduce the reported isolation felt by teachers (Darling-Hammond, et al., 1995). With this in mind, several strategies should be implemented for professional development with a goal of teacher retention. Studies (Corcoran, et al., 1998; Darling-Hammond, et al., 1995; Gutierrez & Basile, 2007; Schlager, et al., 1998) have revealed some of the most important characteristics of this type of professional development. These characteristics are (1) professional development is an ongoing process, (2) knowledge sharing among teachers is necessary, (3) time allowance for collaboration should be incorporated, and (4) teachers should be engaged in the planning of activities.

Teacher induction and professional development can both aid school systems with teacher retention. Both induction and professional development work better when teaches work in collaborative groups. When teachers begin working together toward common goals, they form a community.

Communities of Practice

Communities of practice were first introduced by Lave and Wenger in 1991. They were expounded upon by Wenger in 1998. Wenger describes communities of practice as being three-fold. For communities to be communities of practice, they must have a "mutual engagement, a joint enterprise, and a shared repertoire" (p. 73). Brown and Duguid (1991, 2000) also stress the importance of the word practice. They posit that practice is central to the concept and that the purpose of a community of practice is the activity of getting work done.

This "work" that needs getting done by the community of practice can be general or specific. One type of community of practice, the bounded community, is formed in a structured setting and begins with specific work. The setting is typically a class. These communities are bounded by expectations, as well as a timeframe. Bounded communities go through three phases: initiation, participation, and closure. It is important to note that part of closure

may be the formation of an unbounded community (Wilson, Ludwig-Harmon, Thorman, & Dunlap, 2004). For this type of community to fit our key principles for teacher induction and professional development, they must form an unbounded community.

Designing for Communities of Practice

Although teachers often work together for a common purpose, they do not necessarily form communities of practice. Schlager and Fusco (2004) state that communities of practice should not be created separate from the professional community. Wenger, McDermott, and Snyder (2002) give seven design principles to form exciting, relevant, and valuable communities of practice: 1) design for evolution; 2) open a dialogue between inside and outside perspectives; 3) invite different levels of participation; 4) develop both public and private community spaces; 5) focus on value; 6) combine familiarity and excitement; and, 7) create a rhythm for the community. Following these principles, a community of practice can be successfully designed for. However the bigger challenge may be sustaining the community.

Participation and adaptability are key to the sustainability of communities of practice. Active participation within the community is vital to its success (Wenger, McDermott, & Snyder, 2002; Wilson, et al., 2004). Participation in a community of practice is voluntary. So to sustain the community, it must be a place where people want to be. It must be exciting, relevant, and valuable (Wenger, et al., 2002). To remain exciting, relevant, and valuable, the community must adapt to new members and new circumstances (Brown & Duguid, 1991).

Social Networks

Because communities of practice must adapt to survive, we want to look at social networks as a means of making new connections for the community of practice. Penuel and Riel (2007) define a social network as "a set of people and the relationships among them" (p. 611). These networks provide many advantages such as the promotion of collaboration, building new relationships, and bettering communication skills (Cross, Borgatti, & Parker, 2002, Jones & Conceicao, 2008). They also provide access to experts and other help outside a member's immediate circle (Penuel & Riel, 2007).

Social networks support collaboration, which is important for job satisfaction and performance (Cross, et al., 2002). They also aid in the promotion of personal development (Jones & Conceicao, 2008). This increased satisfaction may lead to higher retention rates for new teachers.

Limitations

As with induction and professional development, access to experts and time are obstacles in communities of practice. Penuel and Riel (2007) state that building in time for experts to help is crucial, especially if funding is scarce. To combat the scarcity of time and access to experts, we must look at another option for supporting communities of practice.

Online Communities

Professional networks among teachers are a growing trend (Schlager, Farooq, Fusco, Schank, & Dwyer, 2009). Traditionally, teacher induction and professional development have taken place in face-to-face groups. Communities of practice have also taken the face-to-face format to meet. However, with the prevalence and accessibility of the Internet, we should explore how web-based tools can be used to facilitate communities of practice with the purpose of induction and professional development.

Wenger, White, Smith, & Rowe (2005) point out that technology does not make a community. This illustrates the importance of keeping the focus on the community of practice and not on the technology. Technology can provide access to experts that are not located in a specific school or even region. It can enable more time to access the community outside of working hours. It can provide many tools to facilitate interactions within the community. However, as stated in previous sections, participation and adaptability are key to sustaining communities. The tools must allow for and encourage participation and adaptability or the community risks certain failure.

Benefits of Online Communities of Practice

Online communities provide members with access to community resources 24 hours a day, seven days a week (Grove, Odell, & Strudler, 2006). By sharing or posting resources in an online community, the time constraints

of meeting during work hours are lessened if not completely lifted. In Fletcher, Tobias, and Wisher's (2007) work with advanced distributed learning, they found it was beneficial to have materials readily accessible for teachable moments. The same concept applies to storing resources in the online community.

Another benefit of online tools is the ties that are formed. It is not always the intended audience that benefits from the sharing of resources in the online community (Schlager, et al., 2009). Others may benefit at a different time or in a different situation from materials that are shared.

Online communities of practice also allow for access to experts that may not be located in physical proximity to a school. This is especially beneficial when funding is not available to bring experts to the location. Many teachers find themselves in situations where they are the only person in their area of expertise. Online communities allow them to share resources with experts or peers who share their situation.

Limitations of Online Communities of Practice

Freeing up time and access to experts are great benefits of online communities of practice. But despite these benefits, online communities are still not well understood (Schlager, et al., 2009). Even though online communities of practice allow more options for time to participate, a survey by Fusco, Gehlbach, & Schlager (2000) found that lack of time was still a barrier to participation for some members of an online community of practice.

Time is not the only resource that limits the adoption of online communities. Lack of funding and human capital also pose barriers (Farooq, Schank, Harris, Fusco, & Schlager, 2007; Fusco, et al., 2000). Online platforms often have a subscription fee and training users on the platform can also incur costs. Also, a facilitator is often necessary to preside over groups, at least initially (Spitzer & Wedding, 1995).

Another limitation is the lack of tools to assess online communities of practice. Current measures and technologies do not adequately measure or characterize the communication in these groups (Schlager, et al., 2009; Tatar, Gray, & Fusco, 2002). Better assessment tools need to be created for studying online communities of practice.

The user-friendliness of the online community's platform can also be an obstacle. If the site does not meet the end user's needs (Farooq, et al., 2007) or is difficult to navigate (Fusco, et al., 2000; Schank, et al., 2002) users will become discouraged from investing time and energy into the online community of practice.

Perhaps the largest obstacle in implementing online communities of practice is developing a critical mass of participants (Barab, McKinster, & Moore, 2001; Farooq, et al., 2007; Hebert, Clift, & Wennerdahl, 2008). Active participation is key to sustaining any community of practice. This becomes even more apparent in an online community (Spitzer & Wedding, 1995). When members log in to their online community and no one is ever there to collaborate with, they lose interest and the community as a whole loses value.

Designing for Online Communities of Practice

In a study by Schlager, Fusco, Koch, Crawford, and Phillips (2003), they asked how a technology-supported teacher network could be implemented and scaled up to meet teachers' professional support needs. We also seek to answer that question in this study. While there is not a one size fits all answer to the question, the literature provides us with direction.

To mitigate the limitations of online communities of practice, a great deal of thought must go in to the design of the online platform (Spitzer & Wedding, 1995). Koch and Fusco (2008) give three phases online communities of practice go through: getting started, modeling and scaffolding, and maturing. It is important that the platform meet the needs of the community at all three levels.

Bringelson and Carey (2000) encourage designers of platforms to be aware of the community for which they are designing. The designer must know who the community members are and why they are engaged in the community (Fusco, Gehlbach, & Schlager, 2000). Bringelson and Carey (2000) give us five guiding points to use when assessing the community. When designing a virtual venue, one should know the community's:

- previous exposure to technology,
- access to new and developing technologies,
- time and rhythm of accessing the venue,
- breadth and depth,
- and sustainability of the interactions. (p. 63)

The technology also needs to support a climate of comfort and trust for the members of the community. This includes generating a feeling of togetherness that lasts over time and across distance (Wenger, White, Smith & Rowe, 2005). Allowing for conditions that support critical thinking and constructive criticism promote more risk-

taking and response. This in turn allows for groups to be innovative (Tatar, Gray, & Fusco, 2002). This risk-taking, responsiveness, and innovation build the excitement and add value to the online community of practice. These characteristics add to the sustainability of the group.

Another key component for designing sustainable platforms is providing access to support. Farooq, Schank, Harris, Fusco, and Schlager (2007) revealed four design interventions that contributed to the sustainability of their online platform. The four interventions are providing users with contact and bug reporting forms, a forum for group members to discuss needed features for the platform, a published task list so users could see what developments were in the works and a timeframe for their implementation, and a help desk.

Much more research needs to be done on the effectiveness of online platform designs. First, tools will have to be developed to accurately project the value communities receive from their online platforms. Fusco, et al. (2000) also suggest the need to know if there is a correlation between log ins on a platform and perceived gains of the users. We expect many more research questions in the near future as the use of online communities of practice continues to expand.

Summary

Online communities of practice can help slow teacher attrition by lessening the isolation felt by early career educators (Spitzer & Wedding, 1995). When used for teacher induction and professional development, online communities of practice provide educators with access to experts, peers, and high-quality resources without the inhibitors of time and physical limitations. While there is much research that needs to be done to validate the use of online platforms for teacher retention, the literature shows that their use is a viable option for many school districts.

Case Study

The University of Memphis is one of three TLINC project sites. The focus of the Memphis site is to form online communities of practice for student teachers. During the 2008-2009 school year, preservice teachers at the university were assigned to a mentoring group during their semester of student teaching. The student teachers connected with their groups online using the website Tapped In (http://tappedin.org). Each group consisted of a mentor and an average of six student teachers that share a common focus area. The mentors were either university faculty or a classroom teacher who has been teaching for more than three years and has been recommended for the program by their supervisor or university faculty. 170 student teachers and 20 mentors participated in the project.

During the year, the groups met for a synchronous chat at least three times during the semester. The average chat lasted about 45 minutes. Mentors facilitated the conversation during each session. The TLINC research team did not assign discussion topics. The mentors chose topics they perceived to be beneficial, and topics emerged from concerns voiced by the student teachers. The mentors submitted transcripts of each chat to the research team.

Methodology

The approach to inquiry chosen for this study was a single, within-site, case study. The issue addressed was the isolation felt by new teachers. The bounded case consisted of students completing their student teaching semester during the 2008-2009 school year at the University of Memphis. Data for this study was in the form of collected transcripts of the small group discussions. 105 transcripts were collected from August 2008 until May 2009. Maximum variation was sought by including all of the submitted transcripts in the analysis to identify important common patterns (Cresswell, 2007). Two researchers independently reviewed each transcript and coded the comments into categories. The researchers then compared and discussed the categories. Common themes emerged during this process.

During this study, data was also collected using electronic surveys and focus group interviews. However, the focus of this article is the conversations of student teachers in online communities. Therefore, only the data from the conversation analysis is included.

Findings

The topics discussed in the online communities varied between groups. All groups included general greetings and small talk at the start of their sessions. This usually occurred when two or three participants had

logged on and were waiting for the other participants to join them. In early chats, some technical issues were discussed. Some participants shared issues they had logging into the system or finding their assigned group room. Comments concerning technical issues decreased dramatically as the semester progressed.

Although the group members were pursuing various teaching specialties, (i.e. special education, elementary education, secondary education, etc.) they shared many common topics of discussion. Three key themes emerged from this analysis. The emergent themes were The Work of Teaching, The Teacher as a Professional, and Readiness to Teach. These themes are categorized in the following table.

Themes	Sub-Categories
The Work Of Teaching	• Lesson Planning • Teaching Strategies • Classroom Management • Time Management
The Teacher as a Professional	• Supervisory Issues • Culture of the School • Sharing Resources • About the Field
Readiness to Teach	• Preparedness (as related to coursework) • Emotions • Relating to Students • Experiences in the School • Securing Employment

Implications

Based on these emergent themes, the structure of the University of Memphis' TLINC project will change. Beginning in January 2010, mentors will base each of their three required synchronous chats on one of the three emergent themes. This will give the groups more focus and allow mentors to better prepare for the chats. Students will also have a better idea of what contributions they can bring to the group each month. Asynchronous chats using a discussion board will be used to address concerns that the students have that do not fit one of the themes. The discussion boards will also be used when students have a concern that needs to be addressed before the next scheduled chat time.

The findings of this study will also be shared with the University's Office of School Based Clinical Practice. This office conducts workshops and sessions for student teachers. Knowing these themes may benefit them as they plan future workshops for student teachers.

Future studies are also being planned based on the findings of this analysis. Member checking of the emergent themes is currently being conducted. The data collected from the transcripts must now be triangulated with the results of the electronic surveys and focus group discussions. Hopefully the complete picture provided by this triangulation of data will tell us if this process met our goals of reducing the isolation felt by new teachers and improving their proficiency as they enter the classroom. A follow up study needs to be done with the students who participated in this project as they enter their first years of teaching. It will be important to know if they continue to use online communities of practice for support. It will also be significant to know what their perceived benefits of these groups are, especially if they lessen their feelings of isolation.

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Trends in Online and Video-Based Courses in Higher Education

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Introduction

Distance education evokes strong reactions for many in the field of higher education. When considering distance education options, students search like consumers. Students search for courses convenient to their schedule, budget, and lifestyle. With more non-traditional students enrolling in higher education, distance education is being implemented to help meet student demand, and higher education is becoming a proving ground for new forms of content delivery.

For administrators, distance education may be seen as a source of increased revenue. This can lead to both positive and negative repercussions. In a positive sense, education is available to more students. In a negative sense, distance education can be viewed as a means of generating more revenue with less regard for quality. These relatively new types of demands involve the rapid movement towards distance education.

Distance Education Defined

The definition of distance education varies across and even within universities. With mislabeled course descriptions, students are unable to determine their ability to succeed in the course. Only certain personalities have been proven successful in distance education courses (Heffner & Cohen, 2005). Successful students are self-motivated and able to work independently. At the same time, these students are confident enough to receive minimal feedback from the instructor at times. Perhaps most important, the successful student is competent with Internet, e-mail, communication on-line, and minimal typing and writing skills.

Unfortunately, the decisions for course descriptions are often determined by each college within the university or by a particular administrator instead of the professor that is responsible for the course. Therefore, without a set definition, confusion takes place for all those involved. For example, a web assisted class in the college of business may be a face-to-face course with a Learning Management System (LMS) for videos and PowerPoints available. However, a web assisted course at the same university in the college of history may meet face-to-face only five times the semester and have a LMS for discussion boards, assignments, etc. Students may not be aware of the type of course in which they have enrolled until the first day of class.

The most common terms that apply when discussing distance education include Compressed Video Network (CVN), Web Assisted, or Hybrid. To help minimize this confusion for the purpose of this discussion, CVN, web assisted, hybrid, and distance education will each be defined.

Compressed Video Network operates with "narrow bandwidth communications" (Schlosser & Simpson, 2005). CVN is used to teach students at more than one location simultaneously. To be successful using this method, the instructor is required to be creative. All students are not in the same room with the instructor, in some cases, the student may be the only one in the room. However, the students can interact with each other and the teacher through visual and verbal communications. Although the instructor cannot always be in the classroom with the students he/she can view the body language and facial reactions of the students, depending on the equipment available. If proper equipment such as large screens is not available, instructors will not be able to view or relate to the class at alternative sites. Each individual class is connected and treated "as part of the extended class" (Hanna, 1998). The students and instructors meet at regularly scheduled times but at the convenience of various locations.

CVN seems to be a perfect blend between the traditional classroom and distance education. However, some universities found that "using compressed video as the single medium of delivering distance education" (Weber, 1996) was not as efficient as hoped. Instructors face issues when diving into the classroom. A few examples observed include the equipment turning off in the middle of a student question or shutting down if the students are not moving in the off-site classroom. Another issue includes the instructor's voice. A soft spoken or strongly accented instructor would be difficult to understand. In the case observed, the microphone was placed on a podium restricting movement and requiring the soft spoken instructor to speak directly into it. Hands-on information do not always translate well through this medium. Furthermore, some instructors complain because this type of instruction limits their freedom of movement

Some issues for administrators to consider when beginning a CVN program include scheduling between campuses, grading systems, availability of books and materials, student advising, and faculty training (Weber, 1996). When scheduling classes, the course must accommodate students on all campuses involved. The students should be advised on what is expected in the course and where and when the books will be available. Lastly, the faculty must be trained on the equipment. In the event of a technical problem, the instructor should be able to handle minor operating problems without calling for technology assistance. When communicating with students, the instructor will need to rely on e-mail for the off-campus site(s). It will be the best way to keep in constant contact and monitor progress. As far as the instruction method, the lecture method does not work well in this environment. However, "multimedia presentations" have been proven effective (Weber, 1996).Nonetheless, some instructors are unable to interact with students without visual. Tasks that require hands-on manipulations do not work well through CVN. Instructors also discovered teaching at each site throughout the course helped to develop relationships with the students.

Another type of evolving non-traditional classroom is the web-assisted or hybrid course. The web-assisted or hybrid course is similar to the traditional classroom. Instruction occurs face-to-face with varying degrees of technology implemented. Often, the students can access the information through a wiki, blog, or learning management system (LMS) such as Blackboard. According to the 2006-2007 National Center for Education Statistics (NCES) report, 35% of 2 and 4-year institutions reported offering hybrid courses (Parsad & Lewis, 2008). At the same time, the number of students enrolled in hybrid classes was just over one million (Parsad & Lewis, 2008). Several examples for "extended traditional universities" are available (Hanna, 1998). One includes Washington State University (WSU) and their Web University. WSU foresees the Web University "courses suited for electronic export via satellite, Internet, or a K-20 network" (Hanna, 1998). (Note the word suited.) Similarly, the University of Wisconsin has developed the Center for Learning Innovation, now known as UW Learning Innovations, in order to "develop and commercialize" the university programs and software (Hanna, 1998). WSU and UW predicted the surge of CVN, hybrid, on-line and cooperative programs with K-12 schools more than ten years ago. Looking at this prediction now, where will these programs be in ten years more?

To compare a hybrid course to traditional face-to-face course, a study was conducted with 80 psychology students (DeNeui & Dodge, 2006). It focused on the integration of Blackboard in a face-to-face course. The students were not required to use Blackboard to pass the course; however, all course documents, assignments, announcements, and

detail the number of times each student visited the site (DeNeui & Dodge, 2006). They found the "females used Blackboard significantly more than did males" (DeNeui & Dodge, 2006). In relation to this result, the females had a significantly higher final grade than the males. Overall, the researchers only found a "small but significant correlation" between Blackboard usage and final grade (DeNeui & Dodge, 2006). Another study on the correlation of grades and students' behavior was performed. Its results were significant for the 154 undergraduate psychology students involved (Heffner & Cohen, 2005). The students reported a 90% daily internet usage with 27% of the students stating the course caused an increase. The students were using the Internet to access the courses the information. According to the researchers, the students who passed the coursed "more frequently accessed the Answers to Reading and Lecture Questions" portion of the website (Heffner & Cohen, 2005). Also, there was a significant correlation between the final exam score and the Answers to Reading and Lectures Questions which was viewed as a study guide (Heffner & Cohen, 2005). An interesting pattern from the data was the females accessed the information more frequently than the males. Nearly everyone reported using the Internet daily to gain information.

Distance education is "a field of education that focuses on the pedagogy and andragogy, technology, and instructional systems design that aim to deliver education to students who are not physically "on site" (Distance Education, 2009). In comparison, Schlosser and Simonson define it as "institution-based, formal education where the learning group is separated, and where interactive telecommunications systems are used to connect learners, resources, and instructors" (Schlosser & Simpson, 2005). Distance education occurs when students are connected most often by the internet through a learning management system. During the 2006-2007 school term, 9.39 million students enrolled in distance education courses (Parsad & Lewis, 2008).The instructor delivers assignments, provides discussions, projects, and administers tests.

Washington State University (WSU) developed Distance Degree Programs (DDP) in order to meet the needs of distance education (Kendall, 2005). In 1992, WSU began the DDP with fifty-seven students. Now the DDP has graduated 1,400 with bachelor's degree and enrolls an estimated 5,500 students each semester (Kendall, 2005). The DDP at WSU ensures each course meets internal integrity or a face-to-face course will contain the same content as an online course. The DDP acts as a portal for students to enter their courses, gain information about advising, grades, etc. At the end of each semester, the students are given an evaluation for feedback. Their advisors encourage them of save a copy for records. Other services offered from DDP include tutoring, live chatting with forums,

communication areas, and book rental sites (Kendall, 2005). Each of these services have been tried and proven at WSU. It is similar to the University of Memphis student MyMemphis portal. MyMemphis portal includes has links for registration, accounts, admissions, advising, umdrive, etc. Individual institutions should determine their and their students' needs.

Growth and Success in Distance Education

The United States Department of Education has monitored the growth of distance education. According to the National Center for Education Statistics, the number of distance education courses is growing rapidly. During the 2006-07 school year, 66% of the 4,200 postsecondary institutions offered a form of distance education course. Interestingly, the most widely accepting of the distance education was the public two year colleges. Almost all of these community based colleges allowed for online courses and degree programs. Surprisingly, the schools lagging behind were the private universities and colleges.

By spring 2009, Arkansas and Tennessee have already observed growth of distance education courses offered on both college and university campuses. According to web-based research gathered from institutions in Arkansas and Tennessee, the national numbers have increased by comparing the current state numbers. In Arkansas, there are 44 public or private universities and community colleges. At this time, forty-one institutions offer online courses (Arkansas Department of Higher Education, 2009). These online courses are those which are taught using a LMS. In comparison, Tennessee has 46 public or private universities, community colleges, and Tennessee Technical Colleges (Tennessee Higher Education Commission, 2009). Each institution offers online courses.

As the numbers indicate, distance education is becoming the educational method of choice. Distance education has become popular "for working adults, for persons in locations without immediate access to formal education facilities, and for persons with disabilities" (Milligan & Buckenmeyer, 2008) For example, working adults may include first time degree seekers or degree seekers who are earning their graduate degrees. While these students are more likely to appreciate the convenience of distance education, all of the students may not have the necessary skills required for the course(s). These categories of students have become known as the non-traditional students. To meet their specific needs, administrators have begun developing degree and certificate programs online exclusively. An estimated 11,200 degree and certificate programs have been designed for this specific purpose by 2006-2007 (Parsad & Lewis, 2008). Of those online opportunities, 66% were reported as a degree program (Parsad & Lewis, 2008). At Arkansas State University, graduate students can earn a MSE in Education Theory and Practice (a non-licensure program) through online courses.

Future Issues

Issues such as convenience, increased class sizes, increased revenues, and economical concerns are among the issues causing these trends towards increased distance education classes and degree programs. When trying to meet the needs of the students the administrators look at several items. According to the NCES the most reported items include, flexible schedule for students (68%), access for all students (67%), and course availability (46%) (Parsad & Lewis, 2008). Administrators want to increase the numbers of minority students while offering cost-effective instruction to all students (Clark, 2009). According to a previously mentioned study, students who live far from campus are at a disadvantage for access to education. Therefore, these students might choose any of the current distance education options available (Dellana, Collins, & West, 2000). For example, students might choose to attend a hybrid course with limited in class instruction or a complete online course.

Particular trends and issues will be discussed as well as appropriateness of some of the trends. Can any class be an appropriate online course? Currently, administrators want to make all types of classes available on-line. This includes classes that are theoretical, field-based, kinesthetic, foundations, and methodology courses. Is this particular trend really where we should go or is it simply a means to make money? The student-instructor interaction is a concern for many in regards to distance education. Without the physical classroom, the interaction and relationship is altered inevitably in the minds of some instructors (Dellana, Collins, & West, 2000). There are mixed results from research on the overall effectiveness of an online methodology course (Dellana, Collins, & West, 2000). Most show favorable results for graduate methodology courses while giving unfavorable results for undergraduate methodology courses. This could be related to the type of student. To help view this more closely, a research study was done with 199 students. They were enrolled in an identical course taught by the same instructor either face-to-face or face-to-face with an online component. Sixty-five students were enrolled in the face-to-face course and 135 were enrolled in the online course (Dellana, Collins, & West, 2000). The study found no significant difference between the two final scores for the courses. However, in both courses, there was a significant relationship between the type of course, GPA, and absence rate (Dellana, Collins, & West, 2000)

One type of course discussed earlier was the hybrid course. The trend being researched is a hybrid degree program. Because the courses would be traditional with online influence, the students would have more schedule flexibility (Toth, Fougler, & Amrein-Beardsley, 2008). Research of nine hybrid courses from 450 students was performed. To begin, the students and instructors were given surveys. Although some students enjoy the hybrid method, expectations and course design must be clearly communicated to students from the beginning. When developing the degree program, eliminate any inconsistencies from the courses (Toth, Fougler, & Amrein-Beardsley, 2008).

To assist in the determination of the overall effectiveness of the courses, each semester students are asked to evaluate instructors and the course. These evaluations are supposed to determine the instructor's ability to impart knowledge. However, there has been "clear evidence" these are a poor method of evaluation (Clark, 2009). With the movement towards online courses, the need to verify teaching ability, which is necessary for promotion, is becoming more complicated. It is not as simple as with a traditional course. The instructor can no longer invite the department or committee chair into the classroom to observe his or her teaching ability. The instructor must produce evidence of teaching standards (Oslington, 2005). Although projects have been attempted, they have not been proven successful. Another issue is the ability to "attract good students" (Molenda, 2009). No matter the course format this has always been an issue for each department. However, technology departments understand the expense necessary for equipment and the need for students. The purchase of new technology is expensive. Therefore, technology departments must be competitive for top students in order to keep from being given budget cuts (Molenda, 2009).

Conclusion

When designing the new online courses, the curriculum is sometimes allowed to suffer. For example, course requirements and learning expectations are sacrificed to meet "consumer" needs (Dellana, Collins, & West, 2000). In order to be considered a quality course, it must include pieces from the face-to-face course, "effective pedagogical technology," and learning theory (Toth, Fougler, & Amrein-Beardsley, 2008).

Teaching method includes collaborative problem solving is recommended for most higher education courses (Clark, 2009). At the same time, beginning students lack the skills required for success in discovery learning and collaborative teams (Clark, 2009). Strong cases have been made for guided discovery methods with demonstrations and immediate feedback. Recently developed Cognitive Load Theory offers a solution to the multimedia instruction. There needs to be more research in this area. For example, there has been research on the same instructor teaching in various delivery methods, but what about the teacher that is so dynamic in person that online can not capture the same essence? Again, the research has primarily focused on classes in general as if all classes are the same. Do some classes shine in an on-line environment more than face-to face and will which ones will fail miserable because of the particular content or necessary means of delivery. What about when on-line is the only option given to students? How does that affect student's attitudes and successfulness?

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Design of a Web-based System to Support Assessment in Virtual Environments for Learning (VEL)

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Introduction

One of the affordances of Internet-based learning environments, from e-learning to online electronic games, is the potential to provide formative assessment. Learning and instructional theories maintain that students come into the learning environment with preconceptions of the world; it is important to conduct formative assessment to reveal their thinking and to design activities to improve their understanding (Brandsford, Pellegrino, & Donovan, 1999). Research indicates that formative assessment can indeed lead to strong learning gains (Black & Wiliam, 1998). However, formative assessment is practiced infrequently in the classroom because it is extremely time consuming and requires expertise that teachers usually do not have (Hunt & Pellegrino, 2002; Pedersen, Arslanyilmaz, & Williams, 2007). Technology tools can be designed to facilitate formative assessment. There is a body of literature on formative assessment and computer tools designed to facilitate formative assessment, but there is little guidance on how to use technology to facilitate formative assessment in Internet-based learning environments.

This paper describes the design of a web-based management system created to facilitate formative assessment in Virtual Environments for Learning (VEL), which consists of a set of computer-based modules developed to engage children in student-directed inquiry. This paper may be of interest to researchers and practitioners interested in assessment in virtual learning environments.

Formative Assessment

There is no consensus on the definitions of formative assessment, and different terms such as "feedback," "formative evaluation," "classroom evaluation" have been used interchangeable with formative assessment (Wiliam & Black, 1996). Formative assessment may be conducted using different strategies (McGuire, 2005; Wiliam, Lee, Harrison, & Black, 2004) including dialog between teachers and students about the learning process, self assessment, peer assessment, rich questioning, comment-only marking, and criteria sharing with students. In spite of the different definitions and different strategies used to implement formative assessment, researchers (Harlen & James, 1997; Miller, Bradford, & Cox, 1998; Wiliam & Black, 1996) seem to generally agree that formative assessment differs from summative assessment in that information about student performance should be fed back to the student to influence the learning process.

In schools, assessment is usually associated with accountability and standardized testing. This type of high-stake summative assessments is greatly valued by administration, yet researchers argue that these tests usually have little positive impact on student learning (Wiliam et al., 2004). In contrast, formative assessment can lead to strong learning gains (Black & Wiliam, 1998). For example, timely feedback reduces the learning time needed and it better motivates students (Corbett and Anderson cited in Koedinger, 1998). Two studies that evaluated the effectiveness of a web-based formative assessment tool in undergraduate psychology courses found that students who used the tool achieved higher level of performance than those who did not (Buchanan, 2000). Another experimental study found that improving formative assessment could actually benefit students' performance in mandated summative assessment (Wiliam et al., 2004).

Using Computers in Formative Assessment

Hunt and Pellegrino (2002) present a couple of reasons why formative assessment has not been a common practice in the classroom. First, it is not feasible to expect all teachers to be experts in formative assessment, because to perform effective formative assessment, teachers need to know ahead of time all the materials students need and all the potential problems students may have. Second, formative assessment is very time consuming because it requires teachers to identify, analyze, and address the problems each individual student has. It is not realistic to ask teachers to spend extensive time on each student. Further, formative assessment in problem-based learning (PBL) environments is particularly challenging (Hoffman & Ritchie, 1997). These environments are usually open-ended,

and students take initiative in negotiating learning objectives and assessment methods. Teacher feedback is critical to student success, but the ill-structured nature of learning environment makes formative assessment particularly difficult. To address these issues, Hunt and Pellegrino (2002) propose that technology tools be designed to automate formative assessment tasks. This agenda is supported by National Research Council (NRC), which recommends that developers of educational materials create tools "that will enable teachers to implement high-quality instructional and assessment practices" (NRC, 2001b).

Researchers usually categorize computer-supported formative assessment based on the content of feedback provided to the learner. McKendree (cited in Merrill, Reiser, Ranney, & Trafton, 1992) distinguishes between feedback that simply points out that an error has occurred from those that also remind the learner of the current goal and aspects of the error. Similarly, Reiser, Connelly, Ranney, and Ritter (cited in Merrill et al., 1992) discusses minimal feedback strategies which only inform the learner of the error without further information as compared to explanatory feedback which identify the aspects of the solution that are incorrect. Narciss (1999) uses the level of informativeness to classify computer provided feedback into three categories: feedback with low informativeness provides knowledge about results; feedback with medium informativeness offers knowledge about mistakes; feedback with high informativeness embeds knowledge on how to proceed. Graesser, VanLehn, Rose, Jordan, & Harter (2001) discuss three levels of feedback: backchannel feedback, evaluative pedagogical feedback, and corrective feedback. Backchannel feedback acknowledges the learner's input by having a pedagogical agent periodically nodding and saying uh-huh while the learner is typing important words into a system. Evaluative pedagogical feedback conveys negative, neutral negative, neutral positive, and positive evaluation of the learner's responses. Corrective feedback provides canned responses to correct common bugs and misconceptions.

Despite the different categories or taxonomies of formative assessment/feedback, researchers seem to generally agree that the levels of formative assessment/feedback can vary depending on how much information provided to the learner. Lower level feedback only indicates that an error has occurred; the location of the error, the aspects of the error, and suggestions on how to correct the errors are provided in higher level feedback. Research shows that higher level feedback tends to result in better learner performance (Merrill et al., 1992) and motivation (Narciss, 1999) than lower level feedback.

The Design of the Assessment System

A web-based system is being designed to manage the implementation of VEL. The task presented in a VEL is ill-structured and anchored in an opening scenario or movie. Each VEL contains information resources in the form of virtual scientific instruments and hypermedia assets which students use as a resource for conducting inquiry. Additionally, each VEL contains scaffolds which aid students in conducting inquiry. A web-based system contains tools for assessing student learning and resources for supporting teachers in effective integration of the VELs into the classroom.

The assessment system interfaces with the VELs. Students' responses are delivered from the VELs to the assessment system. The teacher accesses students' responses through a web interface and provides individualized feedback. The feedback is sent from the web-based system to the VEL and presented to students in the virtual environment.

The design of the assessment system was informed by our previous work that examines how teachers assessed student learning and their reasons for these assessment practices when using Alien Rescue, a computer-based, problem-based learning (PBL) environment (Pedersen et al., 2007). The study suggests the following design guidelines for improving Alien Rescue and other PBL programs. The first guideline is to embed multiple-choice questions within PBL activities. Although this practice is inconsistent with social constructivist learning theories, teachers need multiple-choice questions because of high stakes testing. The second guideline is to provide modifications and scaffolds within the PBL program that teachers can assign to individual students based on special needs. Some teachers were concerned that PBL is too challenging for some students. They may need to provide greater structure and support for them. The next two guidelines concern educative components, information embedded in the PBL program to educate teachers about how to best implement the program. For example, educative components should present research findings on motivation, especially the impact of grade on intrinsic motivation. They should also emphasize the value of student reflection on their process and solution through self and peer assessment.

Performance-centered design (Raybould, 1995) also provides guidance for our development effort. It is a system design methodology that focuses on the system user as a task performer who is supported by a knowledge base provided in a just-in-time fashion. It aims to reduce training and improve task performance via just-in-time information and easy-to-use tools. It is consistent with the suggestion to embed educative components in PBL programs for teachers to implement the programs as they were designed (Pedersen et al., 2007). Some of the key design strategies include: focusing on tasks, processes, and the natural flow of work, supporting performance through best practice processes, establishing or aiding in establishing goals, providing layered access to resources (from easy-to-understand labels to information boxes to linked resources and training programs).

Assessment design within each VEL is informed by the assessment triangle presented in Pellegrino, Chudowky, and Glaser (2001). To assess student learning, three key components should be considered: cognition, observations, and interpretations. During design we identify the aspects of student cognition that are important to measure. Student artifacts including the final product required in each module will be designed to allow observation of this cognition. Instruments were developed to support teachers in interpreting these observations in terms of targeted student competencies.

Drawing on these guidelines, our current management system design has the following features: task-oriented interface, teacher adjustable scaffolds, teacher adjustable assessments, contextual formative assessment support, and educative components

Task oriented interface. The web-based assessment system has been developed to support teachers in implementing VELs in the classroom. We identified four key tasks or goals that teachers may need to complete in order to conduct formative assessment in these types of learning environments: configuring module, managing students, monitoring progress, and assessing artifacts. The first two tasks, configuring modules and managing student, are prerequisite for formative assessment. They involve management activities such as setting up the module and creating student accounts. It allows a teacher to set the game access dates and times, to determine the difficulty level for an entire class or for individual students, to choose grading methods, to modify grading rubrics, and to identify the type and amount of scaffolds provided for an entire class or individual students. Student information will be entered into the system before students can enter a VEL. Teachers may also edit students' information, delete or add students. The next two tasks, monitoring progress and assessing artifacts, are the core features of the system. They support daily monitoring and assessment activities. Monitoring progress feature assists teachers when they monitor student progress in the VEL without any specific goal of assessing certain artifacts. Teachers may start by viewing a list of student names and the current tasks that they are completing. Teachers may choose a student to get more details such as current task status and performance, completed and pending activities and the associated evaluation, time spent in the game, tools used, and a list of game sessions. Assessing artifacts feature enables teachers to assess certain artifacts students created in the game. From a list of student names and a list of artifacts, teachers may choose to grade a certain artifact for a certain student. Depending on the artifact type and grading method configured for the artifact, appropriate artifacts, rubrics, and grading suggestions will appear.

Teacher adjustable scaffolds. The management system enables teachers to adjust the support provided to children as they work in the VELs. These supports can be assigned by the teacher to a class, group, or individual student. For example, textual content embedded in a VEL could be presented at a fourth or eighth grade reading level. The teacher may decide to change this scaffold for a class, group, or individual student.

Teacher adjustable assessments. Different types of assessment tools (i.e. rubric, checklist, numeric score) are available for the teacher to edit or disable. For each VEL, there are various artifacts or products created by the children as they play. These can then be evaluated using assessments. The teacher can decide which artifacts to evaluate. She may also decide to adjust the points allocated to each level of a rubric.

Contextual formative assessment support. Contextual support is provided to aid in formative evaluation. Examples include student exemplars, scoring guides, and learning task background information. We adopted several design strategies to support teachers' use of the system. First, we highlighted the four main tasks described in the previous sections by creating a tab for each. We hope this design will clarify the purpose of the system for teachers and guide them in using the system. Second, we dedicated an information box on the screen to embed educative components that are relevant to the context in which the teacher is working. For example, as discussed in the previous section, we provide examples to guide teachers in providing feedback. This is an important feature, because teachers who are new to the game may not know what to expect from students and they may not know how to provide feedback so that it seems to come from the virtual mentor.

Educative components. This aspect of our design still needs additional work before it is fully implemented. The educative components will provide information to the teacher to facilitate a better understanding of the theoretical underpinnings and methods for successful implementation of the VELs.

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Integrating Virtual World Spatial Presence into Constructivist Learning

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Abstract

Spatial presence is an integral part of virtual learning environments (VLE's). Research findings indicate that spatial presence in VLE's may positively affect learning by stimulating abstract thinking and problem solving capabilities. This paper proposes research into the two principle components of spatial presence, the style of the visual display and the organization of interactive elements, to better understand design elements that make this emerging medium instructionally effective.

Introduction

Virtual reality (VR) is an engaging and attractive form of multimedia computing that is gaining a strong foothold in our daily lives. VR's unique array of affordances and opportunities for interactivity allow for a wider range of user controls than other forms of multimedia. Use of virtual reality in science, engineering, aeronautics, and medicine has been developing since 1987 in projects funded by the federal government, particularly the Department of Defense, the National Science Foundation, and the National Aeronautics and Space Administration (Virtual reality, 2008). Over the past decade, the use of virtual reality in entertainment games has increased dramatically. Currently, scientific research based on computer simulation, called e-Science, is a successful method used in the physical and natural sciences, medicine and engineering for experimental scientific discovery (Getov, 2009).

Educational use of virtual worlds is increasingly rapidly (Bainbridge, 2007; Chittaro, & Ranon, 2007). Contemporary VLE's are used for many types of subject matter and learning outcomes, including medicine, accounting, business, art, history, science and math; and for training of soft skills such as management and negotiation. Two popular multi-user web based virtual reality programs used by educators are Second Life and Active Worlds.

VR has been described as a "partnership between computers and the human brain" accomplished through the use of various input devices (Virtual reality, 2008). The experience is predominantly visual, but can include the other senses: sound, touch, smell. What distinguishes it from other multimedia computer experiences is the user's sense of *being there*, in the virtual world, accomplished through interaction with a vivid, immersive simulated environment. This is referred to in the literature as *presence*. Presence is a state of mind, the user's sense of being present in a virtual space (Ijsselsteijn, 2003; Lombard & Ditton, 1997; Winn, 1993). Presence may include a spatial sense of being in the virtual environment, and/or a social sense of being in a space with other sentient beings (Spagnolli, Varotto, & Mantovani, 2003). Social presence can occur in text chats or teleconferences without graphics or simulations (Jacobsen, 2001), but spatial presence requires a visual display (Schubert, Friedmann, & Regenbrecht, 2001).

Spatial presence is a theoretical construct that can guide design and development of virtual learning environments. Effective VLE's will utilize the affordance of spatial presence through carefully designed visual

displays and user interactivity. This reflection paper reviews current scholarly literature into the nature of spatial presence in VLE's, and how spatial presence may affect and impact learning outcomes. Based on conclusions from this literature review, the authors describe and propose new research into the interactive component of spatial presence.

Literature selected for this review consists of peer reviewed articles from scholarly journals in the fields of education, psychology and human- computer interaction. This includes publications devoted exclusively to the study of presence, such as *Presence-Teleoperators and Virtual Environments* (published by MIT press journals) and the International Society of Presence Research website, and other publications whose focus is educational technology and research. Relevant research into the effects of spatial presence in formal education or training settings, with adult or high school-age populations, is examined for conclusions and need for further research. Studies that use children as participants are excluded unless adult populations are included in the same study. Studies that use VLE's to examine or treat psychological disorders, such as phobias or hallucinations, are also excluded from this report. Social presence is discussed only as it affects the user's sense of spatial presence.

Defining Spatial Presence

Spatial presence includes realism, transportation (the ability to move to different spaces, or bring objects closer to the viewer) and immersion or user involvement. The user's perception of their potential for action in the space and the resulting consequences are important dynamics in the experience of spatial presence (Chertoff, & Schatz, 2008; Mantovani, & Castelnuovo, 1999; Spagnolli, Varotto, & Mantovani, 2003). Spatial presence defines virtual reality and separates it from other multimedia programs (Mikropoulous, 2006; Romano, & Brna, 2001; Stanney, 2002).

Spatial presence fits the definition of a perceived affordance as described by Norman (2004) because it affords the user a unique perception of potential interaction with a simulated environment. In a non-virtual interface, the user perceives icons and text links as having the potential for displaying different web pages, windows, or activating specific programs. In virtual reality, the user perceives the interface as an interactive spatial environment in which they have a presence that is separate or in addition to their existence in the real world. Their actions in the virtual world can affect the virtual environment itself.

Sensory stimuli make spatial presence an external as well as an internal state (Marsh, 2003; Waterworth, & Waterworth, 2001). Virtual reality can include audio and haptic sensations, but it is primarily the visual display and user interactivity that creates the sense of being in a virtual space (Schubert, Friedmann, & Regenbrecht, 2001). The virtual spatial experience blends the learner's internal visualization with the computer generated one.

Spatial presence is sometimes associated with the theory of embodied cognition (Wilson, 2002) because it is characterized by a sensation of a strong perception-action link between the display and the user (Schubert, Friedmann, & Regenbrecht, 2001). Presence includes the user's conscious suspension of disbelief, a willingness to immerse oneself in the simulated environment and to block out the real environment (ISPR, 2000). This results in the user's sense of being in two worlds simultaneously, the real and the virtual, in a sort of blended reality.

The International Society for Presence Research describes presence as

"A psychological state or subjective perception... of an individual's experience... filtered through human made technology... part or all of the individual's perception fails to accurately acknowledge the role of technology in the experience… To some degree the environments are experienced as if the technology was not involved" (2000).

Virtual Learning Environments in Education

The convergence of presence with constructivist learning theories became of particular interest with the development of computer generated three dimensional environments that could create first person experiences in a simulated environment (Winn, 1993). In early research with virtual reality simulations during the 1990's, Winn pointed out that the users' sense of interaction with an environment stimulates deep learning. The immersive environment eliminates the need for a symbol system, and enables direct first person learning experiences that are "…direct, personal, subjective and often tacit…" in a safe and controlled environment (1993). This fits well with constructivist learning theories of knowledge construction. That is, that knowledge construction occurs most efficiently when learners are actively involved in activities that are personally relevant (Chittaro, & Ranon, 2007). Subsequent research indicates that spatial presence is important in virtual worlds to accomplish learning goals (Jacobson, 2001) and has positive effects on students' perceptions of the course communications and relevance (Nishide, Shima, Araie, & Ueshima, 2007; Reznick, & MacRae, 2006; Takatalo, Nyman, & Laaksonen, 2008).

Spatial Presence

Spatial presence in VLE's is generally considered to benefit learning by creating first person experiences, as in simulations, and by enabling observation of processes or phenomena that would be difficult, expensive or impossible to observe in the real world. But some of the most intriguing observations from research into spatial presence are its effects on higher thought processes: conceptual understanding and creating mental models (Chittaro & Ranon, 2007; Kontogeorgiou, & Bellou,2008; Limnou & Roberts, 2008; Zacharia, 2007), problem-solving (Cai, Lu, Zheng, & Li, 2005; McClean & Saini-Eidukat , 2001), metacognitive and abstract thinking (Antonietti & Cantoia, 2000; Cai et al., 2005).

In virtual reality, the user perceives the interface as an interactive spatial environment in which they have a presence that is separate or in addition to their existence in the real world. The learner's awareness of being in the two environments simultaneously may stimulate metacognitive reflection. The experience of presence that occurs in VLE's can connect learners' imagination and internal mental models with an external guided stimulus to help them "...find points of convergence and divergence between different worlds to understand their relationships to one another…" (Thomas & Brown, 2007, p.150).

The interactive element of spatial presence is important in helping users build mental models and connect them to existing knowledge. Learners interpret their experiences and use them to refine their mental models (Dede, 1995). Mental models help the learner visualize the phenomena and construct analogies (Seel, 2006). The reciprocal nature of learning and doing in VLE's can build conceptual understanding (Barab, Hay, Barnett, & Squire, 2001).

Constructivist Learning Theories and VLE's

Most educational programs in virtual worlds are designed around constructivist learning theories, that is, that deep learning is achieved through active student involvement in the learning process.   Two constructivist learning theories that might help guide design and development of VLE's to include spatial presence as an affordance, are multimedia learning theory (MLT; Mayer, 2001) and cognitive flexibility theory (CFT; Spiro, Coulson, Feltovich, & Anderson, 1992). Both MLT and CFT consider how student involvement with media might enhance or decrease deep learning. MLT applies Sweller's cognitive load theory to learning from words and pictures and recommends arrangement of text and media that will result in germane cognitive load. CFT advocates richness of content in a flexible, open environment, with multiple representations at different levels of instruction (Spiro, Collins, & Ramchandran, 2007). CFT emphasizes unstructured learner control of content selection and pace to encourage flexible thinking by the learner, whereas MLT proposes a more structured program control of media. Both theories aim for what Sweller calls germane cognitive load, the optimum effort required for deep learning (Clark, Nguyen, & Sweller, 2006).

Design of VLE's

How should virtual reality interactive displays be designed to develop flexible habits of mind, and help the learner integrate new knowledge with existing knowledge? How does style and manner of presentation of the visual display and interactive elements affect and impact learning outcomes? The two most significant components of spatial presence are the visual display and user interactivity (Lessiter, Freeman, Keogh, & Davidoff, 2001; Schubert, Friedmann, & Regenbrecht, 2001).

Visual Design

Effective visual design of VLE's is governed by the same fundamental principles used in visual art, graphic design, animation and cinema, grounded in psychological theories of perception. Traditional visual media create memorable experiences and direct the viewers' attention to key elements through judicious combinations of the scientific principles of optics, accepted practices of illustrating spatial depth, and psychological theories of perception and the viewer's organization of images. Theoretical foundations include Gestalt theories of visual perception, Mayer's multimedia theory, Sweller's cognitive load theory, Paivio's dual coding theory

Visual design principles and theories can be applied to the visual design of graphic elements in VLE's to enhance the users' sense of spatial presence and reduce extraneous cognitive load.   In VLE's, as in other types of visual design, adherence to real world imagery that is not relevant to the learning outcome may create extraneous cognitive load. Luo, & Duh (2009) concluded that detailed architectural and landscape features in VLE's can cause slower learner reaction times and reduced memory. Circular environments seem to be easier to navigate and

remember than square environments, possibly because the weaker ecological features of cylindrical rooms (fewer angles to perceive and navigate) reduce extraneous cognitive load (Luo & Duh, 2009; Jansen-Osmann, Wiedenbauer, Schmid, & Heil, 2007).

Interaction Design

Research findings indicate that the users' interaction or sense of potential for interaction, in the virtual world is the most significant factor in the experience of spatial presence (Chertoff, & Schatz 2008; Lessiter, Freeman, Keogh, & Davidoff, 2001; Mantovani, & Castelnuouvo, 1999; Schubert, Friedmann, & Regenbrecht, 2001; Spagnolli, Varotto, & Mantovani, 2003). Students' interaction with computer mediated technologies can combine for powerful teaching and learning (Cifuentes, Carpenter, & Bulu, 2008). A meta-analysis of studies of distributed learning environments that have analyzed subjective vs. objective control concludes that any type of learner control enhances learning (Kraeger & Jerden, 2007). Spatial presence is a metacognitive awareness of the potential for action in both the real world and the virtual world. More research is needed to develop models for the design of learner interaction in VLE's that will optimize learning outcomes and minimize extraneous cognitive load. User control features such as free navigation, first-person point of view, manipulation of size and reification of concepts should be studied for their effects on learning.

Proposed Research into Components of Spatial Presence

Merrill refers to instructional strategies as "…algorithms for manipulating data (knowledge objects)…" His instructional transaction theory proposes that patterns of learner interactions can be designed to teach specific skills and knowledge (1999). The proposed research will test two possible algorithms for learner interaction in a VLE to teach visual design concepts. In the high interaction tutorial, the knowledge objects will be interactive graphic elements that learners will be required to manipulate. The high interaction tutorial will combine what Cifuentes calls "…learner interaction with subject matter…" and "…learner interaction with technology…" (personal communication September 16, 2009) to the degree that is practical and reasonable, making the technology a reification of the subject matter. The design of the virtual space will maximize learner interaction with reified subject matter, and minimize extraneous interactions with technology. In the low interaction tutorial learners will interact with generic graphic elements to display non-interactive knowledge objects that they will view passively.

Research Questions

Does use of increased interactivity in the form of controllable, reified subject matter in a VLE improve transfer of learning? How does it help learners build mental models of concepts? Does it increase the learners' sense of spatial presence? Does increased interaction and/or spatial presence affect the mechanisms associated with constructivist learning and increase critical thinking?

Research Design

For the pilot study the research will be qualitative, due to the small number of participants. Participants will be students enrolled in a graduate education course. Two different tutorial environments will be designed, each with different degrees of user control and interaction. The graphics and text in each tutorial space will contain the same information. Half the class will start with the high interaction tutorial; the other half will start with the low interaction version. After they complete each tutorial, students will be given a text instructional message and be asked to create a graphic illustration of the message that emphasizes the important concepts. They will then repeat the process using the other version of the tutorial, and completing a different post- tutorial assignment. The interactive tutorial space is shown in Figure 1.
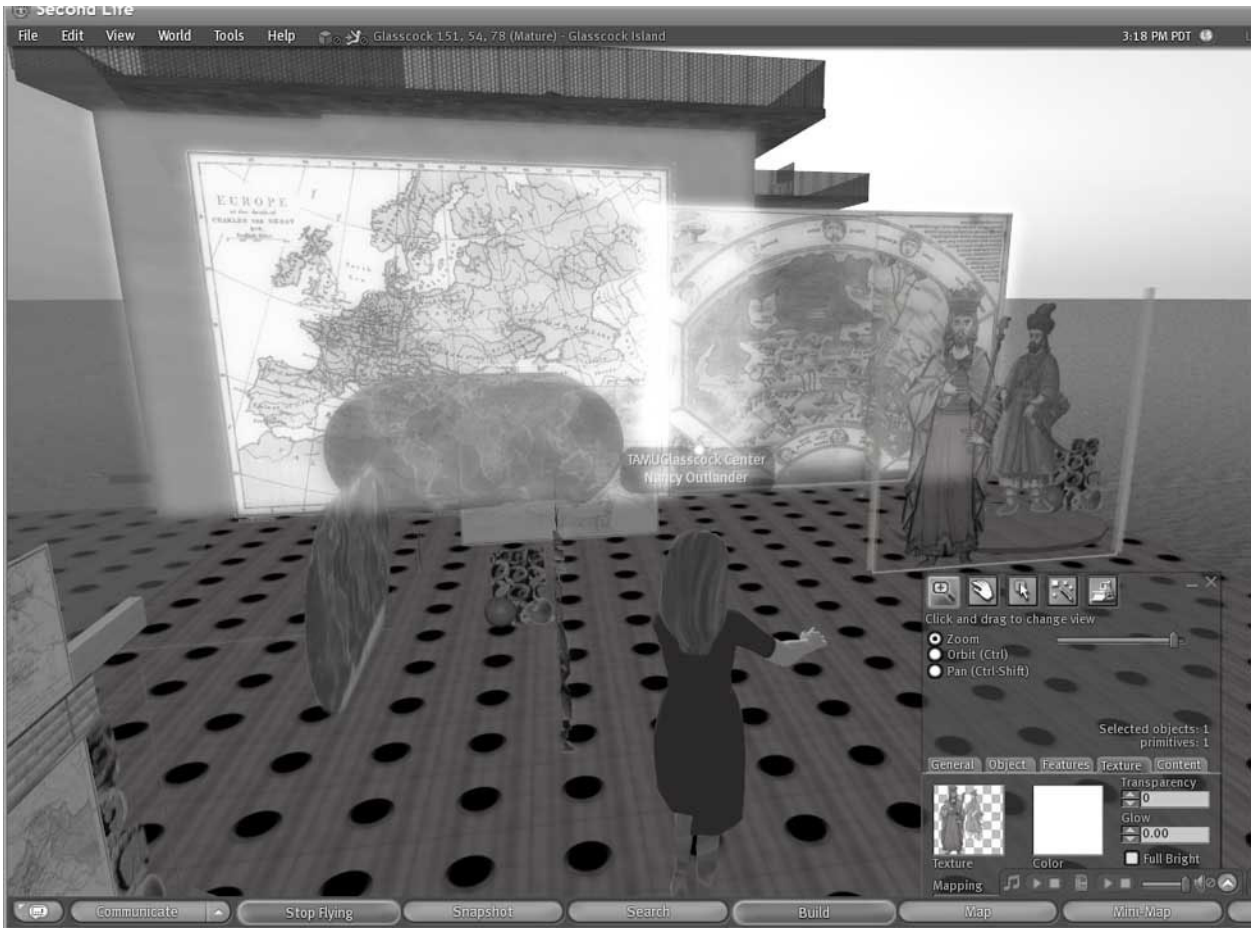
Figure 1. The high interaction tutorial will be unguided, to intensify the users' perception of their potential for action in the space

Participants will answer questions from the Witmer and Singer Presence Questionnaire following their use of each of the tutorials and before completion of each design assignment. Their completed design assignments will be evaluated by two or three experts in instructional visual design. Participants will write a paragraph describing the process they used in creating their design after they complete each design assignment. These reports will be analyzed using qualitative coding analysis methods, for evidence of critical thinking, such as the frequency of "how" or "why" statements or questions (high critical thinking), compared to "what" statements or questions (low critical thinking). They will also complete post-treatment questionnaires that measure the occurrence of mechanisms associated with constructivist learning and their perceptions of the effectiveness of the tutorial for transfer of learning.

Participants will receive detailed instructions for joining Second Life, obtaining an avatar, and practicing basic skills in Second Life about two weeks before starting the assignment. They will complete these activities on their own schedule before beginning the exercise. When they begin the exercise, they will receive instructions for using each tutorial. The course requires use of image editing software, so it can be assumed that they have sufficient technical skills to complete the design assignments.

Measures

Measure One

       Does increased interactivity increase learners' sense of spatial presence while using the tutorial?
From Witmer, & Singer's 1998 presence questionnaire:

1. How much were you able to control events?
2. How responsive was the environment to actions that you initiated (or performed)?
3. How natural did your interactions with the environment seem?
4. How much did the visual aspects of the environment involve you?
5. How natural was the mechanism which controlled movement through the environment?
6. How aware were you of events occurring in the real world around you?
7. How aware were you of your display and control devices?
8. How compelling was your sense of objects moving through the environment?
9. How completely were you able to actively survey or search the environment?
10. How compelling was your sense of moving around inside the virtual environment?
11. How well could you examine objects from multiple viewpoints?
12. How well could you move or manipulate objects in the virtual environment?
13. To what degree did you feel confused or disoriented at the beginning of the tutorial?
14. How involved were you in the virtual environment experience?
15. How distracting were the control mechanisms?
16. How quickly did you adjust to the virtual environment experience?
17. How proficient in moving and interacting with the virtual environment did you feel at the
end of the experience?
18. How well could you concentrate on the assigned tasks or required activities?
19. Were you involved in the task to the extent that you lost track of time?

Measure Two

       Does use of increased interactivity in the form of controllable reifications of the subject matter in a VLE
improve transfer of learning? How well do students understand the concepts presented in the tutorial and transfer
them to novel design problems?
Post treatment questionnaire item stems:

1. The concepts were presented clearly in the tutorial.
2. I was able to understand the topics presented in the context of instructional design
3. I used the concepts presented in my design assignment.
4. I will apply what I learned in future tasks
5. I learned.

       Following their use of the tutorial, the participants will create a visual instructional message based on an
assigned text message. Their completed designs will be assessed by two to three raters, using the rubric shown in
Table 1.

Table 1.
Rubric for Design Assignment.

Grading Criteria	Maximum Points
The design utilizes the **shape** and **level of detail** of graphic components to place emphasis on one to three crucial concepts of the message, de-emphasize less important elements, and create an overall visual unity.	10
The design utilizes the **size** of graphic components to place emphasis on one to three crucial concepts of the message, de-emphasize less important elements, and create an overall visual unity.	10
The design utilizes **position** of graphic components to place emphasis on one to three crucial concepts of the message, de-emphasize less important elements, and create an overall visual unity.	10
The design utilizes **color and/or brightness** of graphic components to place emphasis on one to three crucial concepts of the message, de-emphasize less important elements, and create an overall visual unity.	10
The designs utilizes **texture or pattern**, of graphic components to place emphasis on one to three crucial concepts of the message, de-emphasize less important elements, and create an overall visual unity.	10
The design uses **proximity, common fate and variance** to connect related elements and create unity.	10
Style and detail of imagery is appropriate to the message.	10
Selected imagery promotes a conceptually clear and unified message.	10
Written explanation of design process describes impact of Second Life tutorial on transfer of concepts to finished design.	20
Total	100

Measure Three

Does the design facilitate the mechanisms associated with constructivist learning as measured by learners' self reports? Does the design engage and challenge learners, motivate learners to take responsibility for learning, and foster active social discovery of meaning and dynamic interactions between learners and the environment? Post treatment questionnaire item stems:

1. Experience in the environment helped me develop and refine my ideas for the subsequent assignment.
2. I understood the concepts that were presented in the environment.
3. The learning goals were clear to me.
4. I felt like an active member in the environment.
5. I actively explored the principles and concepts presented
6. I felt that I had control to explore the environment in a manner that interested me.
7. I was able to create a valuable learning experience during the time I spent in the VLE
8. The environment stimulated my interest in learning the concepts
9. The subsequent assignments were challenging.

Data Coding and Entry

Student names will be replaced by a code number for the reports. Questionnaires will be conducted anonymously on the internet, with encryption used to protect their identity. Questionnaires will not be matched to self reports.

Analyses

        Students' design projects will be assessed by 3 experts in instructional visual design using a common rubric. Students' responses to interview questions and written assignment will be analyzed using qualitative coding and analysis methods. Results from this pilot study will be used to design a larger, more detailed study involving a sufficient number of participants to use quantitative methods of analysis of learning outcomes and sense of spatial presence.

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Extracting Heuristics from Expert Instructional Designers

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Abstract

Expert instructional designers make sense of ill-structured problem situations more quickly than novices by drawing upon prior knowledge, previous experiences, and an "established repertoire of heuristics" (Day & Lord, 1992, p. 45). Heuristics, or rules of thumb, are guidelines that enable designers to respond to complex problems more efficiently. This study examined heuristics used by expert instructional designers when engaged in the instructional design (ID) process. Qualitative interviews were used to capture the heuristics used by 16 instructional designers when completing complex ID projects and resulted in 25 ID heuristics, divided into eight categories. Although some of the identified design heuristics overlap with other fields of study such as business management and communication, others are unique to this study. Implications for the education of instructional designers are discussed.

Extracting Heuristics from Expert Instructional Designers

Solving problems is a big component of what instructional designers do (Muraida & Spector, 1993; Perez & Emery, 1995; Rowland, 1991; Seel, Eichenwald, & Penterman, 1995). Typically, designers are presented with an ill-structured situation and asked to close the gap between the current situation and the intended end point. This can be considered a "problem." When solving a problem, a person not only applies rules, but he/she combines multiple rules in order to arrive at a solution (Gagné, 1985). The solving of a newly encountered problem could require a learner's use of declarative knowledge and cognitive strategies as well as the inclusion of previously learned relational and procedural rules. Johnson (1988) elaborated on the use of rules in solving ill-structured problems when he stated, "… no single correct procedure exists, and there is no definitive way of assessing the correctness of a rule based upon the outcome of a single case. There is no *optimally* correct rule… only rules which are *relatively* more accurate" (p. 212). Ingram (1988) noted, when solving ill-structured problems, there is no one set of strategies that can be used in all situations, thus many people rely on heuristics to solve problems.

This study is about heuristic use by instructional designers. Heuristics are "simple decision rules through which individuals make judgments" (Dudczak, 1995, p. 4). Ingram (1988) defined a heuristic as "a general strategy for approaching a problem" (p. 215). Heuristics help to simplify the problem (Abel, 2003). Heuristics may be called many things: informal procedures, generalizations, strategies, principles, decision rules, intuition, or rules of thumb [list not inclusive]. For purposes of this paper, 'heuristics' and 'rules of thumb' will be used interchangeably (Abel, 2003).

The use of heuristics, by experts, has been examined by a number of researchers (e.g., Day & Lord, 1992; Murphy, 2005; Seel et al., 1995; Woods, 1988). In a study by Day and Lord (1992), 38 experts and 30 novices participated in the task of sorting organizational problems. Results showed that experts categorized the ill-structured problems faster than novices. They specifically stated, "Experienced executives quickly make sense of relevant problems and draw upon an established repertoire of heuristics to guide their sense-making efficiently" (p. 45). Chi (2006) stated that experts may use heuristics of which novices are not aware. However, experts may perform with some heuristics so automatically, that even the expert is unaware of their use (Lee & Reigeluth, 2003).

One of the pioneering efforts regarding heuristics in instructional design is a piece by Haney, Lange, and Barson (1968). The premise was to provide instructional developers with heuristics to use when working with professors in higher education. From empirical observations of an instructional development project, they created a collection of 18 heuristics. These heuristics are so general that even though they were compiled 40 years ago, they still apply today. For example, some of their heuristics included: "Always move toward determining the professor's objectives," "Involve the student in the developmental process," "Stress the human elements in an instructional system," and "Don't let the words get in the way" (pp. 4-5). Hoban, Heider, and Stoner (1980) elaborated on Haney et al. (1968) by identifying eight additional heuristics they noted from their empirical observations of a large instructional development project. Some of their heuristics included: "Carefully assess the need," "Do not try to please everyone," and "Set reasonable time limits" (pp. 8-9). Noel and Hewlett's (1981) theoretical article on heuristics in instructional development derived from their own experiences and that of colleagues. They explained when heuristics can be used in the development process. They listed both general heuristics as well as heuristics that

align with the instructional systems development (ISD) model. For example, heuristics included: "Adopt an ISD model, then adapt it," "Plan on how long it will take, then plan on it taking longer," "Test the objective," and "Keep your eyes and your options open" (pp. 15-17).

Ertmer et al. (2008) suggested expert instructional designers use their prior knowledge and experiences to create and apply personal "rules of thumb" (i.e., heuristics) when solving instructional design problems. This idea has been supported by other researchers (i.e., Haack & Mischke, 2005; Kolodner, 1997; Rowland, 1993). These rules are not taken from textbooks, but are much more personalized – acquired from the individual's schema of previous experiences that they bring to the design situation (Klein & Calderwood, 1988; Kolodner & Guzdial, 1999). In his textbook, *Designing Instructional Systems*, Romiszowski (1981) conjectured that instructional designers take the systematic approach they were taught and change it into heuristics they can use.

Purpose

This study was designed to explore the heuristics experienced instructional designers use when engaged in the ID process. In order to achieve this, semi-structured interviews took place with 16 purposefully selected instructional designers who had practiced ID for at least ten years. During the interviews, participants described their experiences in the form of narratives, reflecting on complex or challenging ID projects they had worked on. The research question was: *What heuristics do experienced instructional designers use to solve instructional design problems?*

Theoretical Framework

A phenomenological research design, utilizing semi-structured interviews (Patton, 2002) of expert instructional designers, was used. Phenomenology is an approach that revisits the conscious experience as a way of capturing the core of that experience through thorough first person descriptions (Moustakas, 1994; Smith, 2005). In this study, interviews elicited this first-person point of view and situated it within the participants' narratives of their instructional design experiences. In this study, the researchers elicited multiple participants' personal experiences of instructional design in order to get an accurate picture of heuristics used in actual (not theoretical) instructional design projects. A component of phenomenology allows for the examination of the "essence of shared experience" (Patton, 2002, p. 106). Therefore, phenomenology was the approach that was undertaken for this research.

Methodology

Participants and Site

A purposeful sampling technique (Creswell, 2007) was used to select participants who had at least 10 years of instructional design experience, were currently active in the field, and were known by their peers as expert instructional designers. An initial list of potential participants (n = 31) was created from a list of "seasoned" professionals who regularly attended the annual conference of the Association for Educational Communications and Technology (AECT). In addition, participants were selected based upon their availability for either a face-to-face interview at the 2007 AECT conference or via a phone or video conference in the three months following AECT. The snowball method (participants identifying other potential participants) was used to increase the number of potential participants to 49. After approval from the university's IRB, persons who met the inclusion criteria were emailed requesting participation. Participants (n=16) had an average of 23 years of professional instructional design experience. There were six female and ten male participants.

Of the 16 participants, 7 (44%) were interviewed at AECT while 9 (56%) were interviewed in the following months via videoconference and phone interviews. In addition, those who agreed to participate were asked to complete a demographic survey that allowed the research team to determine if they met the minimum level of expertise required. Criteria included 10 years of professional instructional design experience (Ertmer et al., 2008; LeMaistre, 1998; Perez, Johnson, & Emery, 1995), high educational degree (Day & Lord, 1992; Eseryel, 2006; Korth, 1997), and currently practicing/managing instructional design (Ericsson & Charness, 1994; Rowland, 1992). All 16 participants met the aforementioned minimum criteria for expertise. The research team believed that 16 interviews would be enough to answer the research question, but left open the option that if after the interviews they felt they needed more data, more participants could be found and more interviews conducted.

Role of the Researchers

The first author took primary responsibility for the research, including designing and implementing the study. A faculty member and a visiting scholar at the university acted as consultants. The first author is a doctoral student in an educational technology program at a large mid-western university. With each participant she established her own background in instructional design. This was done to foster their freedom to use instructional design terminology during the interview. However, it also led some of them to take on a "teacher" perspective since she was considered a "novice" or "student." Whether this impacted their responses during the interview or not, cannot be said.

Interview protocol

A six-page data collection protocol was created and piloted by the research team. It included the steps the researchers should complete before, during, and after the interview, as well as demographic survey questions, research questions, possible interviewee questions and appropriate responses, follow-up questions, and an interview check-out list (to ensure necessary data were collected). Jonassen and Hernandez-Serrano (2002) stated that experienced practitioner stories can provide relevant information about strategies they use in the instructional design problem-solving process. They listed specific steps for working with practitioners to identify lessons learned. Some of these ideas were used in the interview protocol as probing questions. For example, participants were asked to identify the problem goals and to describe the context in which the problem occurred. In addition, they were asked to describe the solution that was chosen and the outcome of that solution. Participants were also asked to identify any lessons learned from the project.

Prior to the start of the study, the research team conducted three practice interviews with professors in the Educational Technology program at the university in order for the lead researcher to familiarize herself with asking the interview protocol questions. Subsequently, the research team refined the interview protocol; some interview questions were added, eliminated, and altered for better interview communication procedures.

Demographic survey

A demographic survey was provided via email to participants prior to interviews. It requested the following information: participants' gender, age, current position, number of years in that position, current organization or institution, highest degree earned, area of specialization, number of years in the instructional design field, context and years of instructional design positions, and instructional delivery formats used.

Data Collection

After approval from the university's IRB, persons who met the inclusion criteria were emailed requesting participation. Once participation was accepted, the demographic survey and consent form were emailed to participants. Participants returned the survey and consent form via US Postal Service, Email, in-person, or fax.

Interviews were conducted over a four-month period. Interviews took place in a face-to-face manner at AECT, as well as via telephone and video-conferences; at a time and location convenient to participants. An email was sent to participants verifying interview location and time as well as providing them a brief question to prepare them for the interview. A semi-structured interview was used to elicit a story about a complex or challenging instructional design problem on which the instructional designer has worked. The lead researcher began the interview by stating:

> I would like you to start by telling me a story about an instructional design project you worked on in which you had to solve a complex or challenging instructional design problem. If you could, I would like you to start with you entering the situation and continue the story until you solved the problem. Include as much of the following as is needed to make the story understandable: setting, context, environment; characters involved, roles; time span or timeline; and actions, events, or decisions. I am interested in hearing your story about solving the instructional design problem. Remember the ultimate goal is to identify some of the rules of thumb you use in your practice.

Narratives were elicited via interview questions such as: (a) What major constraints or functional requirements existed for the completion of the task? (b) How did you go about determining possible solutions? (c) What was the outcome of that solution? and (d) Were there any lessons from this ID problem you've continued to utilize in solving future ID problems? Probing questions were used by the lead researcher to elicit lessons learned and extract rules of thumb by which the participant operated in the design process (e.g., In hindsight, were there any aspects of the project that could have been improved? What types of lessons did you take away from this ID problem? After having these experiences, what advice would you give to someone who has just discovered that he or she is in the same situation? What is your greatest challenge when trying to solve ID problems?). Each interview lasted between 30 and 90 minutes. All interviews were audio/video-taped and transcribed verbatim.

Transcription of the interview data was completed with outside assistance. The lead researcher verified the accuracy of each transcript by reading through the transcript while listening and viewing the audio and videotaped interviews. Corrections to transcripts were made during the verification process.

Data Analysis

Phenomenological methods employed by Colaizzi (1978) and modified by Moustakas (1994) were used to analyze the data. Giorgi (1985) outlined two descriptive levels of the approach: Level one utilizes the original data (the verbatim transcript of the interview) and can be considered 'naive' descriptions, whereas level two contains the researcher's interpretation of the data, where through reflective analysis, he/she describes the structures of the experience. These structures are the "underlying structures that account for an experience being what it is" (Moustakas, 1994, p. 137) and are the 'essence' of the experience. In the final step, the researchers combine the two

descriptions (raw data and interpreted meanings) into a comprehensive analysis of the phenomenon. For example, a level one comment was, "I let people describe the problem. And again, even though it can be difficult for me, I will not ask any questions, what so ever, until they are completely finished." This statement is verbatim from the interview. The level two analysis led to, "the instructional designer needs to really listen to the client when the client is describing the problem." From these two descriptions, the rule of thumb that emerged was, "As a designer you need to listen more than you talk."

To begin, video and audio transcripts were read a number of times in order to obtain an overall feeling for the interviews. Significant statements related to instructional design heuristics were identified in the transcripts. These were highlighted and written on index cards for easier organization. Systematic steps (i.e., open coding, axial coding, and selective coding) were used to generate categories of heuristics (Creswell, 2007). Statements were then grouped into themes (within the categories) common to all participants' transcripts. A theme comprised a recurring idea, thread, or meaning that might not be mutually exclusive; statements sometimes fit into more than one theme (Graneheim & Lundman, 2004). Themes were then described as an in-depth look at the phenomenon. Findings were validated with the participants and any discrepancies were negotiated or noted (Creswell, 2007).

Trustworthiness of the Study

Trustworthiness of the study appears through the systematic, rigorous steps executed in the data collection and analysis procedures (Patton, 2002). The development of an interview protocol and use of a pilot study ensured consistency of the interviews. The interview process allowed for the collection of rich, detailed, personal narratives from the participants. Reliability of the data was enhanced by viewing the videotapes multiple times, listening to the audiotapes multiple times, and verification of the transcripts (Patton, 2002).

Results

This study examined the heuristics used by experienced instructional designers when solving complex design problems. Analyses of interview transcripts led to the identification of eight categories of heuristics. Categories included: (1) communication, (2) management, (3) learner/audience, (4) solutions/deliverables/outcomes, (5) design process, (6) design team, (7) design problem, and (8) client. Within each category, multiple heuristics were identified. In the next section, we describe the eight categories, the heuristics included in each category, and supporting statements made during the interviews by participants. It should be noted that these are not listed in any order of importance. In addition, the number of participants who referred to a specific heuristic is listed after the heuristic.

Communication

The communication category (see Table 1) includes heuristics that relate to communication between the instructional designer and his/her client. In this category six participants discussed listening to what the client was saying in order to get as much information as possible. For example, "Go to the meeting and keep your ears open. They are going to say things there that you are going to need to know about later" [E.B.].

Once the instructional designer felt he/she had the information from the client, five participants said it was necessary to verify that he/she heard that information correctly. For example, "The first thing I want to do is I verify things that I've heard. Just literally, honestly, and completely verify the things that I've heard. Not to ask a leading question, but just simply for me to verify that what I think I've heard is what the client is trying to say" [J.Q.]. "I put things in writing and I say 'do you agree with this? Is this accurate? Let's change this until it's accurate'" [S.P.]. The confirmation message, written after meetings and sent usually by email, seemed to be an additional way of documenting and verifying statements regarding the instructional design problem. Seven participants discussed the importance of visuals and documents when communicating with the client. That documentation was very important in facilitating communication. As one participant described, "It is always more successful for me to show people what I am thinking, than it is to tell them about it" [E.B.]. Another said, "Visually portray whatever process model you will be using and consider sharing that with the client or the primary stakeholder group early on in the process to help make sure the lines of communication are clear" [R.B.].

In addition, three participants discussed using the correct lexicon when conversing with the client in order to facilitate communication and reduce misunderstandings. "I think the important thing for any designer to do would be to provide yourself with ample time to learn the lexicon ahead of time so that you can more easily just follow on the conversations faster" [P.L.]. This means the instructional designer needs to understand the terminology used by the client and only use instructional design terminology if it is necessary to the conversation. Otherwise, it was suggested that the instructional designer use terms the client would understand. As J.Q. explained, "We use our technical terms, but when we talk to clients, not only should we not do it unless we explain it, I don't think we should do it unless we need to do it. It builds up a barrier in a sense, or it can, with a client if they aren't familiar with this terminology."

Table 1
Communication Instructional Design Heuristics

Heuristic	No. Participants
As a designer you need to listen more than you talk.	6/16
Verify all information received from the client to prevent miscommunication. Send a follow up email (confirmation message) after meetings.	5/16
Use visuals and documents to prevent miscommunication.	7/16
The instructional designer and client need to understand the lexicon used by the other.	3/16

Management

   Managing the first meeting with the client was discussed as important by three participants (see Table 2). One participant explained how the first meeting progresses: "I would say to [the client], 'In the first meeting, you are going to be doing a lot of the showing and talking because I want to hear all your perspectives on this situation that you are faced with. I will be taking notes and if you have any materials, etc. send them to me ahead of time.' And then I will say, 'I will either give you some initial thoughts on the situation, or if the problem seems quite complex, I will take it away and come back in a week and give you my thoughts on where we should go from then on'" [J.Q.]. This indicates that the instructional designer took time to process the provided information and did not just jump into designing in the first meeting with the client. R.B. supported this notion when he said, "Don't even do any instructional design things in the first meeting."

   In addition to managing the first meeting with the client, five participants stated how the instructional designer needs to identify the constraints placed on a project as well as negotiate the scope of the project with the client. "The first thing I do is I look for the constraints that have been placed on the project. Those constraints are the key to design" [A.G.]. M.G. stated, "It was really ingrained, very early in my head, about how limitations at the end impact what you are able to do at the beginning, and so understanding what those limitations are really makes it more successful for you to not have to redo work." When looking at the beginning of a design project and the constraints, eight participants discussed how a statement of work should be created and verified by the client. As M.Sp. noted, "Getting the scope of the effort right is important. And I think that people are constantly underestimating what the scale of the training design effort was going to be, they just never scoped it correctly. They underestimated how long it would take, how much and what kind of resources would be required." Because of the constraints placed on a project by the client, as well as the resources provided, four participants discussed not being able to create "perfect" instructional design. As J.Q. explained, "One cannot often do the best project that you would like to. You can do the best instructional design with the resources that your client provides."

Table 2
Management Instructional Design Heuristics

Heuristic	No. Participants
Don't do any instructional design in the first meeting.	3/16
Look for constraints that have been placed on a project.	5/16
Negotiate the scope of the project. Create a statement of work upfront.	8/16
Do the best ID you can with the given resources and constraints.	4/16

Design Team

This category resulted from four participants describing how important it was to have the right people on the team (see Table 3). "Design is a people process. If we don't have tools, if we don't train ourselves to think about how we work with people and how we respect people, especially including our coworkers, that has a huge impact on what we are a able to do and how things get done" [E.B.].

Some participants discussed involving everyone from the beginning, while others stated that they only involve certain people at certain times. As E.B. stated, "One of the things they did that really impressed me was, we didn't just sit with one writer, he called in the whole team. The entire group came. We didn't even know why some of them might be necessary… but that rule of thumb goes something like this: Get together all the excited, exciting people you can find and when the problem is truly something unique to them bring in more, not less and don't ask yourself, 'well, are we really sure we need one of these or one of those?'" Whereas W.C. noted that more than three people can stifle the process, "One person is almost never as smart as two. Two people are never as smart as three, but when you begin to get above that, it gets really interesting. You'll get lots of ideas, but you'll have a hard time getting finished." Those who discussed this category agreed that instructional design is done in teams and that you have to work well with other people in order to come to a viable solution. "I would say that one of the common problems that you see is, especially if you're working with a team, that it's hard to get internal consistency. It's hard to get everybody to really communicate enough so that you finally come to an agreement on what it is that you're doing. That's the real problem …" [S.P.].

Table 3
Design Team Instructional Design Heuristics

Heuristic	No. Participants
Design is a people process.	4/16
The team is critical. Involve the right people at the right time.	4/16

Design Process

The design process category (see Table 4) included items related to the overall instructional design process such as knowing the foundational theories, design models, and past solutions. Six participants mentioned that analysis was a very important step in the instructional design process. As N.D. stated, "Analysis, analysis, analysis; you can never do enough analysis." M.G. also stated, "Making sure that as you move through the instructional design process that you come back to the analysis component again and again."

In addition, understanding the fundamentals of learning theories, instructional design models, and principles of instruction seemed a predominant theme discussed by six participants throughout the interviews. For example, M.T. said, "You need to know the theories. You need to know the models. You need to have that foundation. If you don't have that foundation…that almost needs to be your ground floor." D.M. noted, "We need to implement those principles of instruction that work."

Another concept discussed by five participants in the design process category was the idea of using ideas that have worked in the past. For example, W.C. stated, "Don't try to break too much new ground." A.G. expanded on this by explaining that you can use past situations that have worked, but to add to them, "Be prepared to have to think abstractly, and don't just copy old solutions, try to add something new in every design."

Table 4
Design Process Instructional Design Heuristics

Heuristic	No. Participants
During the ID process revisit the analysis component again and again.	6/16
You need to know the theories and models. Implement those principles of instruction that work.	6/16
When faced with something complex, draw from past experiences.	5/16

Learner/Audience

      The learner/audience category (see Table 5) was mainly comprised of knowing your target audience and what it was you wanted them to be able to do after the instructional experience. This specific heuristic had the largest number of participants (n=8) discuss it. As W.C. stated, "Invest as much time as you can in your audience analysis because it pays probably the biggest returns of all of them. Task analysis gets a lot of attention because it is core to it, but a lot of times people don't spend enough time looking at learning skills and other things about the audience and if you're not careful you'll miss some crucial property of that audience in terms of their experience."

      In regards to the performance outcomes of the learners, seven participants discussed knowing what it was you wanted your learners to be able to do at the end of the instructional experience. "When I approach any instructional design problem, I always try to use the mantra of, 'what do we want people to be able to do?' How can you create an instructional activity that approximates the kinds of activities they are going to be doing in the job you are trying to prepare them for?" [P.P.]. B.B. stated, "Let's spend our time giving [learners] opportunities where we show them what success looks like. Give them an opportunity to practice it. And give them feedback about how to improve. Teach them how to do it well, give them practices to show they can do it well and they're going to be motivated." This indicates that not only should an instructional designer look at the performance outcomes at the *end* of the instructional experience, but also look at the desired performances *throughout* the experience.

      Interestingly, it appears that not all of the designers agreed about the specific implementation of the rules. For example, in the Learner/Audience category, although four participants discussed including scaffolding in the instructional experience, as shown in the heuristic "Consider utilizing scaffolding in your instructional experience," S.P. felt it was necessary to hold off on using scaffolding in the beginning whereas B.W. thought it should be used in the beginning and then tapered off at the end of the instruction. "Don't scaffold at first. Don't direct. In the first version you want to give the minimal amount of direction and support that you can give – because you really want to find out what it is the student needs. Where things break down. And then start trying some of those things out on a verbal basis" [S.P.]. "Use relatively high scaffolding and support early with moving toward more independent work as they get their bearings" [B.W.]. These different viewpoints both take into consideration using scaffolding, but the amount and placement vary depending on the instructional situation.

Table 5
Learner/Audience Instructional Design Heuristics

Heuristic	No. Participants
Know your learners/target audience and their pre-requisite knowledge.	8/16
Determine the criterion for successful performance.	7/16
Give learners the tools they need to succeed. Consider using scaffolding in the instructional experience.	4/16

Solutions/Deliverables/Outcomes

      The solutions/deliverables/outcomes category (see Table 6) has three heuristics. Four participants described the first, whether instruction is the answer to the client's problem. "It's really important that you recognize that education and training will only get you so far, education and training only are appropriate viable solutions when there is a skill and knowledge deficit" [B.B.]. Or as J.Q. stated, "I always listen quietly and I'm always asking myself, 'is it actually instruction that is needed here or not'."

      The second idea was discussed by eight participants. This rule is to approach the design problem with the end in mind. This entails considering what the deliverables, learning, and performance outcomes are. "When it comes to instructional design, I identify what the deliverables are, what do we want to be able to accomplish at the conclusion of the project. And then work backwards from there" [M.Si.]. This heuristic is very similar to one in the

Learner/Audience/Pedagogy category: Determine what it is you want your learners to perform after the instructional experience. However, it differs slightly in that this heuristic is the way to *approach* the problem, not just a step in the process. As B.B. stated, "Always start with figuring out what are the ways you want people to change as a result from this experience."

In addition, four participants suggested generating and providing the client with multiple solutions to solving the problem and letting the client choose which one to implement. For example, "We got to the point where, after developing instructional strategies, we developed alternatives for several instructional strategies so that even the clients could make some judgments about which might be best or which might be preferred given the circumstances of that specific situation" [R.B.]. "You have to first understand a variety of solutions, so you have to have an idea of what are all of my possibilities of outcome" [P.L.].

Table 6

Solutions/Deliverables/Outcomes Instructional Design Heuristics

Heuristic	No. Participants
Ask yourself, "Is *instruction* the solution to this problem?"	4/16
Approach the design problem with the end in mind. What are the deliverables? What are the learning/performance outcomes?	8/16
Generate multiple possible solutions that will solve the problem.	4/16

Design Problem

The design problem category (see Table 7) comprised understanding the particular unique design problem. This category had the fewest participants discussing the same concept, but the researchers felt these heuristics were important enough to include. Two participants mentioned that although the instructional designer might have worked on similar problems, every situation is unique. As B.B. noted, "I think because every single situation is different, because every single situation is unique, that taking clients language to figure out how can I turn this into a viable solution that actually addresses the need and I am not just doing something to do it and I'm not just doing something they asked to do." E.B. said, "You find out immediately there are no cut and dried situations, there are no situations where you can look up in your book [acts as if following a diagram] right…this is what we need to do."

In addition, three participants said that getting to the core of the problem and identifying all of the sub problems was important. For example, "I came back wondering - have I got the real problem? Have they just sort of, for whatever reason, just sort of given me pieces of the problem because of things that might be going on in their own organization or for their own needs, or am I forgetting to ask something about the problem that is really important, but I didn't think to ask?" [J.Q.]. A.G. stated, "I think that every design problem that comes to us has many sub problems that need to be solved. If we can look at our design in terms of, what I call layers, of the design, we find that we solve a bunch of individual problems which then integrate together into one coherent design."

Table 7

Design Problem Instructional Design Heuristics

Heuristic	No. Participants
Never look at the problem at face value. Get to the core of the problem and solve all the sub-problems.	3/16
Understand that every design situation is unique.	2/16

Client

In the client category (see Table 8) six participants discussed determining if the client was able to describe what it was they really wanted from the instructional designer. Once this was communicated, the instructional designer needed to "manage" the client's expectations; part of this overlaps with developing a statement or scope of work. As N.D. stated, "Manage the client's expectation. So don't just take the project as is. Look at the project, look at what they want you to develop, look at your time limits." As M.Si. said, "Many times the client comes to you and they're not really sure what they want. And so you run the risk of proposing something that will satisfy their initial need for some help, some assistance, but without really solving the instructional design situation that brought them to you in the first place." In order to determine what the client wants, the instructional designer needs to listen. As, P.L. stated, you "understand the client by listening to them. By listening to what questions they ask you."

Another theme that emerged from the client category was that different clients have different levels of cultural sensitivity. Five participants discussed cultural and contextual sensitivity when working with a client. "You

have to be sensitive to the context. It's probably the biggest thing that will help you be successful or not" [P.L.]. By creating a trusting relationship utilizing honesty, the instructional designer and client will have a more successful partnership. For example, a project that R.B. discussed was centered on tax accountants who worked with huge sums of money. This resulted in the instructional designers maintaining sensitivity when asking about "the client's companies, what were their sources of income or what were their expenditures" as well as "how questions are perceived by the client." Or as B.B. stated, "I tell them why I'm doing what I'm doing, think out loud, try and help them understand I've got their best interest at heart and go from there. But that means instructional designers really do need to have principles and practices that guide them." The trust and honesty components of working with a client go hand in hand. As M.T. phrased it, "Be honest with the client- in terms of your recommendations." M.Sp. said, "I think you have to be totally brutally honest with the clients."

Table 8

Client Instructional Design Heuristics

Heuristic	No. Participants
Determine if the client knows what he/she wants. Manage the client's expectations.	6/16
Be sensitive to the context and the culture of the client.	5/16
Build trust with clients so that they know you have their best interests at heart.	3/16
Be honest with the client.	3/16

One interesting theme from the results was how many times participants would state that "*Blank* is the key to instructional design." For example: A.G stated that constraints are the key to design. "The first thing I do is I look for the constraints that have been placed on the project. Those constraints are the key to design." Whereas M.T. thought the key to design was recruiting the right people. "…and that was key- recruiting the right people." M.T. also thought that asking the right questions of the client as well as looking at the problem from different perspectives was also key. "Asking the right questions is critical. And looking at it from many different perspectives. Those are really key." B.B. felt that understanding what performances the learner should do at the end of the instructional experience was key. "If I can articulate what the practice experiences should be and what the critical success factors are for knowing how somebody's performed in that practice what success looks like or doesn't look like, and if I can figure out what demonstrations, if I can get that in place, then I've done what I think is the key job of an instructional designer." This demonstrates that there are many aspects to instructional design that cannot be ignored. It also begs the question, are some rules of thumb more important to the instructional design process than others?

Discussion

Results from this study suggest that instructional designers use a number of heuristics in their ID practice. Ertmer et al. (2008) also described the use of rules by instructional designers in their study examining how expert instructional designers used knowledge and experience in the instructional design process. The twenty-five heuristics listed above were found as themes discussed across interviews. The list of heuristics above is a partial list due to the limited number of participants. Some of these heuristics seem to be common sense, such as verifying information to avoid miscommunication. Three of the eight categories of heuristics (communication, client, and management) would appear to be common knowledge to business, or project management fields. One possible reason for the overlap would be the common use of problem solving in the different fields. In the management science /organizational research (MS/OR) field, problem solving is a common component (Evans, 1992). Evans stated that many MS/OR problems fall into the ill-structured category. This is the same with instructional design (Jonassen & Hernandez-Serrano, 2002). Powell, (1995) described three heuristics used in the MS/OR field that are similar to the heuristics found in this study. For example, one of the heuristics he described is "decomposition" of the problem, or in other words, breaking down the problem into smaller problems. This is similar to the ID heuristic we found: "You have to get to the core of the problem and solve all of the sub-problems." It has been said that breaking down the problem into smaller problems allows it to be solved easier (Goel & Pirolli, 1988; Jonassen, 1997). In Nelson's (1988) study, experienced instructional designers did just that and broke down the larger ill-structured problem in order to work on sub-problems separately.

Another MS/OR heuristic Powell (1995) noted was "Prototype: Get Something Working" (p. 117). This is similar to the ID heuristic we found: "When communicating with the client use visuals and documents." Two of the participants in this study did mention using prototypes when involved in instructional design, but not as a rule of thumb they follow. More in common with this ID heuristic is Powell's "Sketch a graph: Visualize" heuristic which is a manner of representing the system they are working on (p. 119). Shanteau (1992) found that experts use *decision*

aids or visuals when working on a problem that requires decision-making. In Hartley and Bruckmann's (2002) book, *Business Communication,* they discuss how to use visual aids as a way to reduce miscommunication. These all support the use of visuals and documents when communicating with a client.

Other heuristics could have been predicted from the instructional design literature and the fact that the majority of the participants are academicians in the field of instructional design. Those would consist of the design process heuristics, the learner/audience heuristics, and the solutions/deliverables/outcomes heuristics, as many of these are taught in introductory instructional design courses. For example, using the models and theories, knowing your target audience, and determining learning outcomes is emphasized in a number of instructional design textbooks (e.g., Dick & Carey, 1985; Reiser & Dempsey, 2002; Romiszowski, 1981; Smith & Ragan, 1999). Of the instructional design heuristics above, we have yet to find the following in the textbooks or journal articles: (a) As a designer you need to listen more than you talk. (b) Don't do any instructional design in the first meeting, and (c) Generate multiple possible solutions that will solve the problem. This last heuristic seems to follow the idea that ill-structured problems have multiple solutions (Jonassen, 2000). However, the idea of presenting the client with alternatives seemed to be the supporting foundation for this heuristic.

What is unique about the list is that it combines these different areas of business, project management, and design into one overall package of heuristics that instructional designers might follow. This leads us to ask if there should be a business/project management course in instructional design curricula.

Not every participant in this study described using every heuristic. This does not necessarily mean that they do not use that heuristic only that it did not emerge during the narrative interview.

Educational or scientific importance of the study

Why is it important to understand the heuristics used by practicing instructional designers? Because instructional design is a problem-solving process, novice instructional designers need to be taught more about what practicing instructional designers actually do, rather than the steps in a theoretical instructional design model (Rowland, 1991; Silber, 2007). Allowing novice instructional designers to learn vicariously through the stories told by practicing instructional designers may provide them with experiences they would not encounter otherwise (Jonassen & Hernandez-Serrano, 2002). If we can determine the heuristics practicing instructional designers use, the field of instructional design could gain an additional tool to use in the education of novices. Having a list of heuristics may help make designers more efficient in their design problem-solving processes.

The underlying rationale for examining experts' uses of heuristics is to help novice instructional designers develop expertise. However, this concept needs to be examined in future research. It is currently not yet known if these heuristics will help novices develop expertise. The results of this study suggest that in addition to teaching novice instructional designers the foundational models and theories, we should also be including business and project management content.

Limitations and Suggestions for Future Research

One limitation to this study is the number of participants. Sixteen instructional designers took part in this study. A number of them (14) were practicing academicians in addition to being instructional designers. Therefore, their full-time profession is not that of an instructional designer. They were chosen because of their experience in the field as well as their willingness to be interviewed both at AECT and in the following three months. The fields in which these 16 instructional designers worked did not represent all possible areas of instructional design; for example, designers working in the military were not included. This is because the researchers did not have access to any instructional designers currently working for the military. In order to create a more comprehensive list of heuristics and get a better sense of shared heuristics the number of participants would need to be increased as well as the fields in which they work.

A second limitation was the different modes of communication for interviews. Interviews were conducted face-to-face, via video-conference, and by telephone. The varying modes could have produced different results. The face-to-face interviews might have provided for more thoughtful responses, whereas the telephone interviews might reduce interviewer effects.

Another limitation is the amount of access the researchers had to the participants. Interviews consisted of only one 30-90 minute interview. Follow-up interviews might verify the use of heuristics not mentioned in the initial interview. Another limitation is the context of the story told in the interviews. Different contexts might result in different heuristics (e.g., military, industry, academia).

Future research will be devoted to validating these heuristics via the Delphi technique using a panel of carefully selected participants, different from the ones for this phase. The Delphi panel will consist of full-time practicing instructional designers. In addition, the panel will be comprised of enough participants from different fields (e.g., military, industry, academia) that the researchers can examine if there is a difference in heuristics used in the different fields. In addition, the researchers will focus on determining the best methods by which to share the

resulting rules of thumb with novice designers and whether it impacts their experiences as instructional designers. Some questions we would like to ask are: 1) Can we *teach* heuristics to novice instructional designers? 2) What methods should we use to provide this information (stories, cases, guest speakers)? and 3) How does this impact their practice?

Conclusion

"Procedures for intelligently applying past knowledge to new experience often seem to require common sense and practical rules of thumb in addition to, or instead of, formal analysis" (Schank & Abelson, 1977, p. 3). This study elicited rules of thumb from experienced instructional designers as a way of expanding our understanding of what practicing instructional designers do during the design process. This knowledge of instructional design heuristics could be shared with novice instructional designers while they are learning the intricacies of becoming an instructional designer possibly as a way of providing them some wisdom from more experienced designers.

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Appendix A

Participants' Demographics and Description of Story Contexts

Participant	Years of Professional ID Experience	Current Work Context (years in position/rank)	Story Context
Bichelmeyer	20	Associate Professor (6 years) Faculty (14 years)	Industry – large telecommunications company Creating a new employee orientation program and building a company culture
Boling	25	Associate Professor (15 years)	Small independent company working with a large publishing firm to create early reading software (using Apple IIe)
Branch	24	Professor (8 years) Faculty (25 years)	Training company (intern) Developed tax training for accountants working with clients of significant net worth Consulted with transportation company; led development of training development model for the learning service unit.
Cates	34	Associate Dean (2 years) Professor (34 years)	Department of Defense (consultant) Building a multimedia engine for teaching thinking skills to middle school students
Dabbagh	11	Associate Professor (3 years)	Academia/Industry – Project manager Managing an internship experience for students, partnered with an underground coal mining operation, to create a refresher training system for supervisors
Gibbons	33	Chair – Instructional Psychology & Technology Dept (4 years) Faculty (15 years)	Military (consultant) Multiple projects described (capturing the evolution of his design thinking) including: 1) Redesigning an existing course for marine officers (how to plan an amphibious invasion). 2) Creating training to teach helicopter pilots how to conduct anti-submarine warfare
Grant	10	Assistant Professor (5.5 years)	Academia Creating an assessment of web-based instruction for another department

Participant	Years of Professional ID Experience	Current Work Context (years in position/rank)	Story Context
Loughner	15	President of Loughner and Associates Inc. (10 years) – Company that develops custom content training	Pharmaceutical company; lean operations initiative leading to redesign of work processes and organizational change
Merrill	44	Retired from academia; Visiting professor FSU (2 years); Consulting Prof BYU Hawaii (3 years)	Center for International Entrepreneurship (consultant); Creating online business course for non-business majors using real-world examples
Parrish	20	Managing Instructional Designer (9 years) – Atmospheric research group	National weather agency; Introducing (demonstrating the benefits of) a small scale numerical weather prediction model
Pedersen	10	Associate Professor (2 years); Faculty (8 years)	NSF grant - Project Manager; Creating virtual learning environments for middle school science, designed to increase student engagement and ability to do scientific inquiry
Quinn	19	Associate Professor (11 years); Faculty (15 years)	Academia/Industry - Project manager; Managing apprenticeship experiences for students who developed training for a new version of company software
Simonson	34	Professor (24 years); Faculty (33 years)	Military (consultant); US Navy – Surface Warfare Threat Matrix; Creating software to teach naval officers how to identify enemy ships, weapons, and aircraft
Spector	20	Associate Director – Learning Systems Institute (3.5) and Professor (11 years)	Air Force Research Laboratory; Creating CBT to teach research scientists acquisitions technology
Tracey	21	Associate Professor (1 year); Faculty (7 years)	Insurance Company (consultant); Moving / Closing / Condensing call-centers
Wilson	30	Professor (20 years)	Academia; Exploring strategies, such as blogging, to increase student engagement in an online course