

# 33<sup>rd</sup> annual Proceedings

**Volume 1**

Selected Research and Development Papers  
Presented at The Annual Convention of the Association  
for Educational Communications and Technology

*aect*

Sponsored by the Research and Theory Division  
Anaheim, CA

Editor: Michael Simonson

Nova Southeastern University, North Miami Beach, Florida

# 2010 Annual Proceedings - Anaheim: Volume #1

Selected Research and Development Papers  
Presented at  
The Annual Convention of the Association for Educational Communications and Technology  
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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.

REFEREING 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.

Michael R. Simonson  
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# **Evaluation of Students' Perception, Learning, and Satisfaction in an Adaptive Web Based Learning Environment**

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Descriptors: Adaptive web based learning environment, perception

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## **Abstract**

The purpose of this study was to document the processes involved in two phases of formative evaluation of an adaptive web based system which individualized instruction such as content, interfaces, instructional strategies, and resources. The data were obtained through questionnaires, surveys, focus group interviews, and system logs throughout 2009. A total of 186 undergraduate students participated in two stages of this study.

## **Introduction**

The major challenge and aim of Web-based instruction has been, and continues to be, to accommodate students with differing profiles, expectations, prior experiences, and learning abilities (Abidi, 2009; Azevedo, Moos, Greene, Winters, & Cromley, 2008; Dogan, 2008; Sikora & Carroll, 2003). Adaptive Web-Based Learning Environments (AWBLEs) are a form of adaptive instruction which attempt to address the issue of individual differences. AWBLEs do so by providing mechanisms for individualizing instruction (e.g., content, interface, and

strategies) and providing users with a more personal experience through the incorporation of differing instructional strategies, resources, assessments, and interfaces (Inan & Grant, 2008). Basically, AWBLES gather user information and preferences (Brusilovsky, 2001; Triantafillou, Pomportsis, & Demetriadis, 2003; Tsianos et al., 2009); make inferences based on the collected data; and then employ various adaptive methods to accommodate each individual student (Far & Hashimoto, 2000; Dogan, 2008; Inan & Grant, 2008).

Although the idea of what AWBLES are and what they do is simple, the design, development, implementation, and evaluation processes of AWBLES, however, is a challenging and complex topic. Moreover, although several adaptive web based systems have been developed, only a limited number of empirical studies have documented proof of the effectiveness of these systems on students' performance, learning time, motivation, and attitudes. Therefore, it is crucial that more AWBLE designers document the formative and summative evaluations of their systems throughout the design and development phases. In addition to building on the literature, one of the major advantages of formative evaluation is that it will help researchers determine whether their system's current design allows the system to meet its intended goals and objectives.

### Purpose of Study

This study documents the formative evaluation (field testing) of an adaptive web based learning environment. The goals for formative evaluation were, first and foremost, to assess whether the goals of the system were being met (i.e. knowledge gains and motivation gains) and, secondly, to identify weak or problematic areas, in terms of usability, where the system could be improved.

Specific research questions included:

- 1) How do the students perceive the adaptive system?
  - a) What were students' perceptions on the adaptive tutorial in terms of visual design, organization/navigation, content presentation, use of multimedia, assessment feedback, and task value of the system?
  - b) What did students like most about the adaptive tutorial? What did they like least?
  - c) Did the students experience any difficulties with the adaptive tutorial?
- 2) How does student learning, engagement, and satisfaction vary with the adaptive tutorial based on student prior knowledge and motivation?
  - a) Based on knowledge or motivation levels (high or low), which groups of students benefited most in terms of knowledge acquisition?
  - b) Based on knowledge or motivation levels (high or low), which group took the longest time to complete the tutorial? Which group took the least amount of time?
  - c) Based on knowledge or motivation levels (high or low), which group rated higher satisfaction with the system?

### Methods

#### Evaluation Design

For field testing purposes, the researchers of this study used a tutor alone evaluation design (Woolf, 2009). In this evaluation design, no control group is used. Rather, only one group of students works with the same system and the study measures specific outcomes from that group. The goal of this evaluation design is to establish or identify something about the learner or the system which can be used to predict those outcomes on posttests (Woolf, 2009). For this study, the outcomes of interest were student motivation and knowledge levels. Using data obtained from the adaptive system, researchers were able to account for prior motivation and knowledge levels in addition to measures of these two factors in posttests.

Field-testing of the AWBLE included two stages. In the first stage, data were collected via the Internet. Participants linked to the AWBLE and studied online. During this stage, students' prior and post knowledge, prior

and post motivation and their thoughts about the system were assessed. In the second stage, student studied the material in a computer laboratory individually. Participants were observed by the researchers to identify any technical problems that users faced. Participants of this stage were asked to fill out an evaluation survey. In addition, focus group interviews were conducted with these participants.

### Adaptive System Prototype

Combining adaptive hypermedia methods with strategies proposed by instructional theory and motivation models, the adaptive online tutorial was developed in the fall 2008 and first half of the spring semesters. At the beginning of the tutorial, students filled out a pretest on their prior knowledge, and a survey of motivation. Depending on the results of these assessments, students were placed into one of four clusters for each of the three sections of the tutorial. Clusters were (1) low motivation and low prior knowledge, (2) low motivation and high prior knowledge, (3) high motivation and low prior knowledge, (4) high motivation and high prior knowledge. Based on gathered data, the adaptive tutorial automatically incorporated relevant adaptive strategies customized to student interest and needs. After which, students would continue through the adaptive content. Following the completion of each section, student motivation and achievement was re-assessed before proceeding into the next section.

### Participants

The target audience for the system was undergraduate students. For field testing purposes, a total of 186 undergraduates from a large southwestern university participated in two stages. Participants came from six sections of an undergraduate introductory technology course. More than half of the students participating in the initial stage were female (53.3%). Their ages ranged from 18 to 30 years old with a mean age of 19.8. The majority of students participating in the second stage were female (55.6%), between the ages of 17 and 26.

### Data Collection & Instruments

- Achievement was measured using a locally developed 20 item multiple choice instrument over the introductory statistics topics covered in the tutorial.
- Items adopted from the Instructional Materials Motivational Scale (IMMS) were used to measure student motivation level (Keller, 1987). Cronbach's alpha for the IMMS ranged from .61 to .81 (Keller, 1987).
- A Formative Evaluation Survey was used to gather information about of students' use of the adaptive system and their perceptions on different utilities provided within the system. The survey had 44 items rated on a Likert-type scale of 1 to 5.
- A Student Questionnaire was used to collect student perceptions about the adaptive system. Three open ended items asked students to elaborate on what they liked and disliked about the system and gathered their suggestions for system improvement.
- An Observation Form was developed to help the designer take notes during the observation. System sections, observed problems and suggestions were written down on the form.
- A Student Navigation Log was used to track student navigation patterns through the adaptive tutorial. This log recorded student actions such as usage time and the sequence of navigation through the tutorial.
- An Interview Guide was primarily used to list questions and outline the topic to be investigated. Semi-structured focus group interviews were conducted in order to investigate students' perceptions about adaptive system in more detail. Each interview lasted about 20 to 30 minutes and all interviews were audio recorded then transcribed.
-



## Summary of Results

### Students Perceptions about Adaptive System

The following table summarizes the evaluation of student perceptions.

Criteria	Findings	Data Sources	Implications
Visual Design	<ul style="list-style-type: none"> <li>- Easy to read, easy to follow, not many words on the screen</li> <li>- Use highlight text to emphasize (color/underline etc)</li> <li>- Limit fancy fonts, flashy things may be distracting</li> </ul>	<ul style="list-style-type: none"> <li>- Interviews</li> <li>- Questionnaire</li> <li>- SME Evaluation</li> </ul>	Minor updates to increase visual appeal and limit distractions
Organization / Navigation	<ul style="list-style-type: none"> <li>- Navigation was easy and simple</li> </ul>	<ul style="list-style-type: none"> <li>- Observations</li> <li>- Interviews</li> <li>- Questionnaire</li> </ul>	N/A
Content Presentation	<ul style="list-style-type: none"> <li>- The practice examples creates interactivity making user feel that they are actively involved in the tutorial</li> <li>- The information may be easy, repetitive for those who known the topic</li> </ul>	<ul style="list-style-type: none"> <li>- Interviews</li> <li>- Questionnaire</li> </ul>	Revise prior knowledge assessment to provide better adaptation for student with high prior knowledge
Assessment & Feedback	<ul style="list-style-type: none"> <li>- Some of the questions were hard and/or wording from the questions was confusing</li> </ul>	<ul style="list-style-type: none"> <li>- SME Evaluation</li> <li>- Questionnaire</li> </ul>	Improvement on the knowledge test
Motivation	<ul style="list-style-type: none"> <li>- Probability is considered as a boring subject or irrelevant to student major</li> <li>- Motivation survey questions were a little repetitive</li> </ul>	<ul style="list-style-type: none"> <li>- Questionnaire</li> <li>- Interviews</li> </ul>	Field test in the setting where student hold students accountable for learning the instructional material (Stage II)  Revise motivation survey
Technical Issues	<ul style="list-style-type: none"> <li>- Browser crashed a few times, while students using practice activities</li> </ul>	<ul style="list-style-type: none"> <li>- Observations</li> </ul>	Re-test practice activities using different version of Flash Player

### Student Learning, Study Time, and Satisfaction

Both high and low motivation groups benefited from the system and showed an increase in their knowledge levels. There were no significant differences between the low and high motivation groups' satisfaction ratings. Based on the descriptive statistics, the students with high motivation spent more time studying the tutorial than students with low motivation.

Results indicated that high knowledge groups rated significantly more satisfaction with the system than low knowledge group. Based on their prior knowledge levels, high knowledge students spent more time studying the tutorial than the low knowledge students.

### Discussions

Based on data obtained from the formative evaluation processes, researchers iteratively updated the initial prototypes by increasing visual appeal and limiting distractions; revising prior knowledge assessments to provide better adaptation; notifying students about the number of sections and the anticipated completion time on the login page; and revising the wording on certain topics in order to accommodate students of low prior knowledge. For students with high motivation and high prior knowledge, designers have considered adding more content which may be more challenging and engaging for these students. Further, designers have considered adding additional

navigation links which would allow these users to access additional topics. In order to increase relevance, designers have been working on including more examples and practices which relate probability to student interests or majors. In addition, designers plan to redesign examples and practices to be more appropriate for college-age students. It is anticipated that these new features will increase student motivation by showing relevance.

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# **Animated Pedagogical Agents from Students' Perspectives**

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## **Abstract**

The goal of this study was to investigate the 5<sup>th</sup> grade students' attitudes toward animated pedagogical agents (APA) in language learning environment. 187 5<sup>th</sup> grade students from two different regions of Turkey participated in the study. Data were collected through a four-point Likert type attitude scale developed by the researcher. The results indicated that the participants interpreted the APA as a helpful partner having human-like behaviors. Furthermore, APA supported and facilitated their learning.

## **Theoretical Framework**

As technology advances, the demand for applying technological tools in the education for various purposes increases. One of the latest technological evolutions is animated pedagogical agents (APA) which are likable computerized characters with embodied life-like behaviors such as gesture, gaze, locomotion, speech emotions, etc. (Moreno, Mayer, Spires & Lester., 2001). Because these non-verbal and verbal behaviors also occur in human- human interaction, APAs having these behaviors add powerful capability to multimedia learning environments (Atkinson, Mayer & Merrill, 2005). These behaviors also let the people to perceive the environment as a social context (Moreno, et al., 2001; Dunsworth & Atkinson, 2007). Thus, the naturalness of the human computer interaction can be maximized by the use of APAs in the multimedia learning environments.

The pedagogical agents' effectiveness in the human computer interaction is supported by social agency theory. According to this theory, using verbal and visual cues in the computer-based environments encourage the learners to interpret the computer as a partnership. They consider their interaction with the computer as social one, because the social cues are similar what they would expect form a human-to-human conversation (Atkinson, et al., 2005).

Recent research studies in the multimedia learning environments and human computer interaction has begun to focus on the educational benefits of animated pedagogical agents. The effectiveness of APA in educational setting has been studied in different fields, such as science, mathematics and humanities (Atkinson, 2002; Baylor & Ryu, 2003; Moreno, et al., 2001). However, limited research has investigated the use of pedagogical agents in second/foreign language learning. Even though various external and internal properties of the APA various can be beneficial in language learning, the application of APA in multimedia learning environment for second language learning has limitedly investigated. In addition, the recent research studies generally cover the undergraduate or adult learner. This study examined the 5th grade students' attitudes toward animated pedagogical agents in second language acquisition.

### Method

The participants of this study were 187 fifth grade students (99 females, 88 males) from two different regions of Turkey. Participants were between ages of 10 and 11, ( $M=10.91$ ,  $SD=.51$ ). Multimedia learning tool was developed by the researcher by considering the needs of the course teacher, the content of the lesson and levels of the students. This multimedia learning environment aims to teach and practice the model verb "can" to the 5th grade students in their English as a second language courses. The "Peedy", Microsoft animated agent was used in these learning environments. After studying the multimedia learning tool, data were collected through four-point Likert type attitudes toward animated pedagogical agents scale developed by the researcher. Some items were written according to the social agency theory and some items were adopted from existing instruments used for assessing the learners' attitudes toward animated pedagogical agents (Ryu & Baylor, 2005; Adcock & Van Eck, 2005). Reliability coefficients for four factors (supporting to learn, facilitating learning, human-like and being a partner) of this instrument are .77, .82, .68 and .70 respectively.

### Results and Discussion

#### Supporting to learn

Participants' attitudes toward the Peedy in term of supporting to learn was high with a mean of 3.32 and standard deviation of .62 on a four-point likert scale. This indicated that APA is a beneficial technological tool to support the young students' second language learning. He supported the students' learning by giving feedback and clues and taking their attention to important points.

### Facilitating to learn

Participants perceived the Peedy helpful in term of facilitating their learning with a mean of 3.41 and standard deviation of .58. They found the hand movements of the Peedy helpful for concentrating on the important concepts. Peedy made the content enjoyable, entertaining and interesting. Furthermore, Peedy guided the participants in the use of multimedia tool and presents the content effectively.

### Human-like

Participants perceived that Peedy has life-like behaviors and characteristics ( $M = 3.08$ ,  $SD = .68$ ). They thought that Peedy's hand movements, gestures, gaze, locomotion and speech emotions were similar to the people.

### Being a partner

Participants interpreted the Peedy as a social partner in multimedia learning environment characteristics ( $M = 3.32$ ,  $SD = .59$ ). They thought that they were a good team together and get along with well like friends.

## Conclusion and Discussion

APA, which provides instruction through verbal and nonverbal modes of communication, yields a social interaction between the computer and learner. Recent research studies investigated the different roles and aspects of pedagogical agents on the retention, transfer, interest and persona affect. Some of the pedagogical agents are Herman the Bug (Moreno et. al, 2001; Lester, Converse, Kahler, Barlow, Stone & Bhogal, 1997), and Steve (Johnson, Rickel & Lester, 2000). These agents have a role of tutor, motivator, expert, mentor and learning companion. These studies concluded that animated pedagogical agents enhance the students learning, motivation and their interest to the learning environment. Paralell to these studies, the results of this study indicated that 5<sup>th</sup> grade students perceived the APA as a social partner who shows human-like characteristics. APA is also a beneficial to support and facilitate learning especially in second language acquisition.

Ohmaye (1998) stressed the importance of interaction in language acquisition. He mentioned that "language learning depends heavily on interactions with native speakers, and native speakers are hard to come by" (p.2) He continued explaining the limitations of the classroom instruction in the interaction with the native speakers, access target culture and individual attention and feedback. However, Turkish students do not have enough opportunity to interact with native speakers because of limited resources, social norms and personality traits. However, multimedia learning environments with APA offer students opportunities to interact with native speakers and provide a social context (Ohmaye, 1998). Therefore, this study

exemplifies the use of APA in second language learning and provides the attitudes of the young learners toward APA.

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# **Innovative Strategies for the Redesign of Asynchronous Field Trips by Employing Cyber Technologies and GPS Devices: a Situated Learning for Hands-on Experience**

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Barbara B. Lockee

## **Abstract**

This design-based research presents an innovative approach for a field trip, which employs cyber learning tools such as Google Maps, ePortfolio, university course website, and GPS devices, to offer students an environment of situated learning. This paper details the possible solutions and advantages of students self-guided field trips to overcome the challenges existing in a traditional field trip, such as the problems of passive learning, as well as resource and time consumption on field trip planning and implementation.

*Key words:* field trip, GPS, situated learning

## **Problem Statement**

Field trip, as an important instructional means, significantly impacts learning in the cognitive and social aspects, affording learners great opportunities to have a concrete understanding on subjects and to obtain hands-on experience (Tal & Morag, 2009). Although field trips have been widely used in K-12 and higher education, there are still a variety of challenges in its design, management and implementation. A common problem of the field trip is the simple transformation from a classroom lecture to an instructor-led outdoor activity, which merely adds a “look and see” experience (Beierdofer & Davis, 1994). This type of activity deviates from the principles of “situated learning”, which is to encourage learners to take an active role in learning, allow them to construct knowledge instead of receiving information, as well as afford them a situation to comprehend and apply knowledge instead of simply repeating what was learned (Marlowe & Page, 1998). Furthermore, the field trip design, management and implementation is an intensive process. Many field trips can hardly meet requirements, such as: (1) instructors’ training in group management skills, (2) instructor/student ratio no higher than 1:10, (3) pre-trip planning the resources, (4) schedule coordination, and (5) suitable weather conditions (Beierdofer & Davis, 1994). Many field trips fail because of these challenges (Collins & Redcross, 2005; Hoff, 1942; Martin & SeEVERS, 2003). One such example is a biology class at an east coast university. Currently, each instructor takes 24 students on a campus tour to visit plants. The initial increase in the students’ motivation by employing a field trip fades quickly after visiting the first two or three trees. This is due to the fact that receiving a lecture in a field is no better than that in a classroom. During the field trip, the instructor demonstrates plant structures by using a real leaf, seed or fruit. Students standing far away from the instructor can barely see the examples. More seriously, during the field trip, students simply follow the instruction and passively receive information. They have little chance to observe, touch or feel the plants by themselves. This is not consistent with the original intention of the field trip: allowing learners to have hand-on experience. A desired field trip should afford students an effective and enjoyable first-hand experience in which they are intentionally engaged in authentic activities allowing observation, elaboration and knowledge construction (Carroll, 2007; Lei, 2010; Rudmann, 1994; Peterman, 2008). In addition, the application of innovative technology could alleviate some of the challenges often seen in the field trips.

## **Description of Study**

This design-based research project addresses the field trip challenges mentioned above. The proposed project converts an instructor-led field trip into an asynchronous, students self-guided field trip. Learners will form teams to take a trip on campus, looking for plants covered in this lesson. To arouse students’ interests, the element of Geocaching (a treasure-hunting adventure) is added in the field trip. Each plant serves as a geocache waiting for the students to discover. Since this self-guided tour will be conducted on the university campus, safety issues won’t be

a concern. Google Maps containing the geocache locations will be provided. Students will also use GPS devices to guide their journeys. All the guidelines and instructional materials will be available on the course website. Students are asked to print out the handouts before the field trip. Once students find a plant, they will read the information about this plant on the handout. They will also observe it, take notes of it, take pictures, and answer the questions on the handout. Upon the completion of the tour, each team will create an ePortfolio to reflect what they have learned. An ePortfolio encourages learners to take the responsibilities in their knowledge construction, supports peer-to-peer review, facilitates the process of knowledge sharing, as well as serves as evidence of effective learning assessment (Reeves & Okey, 1996).

### Methodology

This project focuses on the design and implementation of an asynchronous, students self-guided field trip at the university level. The researchers will randomly select 5 out of 20 classes as experimental groups. The total number of samples will be five instructors and around 120 students. The study will be implemented for 1 week during Spring 2011. After the first implementation, the researchers will conduct one-on-one interviews with the five instructors to find out the coherent themes on what works well and what does not work in this field trip. A survey will also be used to collect data about students' opinions on the field trip. The survey will include some close-ended (Likert scale) questions and a few open-ended questions to investigate the factors of class effectiveness from the students' perspectives. The researchers will look for the correlation between the students' satisfaction and the learning outcomes, as well as conduct the regression analysis using the students' satisfaction and the learning outcomes to predict the effectiveness of the field trip.

### Application of Results

Design-based research supports design progress as an iterative process where research, design and pedagogical practice are tightly intertwined (Joseph, 2004). Therefore, the research team will revise the field trip design based on the result of the first round data analysis. After the revision, it will be re-implemented in Fall 2011, and then a second round data will be collected for further refinement. This research intends to improve the effectiveness of the field trip, increase the resources economization on the special training of instructors, as well as to save efforts on pre-trip preparation and schedule coordination. The format of this field trip is logistically feasible to be adopted for other natural science courses. Any persons involved in the design, development, implementation, and/or administration aspects of authentic learning experiences will benefit from this project. This research will be of interests to the instructional design and technology professionals in K-12 and higher education.

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# Reverse Modality Effects on Spatial Knowledge Instruction: When Reading is Better than Listening

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## Abstract

This study investigated the reversed modality principle in spatial learning content with two different modality conditions. Participants were randomly assigned to two groups (visual text and spoken text). The findings revealed no significant differences in terms of mental effort for the instruction and assessments, the usability level, and perceived usefulness. However, the significant effects on three assessments showed that the visual text group performed better than the spoken text group. The results support a reverse modality effect. This study provides theoretical support for establishing boundaries for the modality principle as well as practical implication for instructional designers.

## 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 Merriënboer, & 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 verbal information. Presenting textual information visually (as on-screen text) during multimedia learning is purported to overload the visual subsystem and strain attentional resources. This occurs because of the need to temporarily hold and process text along with pictorial information (e.g., animation) in the same memory subsystem (Mayer & Moreno, 1998). 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 (both visual and verbal subsystems) more efficiently (Tabbers, Martens, & van Merriënboer, 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).

The modality principle has been linked to reduce mental effort and study time during instruction and to improved performance on retention, transfer, and matching tests (Ginns, 2005; Tabbers et al., 2004). The modality principle has also been validated across a variety of computer-based media, such as multimedia explanations, agent based computer games, and virtual reality (Moreno, 2006).

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. 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, and 2) a learning task with a significant spatial component. 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.

## Method

This study investigated the effects of modality on spatial knowledge learning from a computer-based diagram and related text. Modality (visual text vs. spoken text), see Figure 1, were examined between two groups. One hundred and seventeen undergraduate students from a large southwestern university were randomly assigned to one of the two experimental conditions.

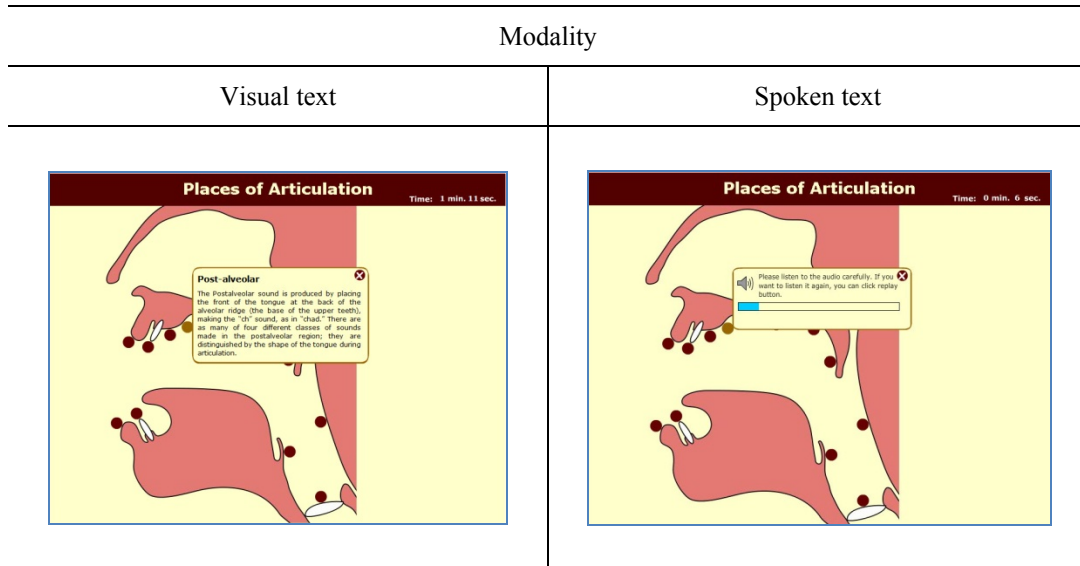


Figure 1. Screen shots from the visual (left) and spoken text conditions

The experimental materials consisted of a computer-presented diagram depicting 12 places of articulation in human speech. The participants accessed the text by selecting a place of articulation on the diagram with a computer mouse. In the visual text condition, descriptive sentences were presented as on-screen text; in the spoken-text condition the text was presented as narration. The participants had complete control over the pace and sequence with which they selected the hyperlinked text. They were instructed to study the diagram and the related text for 10 minutes. After 10 minutes of study, the participants were given the survey, reconstruction, labeling, and matching assessments.

The dependant measures consisted of the number of clicks on description dots, the number of clicks on replay buttons, mental effort, the usability level, the usefulness of either visual or spoken text, a diagram reconstruction test, a special labeling test, and a matching test. All dependant measures were delivered via computer. In the instruction, there are 12 different round markers in the diagram as shown in Figure 1. Once they click a marker, they can see the written text or listen to the spoken text in a pop-up box. Both types of text will stay for 25 seconds, and a review or replay button will be shown after the written text disappears or the spoken text finishes, See Figure 2. The two different numbers of clicks tracked how many times participants revisit or replay the descriptions for each place.

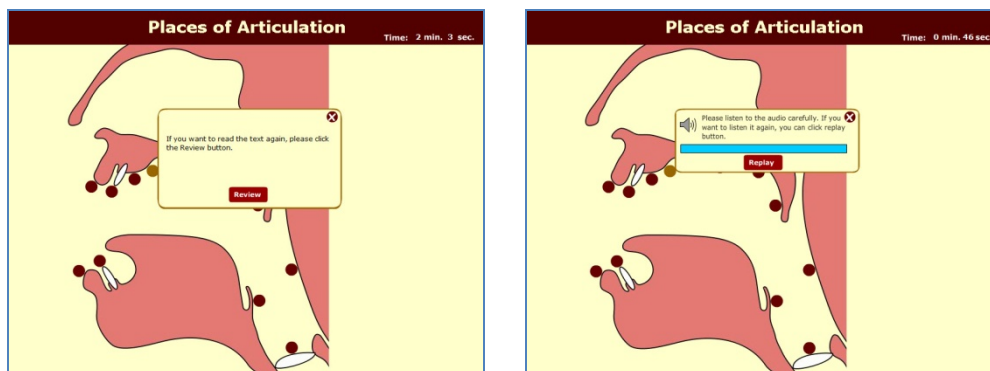


Figure 2. Review and replay screens

Subjective mental effort ratings were obtained after the experimental treatment and after each of the three assessments. These ratings measured (on a 7-point Likert scale) the amount of cognitive resources the participants' perceived they invested in the instruction and the three assessments. This subjective measurement scale has been used to calculate instructional efficiency scores in many studies investigating cognitive load theory (e.g., Kalyuga & Sweller, 2005; Tuovinen & Paas, 2004). The level of usability measured how easily participants operated or navigated the interface. The usefulness of text types represented participants' perceptions toward either visual text or spoken text. 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. We measured the distance between correct locations and the locations participants moved. Similar to the reconstruction test, the spatial labeling test provides the unlabeled places in the articulation diagram and the list so that participants can move a description to the right place. This test measured only right or wrong places. Finally, 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.

## Results and Conclusions

Independent *t*-Tests were conducted to compare all variables between groups. The results revealed that there were no significant differences in terms of mental effort, usability, and usefulness. However, five dependant variables had significant differences. Regarding the numbers of clicks, the numbers of clicks for the descriptions ( $M = 36.80, p < .001$ ) and for the replay button ( $M = 1.39, p = .047$ ) in the visual text group than the numbers of clicks ( $M = 17.39$  for the description,  $M = .82$  for the replay) in spoken text group. In addition, the visual text group had higher scores in all test scores as shown in Table 1. Note that the values of the reconstruction test represent the distance from the correct place, so lower numbers mean higher scores. In summary, we observed a reverse modality effect for all dependant measures, as hypothesized.

Table 1. Results of test scores

Test	Mean scores		Independent t-test
	Visual Text	Spoken Text	
Reconstruction	66.14 (51.75)	90.61 (52.72)	$t(115) = -2.533, p = .013$
Spatial labeling	8.87 (2.96)	7.57 (3.42)	$t(115) = 2.197, p = .030$
Matching	3.54 (2.59)	2.60 (1.66)	$t(115) = 2.294, p = .024$

The results of this study support the results of the study by Crooks et al. (2009) and Tabbers et al. (2004). 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 visual text over spoken text. For example, the visual text group had more control over pacing while the spoken text group had to stay for 25 seconds to listen to whole narrations. So, the visual text group had more chance to revisit and review the description. 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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# The Effects of Post Organizers in Game-Based Learning

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## Abstract

This study investigated the effectiveness of organizers in a serious game as an instructional unit. For this study, a serious game about transistor recycling was used as a tool for game-based learning. The results revealed that a post organizer provided, after the game was finished, positively influenced the participants' recall of the learning content and their perceptions of enjoyment, learning tool, and satisfaction toward the game. However, no organizer and an advance organizer had no effect.

## Introduction

Computer games have been applied to learning environments as an effective instructional tool (Dormann & Biddle, 2006; Gee, 2003; Mansour & El-Said, 2008). The educational utilization of computer games has been defined as game-based learning (Squire, 2008). Specifically, Gee (2003) argued that game-based learning is a virtual learning space where learners enable to experience such unique attributes in computer games as interactivity, enjoyment, and engagement while they attain learning goals in traditional or online learning environments. For instance, instructional software "Computer Tutors," which was developed by BBC, provides a game-based learning course utilizing gaming strategies. Thus, game-based learning refers to the strategic application of computer game for learning.

Serious games have emerged as a pragmatic unit for game-based learning, which is initially designed with a primary purpose rather than for entertainment or enjoyment (Freitas, 2006; Squire, 2008). Therefore, serious games can be considered an attempt to specifically apply the computer game attributes, such as enjoyment and engagement, to learning environments (Koster, 2005; Kirkley & Kirkley, 2005). It has been found that serious games stimulate students' learning motivation, subsequently leading to the increased rate of knowledge acquisition and retention (e.g., Aldrich, 2005; Michael & Chen, 2006), such as "Immune Attack" which was developed for the purpose of educating students about basic concepts of cellular and molecular biology. However, considering that serious games should be situated between the activities of entertainment and pedagogy (Dormann & Biddle, 2006), it is challenging to utilize serious games as a learning tool (Kirkley, Tomblin, & Kirkley, 2005; Mayo, Singer & Kusumoto, 2005). Therefore, there is a need for more research that examines the effective use of serious games.

Previous studies have examined the effect of organizers as supportive materials to learning. It has been suggested that advance or post organizers can enhance students' comprehension in traditional learning environments by increasing their attention to important information (Butz, Miller, & Butz, 2005; Lucas & Goerss, 2007; Robinson, Katayama, Beth, Odom, Hsieh, & Vanderveen, 2006). Therefore, we expect organizers to effectively aid the educational use of serious games. Currently, most of the existing serious games contain brief information, such as how to play the game; however, there have been few games containing organizers that effectively describe the content of the game. Therefore, the purpose of this study is to examine the effects of organizers in a serious game. This study, specifically, determines which organizers would be more effective between advance and post organizers.

## Research Questions

The research questions for this study are:

1. Do organizers in serious games influence students' game scores?
2. Do organizers in serious games influence students' recall of the learning content?
3. Do organizers in serious games influence students' perceptions occurred by playing the game?

## Method

Participants for this study were 99 undergraduate students (mean age = 20 years old) at a southwestern university. This study had three conditions: (a) group 1 – no organizer ( $N = 35$ ), (b) group 2 – advance organizer ( $N = 35$ ), and (c) group 3 – post organizer ( $N = 29$ ).

This study, consisting of three phases, was carried out in a computer lab. In the first phase, the participants were asked to play a serious game ‘*The Transistor*,’ which was developed by Nobelprize.org (see Figure 1), for 15 minutes. Transistor and non-transistor items were featured throughout the game in order to teach the student the importance of transistor recycling. In the game, they were asked to remove all non-transistor items that do not have transistors by using a mouse click. An additional Web page, showing a list of the items appearing in the game, was embedded in the game. It functions as an organizer intending to aid students to better understand transistor and non-transistor items. When the organizer page appeared before playing the game, it was defined as an advance organizer. When the organizer page appeared after playing the game, it was defined as a post organizer. In the second phase, they were asked to answer questions about their perceptions of the game they previously played. Their perceptions of enjoyment, learning tool, and satisfaction were measured using a 7-point Likert scale ranging from ‘strongly disagree’ to ‘strongly agree.’ In the third phase, they were asked to answer questions assessing their recall of transistor and non-transistor items appearing in the game. They were asked to list the items correctly recalled among a total of 21 items.

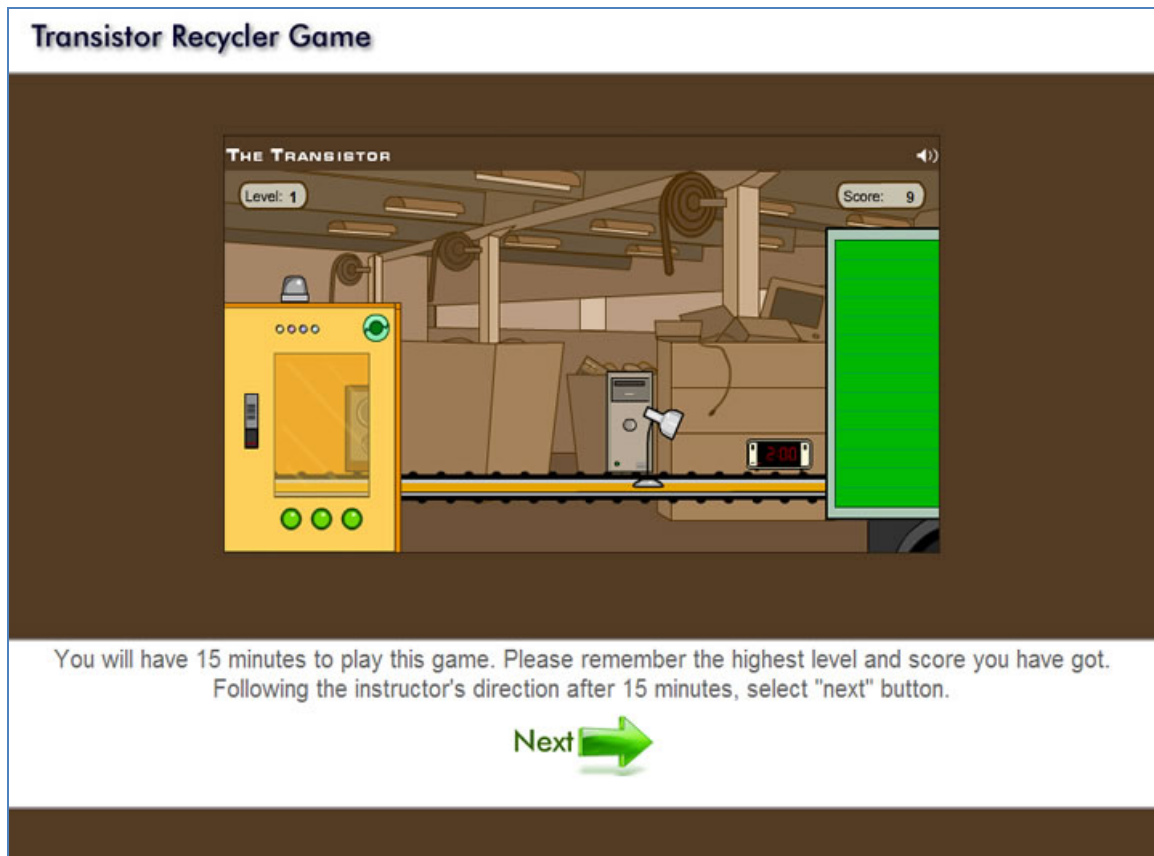


Figure 1. A screenshot of the serious game ‘*The Transistor*’

## Results

A one-way ANOVA was computed to determine the differences of game scores between groups. The result showed that there was not a significant difference in terms of the location of organizers ( $F(2, 96) = 1.68, p = .193$ ). The mean scores of group 1, group 2, and group 3 were 121.66 ( $SD = 37.80$ ), 138.89 ( $SD = 44.04$ ), and 130.41 ( $SD = 35.00$ ), respectively.

Recall of learning content was analyzed by performing a one-way ANOVA. The analysis revealed that there was a significant difference in terms of the location of organizers, ( $F(2, 96) = 4.07, p = .020$ ). A Tukey post-hoc test showed that group 3 ( $M = 12.24, SD = 2.98$ ) had better recall than group 2 ( $M = 10.40, SD = 2.59$ ). However, there was no difference between group 1 ( $M = 10.80, SD = 2.47$ ) and group 3, and between group 1 and group 2.

Another one-way ANOVA was conducted on the perceptions toward the serious game. These perceptions were enjoyment, learning tool, and satisfaction. First, the analysis revealed that perceived enjoyment was significantly different in terms of the location of organizers, ( $F(2, 96) = 3.13, p = .048$ ). A Tukey post-hoc test suggests that group 3 ( $M = 4.72, SD = 1.62$ ) had a higher level of perceived enjoyment than group 1 ( $M = 3.74, SD = 1.49$ ). However, there was no difference between group 1 and group 2 ( $M = 4.09, SD = 1.61$ ), and between group 2 and group 3. Second, it was found that perceived learning tool was significantly different in terms of the location of organizers, ( $F(2, 96) = 3.51, p = .034$ ). A Tukey post-hoc test showed that group 3 ( $M = 4.99, SD = 1.58$ ) had a higher level of perceived learning tool than group 1 ( $M = 3.99, SD = 1.70$ ). However, there was no difference between group 1 and group 2 ( $M = 4.16, SD = 1.46$ ), and between group 2 and group 3. Third, it was also found that satisfaction toward the game was significantly different in terms of the location of organizers, ( $F(2, 96) = 5.09, p = .008$ ). A Tukey post-hoc test showed that group 3 ( $M = 4.69, SD = 1.60$ ) had a higher level of satisfaction than group 1 ( $M = 3.46, SD = 1.52$ ). However, there was no difference between group 1 and group 2 ( $M = 4.18, SD = 1.54$ ), and between group 2 and group 3.

### Discussions and Conclusion

Based on the results, the use of post organizers should be encouraged to enhance positive educational effects of serious games, such as recall of the learning content and perceptions of enjoyment, learning tool, and satisfaction. Post organizers were proven to help students develop a well-established schema for the learning content, ultimately causing better recall. An interesting aspect, found in this study, was that post organizers positively influenced the students' perceptions toward the serious game. Thus, it can be assumed that the higher knowledge acquisition enhanced by post organizers yields not only higher recall scores but also positive perceptions toward the game. Consequently, post organizers, as an instructional component, could be recommended to strengthen the effectiveness of serious games.

However, the insertion of advance organizers was not shown to be effective on the students' recall and perceptions. It can be assumed that advance organizers did not impact learning because the students tended to forget the earlier insertion of organizers during the game. Within the gaming environment, post organizers can be more effective than advance organizers.

When considering the nature of the empirical research, this study revealed several methodological limitations that should be considered in interpreting the results discussed above. First of all, this study failed to show a significant difference in the game scores in terms of the location of organizers. However, this study asked the participants to report only the best score they received while playing the game repeatedly. Future research needs to examine the effects of organizers on the scores over time and examine each student's score simultaneously. Second, the game used for this study is simple and some participants might bore easily. Thus, future research can use more serious or complex games to stimulate the students' enjoyment. Third, the effects of organizers on students might be different in other kinds of serious games. In addition, the sample size of this study was somewhat small. These could prove to be critical issues that do not allow the results of this study to be generalized. Or, a larger sample size might be used to establish a generalization of the results. Last, a different type of organizers could be considered if a game focuses on affective domain and psychomotor domain rather than cognitive domain.

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# **Assessing Graduate Students' Needs Related to Online and On Campus Course Scheduling**

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*Key words:* needs assessment, course scheduling, online and on campus delivery

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## **Abstract**

The purpose of this needs assessment was to determine student and program faculty concerns about scheduling courses, related to online and on campus delivery. The needs assessment was a two-part process that took place over two semesters. Extant data, questionnaires, interviews, and focus groups were used to address whether students were satisfied with their ability to schedule courses and identify any concerns related to being able to complete their degrees. Most respondents expected to complete their degrees in a timely manner and were satisfied with the instruction they received overall. Some stated they were not always able to take courses they preferred or when needed, and could take other available courses instead to keep making progress. Concerns about course delivery were expressed, but mixed; that is, some expressed the need for more online courses while others expressed a need for more on campus courses.

## **Introduction**

Needs assessments are conducted for a variety of purposes, but an overarching purpose, in an academic setting, is to gather information from a variety of sources to determine if there is a gap between actual (what is) and optimal situations (what should be) (Rothwell & Kasanas, 2004, Altschuld & Kumar, 2010). In other words, it is about clarifying problems and providing data for decision making (Gupta, 2007). Unlike other inquiry methods (i.e., case studies, narratives, and so on), a needs assessment includes, not only the results, but also provides recommendations or solutions. Kauffman, Rojas, and Mayer (1993) suggested that stakeholders may also receive advice as to the consequences and payoffs if, or when, the need assessors' recommendations are followed.

One of the first tasks is to gather data from a variety of sources to gain a basic understanding of the stakeholders' needs (Rothwell & Kasanas, 2004; Altschuld & Kumar, 2010). Based on information from this preliminary stage, the needs assessor assists stakeholders in determining whether all identified needs can be addressed or resolved, and, if necessary, prioritize them in terms of significance and positive impact on the organization (Moore-Thomas, C & Erford, B. T., 2004). Witkin and Altschuld (1995) suggest there are three levels of stakeholders. Within higher education institutions, level one, service receivers, are the students and level two, service providers, are primarily the faculty and staff. The third level is the resources and support structure that allows the second level to provide services (Altschuld & Kumar, 2010); in colleges and universities, this includes administrators and the infrastructure within the setting.

Although organizations, such as universities, often make decisions with little to no consideration of conducting needs assessments (Watkins, 2005), instructional designers maintain that needs assessments provide

valuable information to meet stakeholders' needs and organizational goals (Ingram, Haynes, Davidson-Shivers, & Irvin, 2005; Rothwell & Kazanas, 2004). Needs assessments also provide them with opportunities for better planning which, in turn, leads to actions for improving the instruction and learning.

### **New academic programs**

Schuttler (2010) suggested that anytime universities consider developing new undergraduate or graduate programs, they should conduct a needs assessment. It could provide information about existing programs within their university as well as similar programs at other universities. The needs assessment could examine the availability and qualifications of existing faculty. In addressing the viability of adding new programs, the results could also establish practical and efficient access [for the potential student body to attend classes], estimate costs related to students obtaining degrees and costs in terms of time and resources to the university. For example, Hoyt, Howell, and Young (2009) conducted a needs assessment (NA) to determine the availability of evening courses for students. The purpose was to gather information about students' needs relating to the availability of evening courses and their impact of scheduling on campus courses in the evening. This contributed to more efficient degree completion and satisfaction of nontraditional students and traditional students. They found that adding evening classes allowed more students to complete their degrees in a timely manner and, in turn, allowed the university to admit a new pool of students.

### **Existing academic programs**

Needs assessments are conducted to provide information about existing programs as well (Davidson-Shivers, Inpornjivit, & Sellers, 2004; Ingram et al., 2005). Examination of degree programs may show areas of improvement in regards to the use of technology and how online delivery can be improved. (Martinez, Liu, Watson, & Bechelmeyer, 2006)

### **Specific needs assessments in an instructional design program**

Three needs assessments (NAs) were conducted on the instructional design (ID) program in recent years at a regional university in the Southeast; each was focused on a specified purpose. The first NA, conducted in 2002, determined whether the ID program met students' educational needs and enabled them to meet their professional goals (Davidson-Shivers, et al., 2003, 2004). Results indicted existing students and alumni expressed overall satisfaction with their education and that the ID program assisted in helping them meet their professional goals. Alumni also indicated that they had jobs in ID or a related field, which required ID knowledge and skills. The second NA, conducted three years later, assessed the program's success in career preparation of students, but also determined alumni involvement in the program (Ingram, et al., 2005). The results verified the first NA findings and showed that alumni were interested maintaining a continued involvement with the program; alumni also provided recommendations of how it could be accomplished. Based on results of the first two NAs, suggested changes to the program were minor and some of the recommendations were implemented. Later, and as a course project, Clinton and Stevenson (2007) conducted a NA that focused on student retention and recruitment. Their findings indicated that student enrollment had been in decline for a few years and determined a need for increased recruitment effort; suggestions on ways to recruit new students were included in their report. The faculty took the findings under advisement and implemented some suggestions based on available resources and support structures in place.

### **Purpose of Current Needs Assessment**

With this decline in student enrollments and a major effort by the university toward moving to more online course delivery, some concern about meeting student needs were being raised by both students and faculty. These voiced opinions indicated there may be a problem with course availability, scheduling, and form of delivery. At the same time, faculty were in the process of identifying an articulated curriculum for required and support course offerings; this curriculum was to reduce offerings of the same course per year in order to increase class size per. Hence, the needs assessment had the potential to verify expressed concerns as well as help with the sequencing of courses within the ID curriculum.

The purpose of this current needs assessment was focused on identifying the current state of the ID program as related to course availability, scheduling, and delivery. Specifically, it was conducted to address whether

students were able to schedule courses satisfactorily and complete their degrees in a timely manner as well as gather information as to whether online or oncampus course delivery impacted student satisfaction levels.

The needs assessment was conducted in two parts. The first part, the preassessment and assessment phase, was conducted as a Needs Assessment course project in summer 2009. The focus of this Part One was to verify voiced concerns using extant data about the program and the previous needs assessments' findings and, then, to determine a need existed and, then, gather additional data from students and faculty as needed. Part Two, the follow-on assessment, was added for further exploration about findings from Part One.

## Methodology

### Organization, stakeholders, and team

**Organization.** This needs assessment was conducted on an Instructional Design (ID) program at the University of South Alabama, in Mobile, AL. There are three degree programs: master's, doctoral foundation track, and doctoral. The *master's program* is a minimum of 40 credit hours and students complete this degree entirely online or oncampus, or with a mix of online and on campus courses. The *doctoral foundation track program*, which began in the academic year of 2005-2006, is for students with a bachelor's degree or with a master's degree in fields other than ID. Students must successfully complete 22 credit hours of master's foundational core courses and pass a comprehensive exam on the foundational core to enter the doctoral program. Once enrolled in the doctoral program, continuous enrollment is required. The *doctoral program* is a year round program and requires a minimum of 60 hours that include successful completion of doctoral core and support courses, research and statistic courses and research/dissertation course hours. Doctoral students must also be successful in completing a research and statistics exam, doctoral comprehensive exam and a dissertation study (University of South Alabama Graduate Bulletin, 2010).

ID courses, especially master's and doctoral core courses (i.e., content directly related to the ID standards and competencies) were offered two times a year, with one delivered on campus and the other online. Research and statistics courses were generally offered at least once a year depending on the ID program and other college programs' enrollments and needs. Support courses were offered once a year or maybe every other year, again, depending on student need.

During summer term, ID faculty generally focused on core courses within the ID program or service courses required of all College of Education (COE) master's students were required take (i.e., an introductory course on learning psychology and introductory course to measurement and evaluation). A few ID support courses were offered during the summer as well.

### Stakeholders

Generally speaking stakeholders within university settings include students, faculty, administration, alumni and the university as a whole. The primary stakeholders for this project were the students enrolled in one of the three programs and the program faculty.

**Students.** Seventy four graduate students were enrolled in one of the three programs at the time of the study. As noted by the enrollment records at the time of the NA, there were 17 students in the master's program, 12 doctoral track students, and 45 doctoral students.

**Faculty.** Although we primarily focused on the needs of the students, we also considered the needs and concerns of faculty. The ID program has seven full-time faculty members. Five of them have doctorates in instructional design and the other two have doctorates in measurement and statistics or educational psychology.

### Needs assessment teams

**Part One: Preassessment and assessment phase.** For Part One, students ( $n = 5$ ) enrolled in the Needs Assessment course, were assigned to two teams. Two were in the master's program with the remaining three in the doctoral program. The two master's students were placed on different teams. One team had two members, both female students; the other team had three members, one female and two male students. These teams worked separately during the preassessment phase and prepared a report. During the assessment phase of Part One, the

teams worked collaboratively to develop and administer the survey instruments for data from students and faculty. However, each team wrote separate final reports as part of the course requirements. A final exam and participation were part of each individual's final grade.

**Part Two: Follow-on assessment.** After the class was over, students could elect to continue with the project. In the fall 2009, the three doctoral students began working with the same instructor on gathering additional data; they are the co-authors of this paper.

### **Data Sources and Instruments**

Data collected through various means and from the level one and two stakeholders was kept confidential and placed in a secure location. Any potential identifiers of individuals were removed and findings were expressed in aggregate form.

#### **Part One: Preassessment and assessment phase data sources & instruments**

**Extant data.** Extant data was provided by the course instructor. The documents showed course availability documents were from fall 2006 to summer 2009 included information on: how often courses were offered, whether they were online or on campus, number of seats available and number filled per semester/term. The enrollment data showed total number of students enrolled in the IDD program and by type of degree from spring 2004 to summer 2009. Documents on degree requirements for Master's, Doctoral Foundation Track and Doctoral were also examined. Lastly, the team had the published results from previous needs assessments conducted in 2002 and 2004 and the PowerPoint™ presentation on the third needs assessment in 2007 (as previously mentioned in this paper).

In the preassessment phase, one of the teams looked at other graduate programs in Instructional Design and Instructional Technology. Specifically, they examined Utah State, Texas A&M University, Capella University and the University of Southern Mississippi.

**Student questionnaire.** The Student Questionnaire (SQ) was constructed by the two teams. It contained 31 items within the sections of demographics such as their program, employment, etc., type of course delivery taken and preferred, questions about course availability, scheduling, and satisfaction in their program of study and progress toward completion of their degree. It was administered through *Survey Monkey®*.

**Faculty interview questions.** The two teams also developed specific questions to ask faculty on an individual basis. There were 8 open-ended questions to about their perspective on the history of the ID program, the program in its current state, and whether they thought student needs were being met. The faculty would be able to inform us of the process that takes places to make adjustments to the class schedule as well as their opinions and recommendations for improving the IDD program.

#### **Part Two: Follow-On assessment instruments.**

In the fall of 2009 and early spring of 2010, the team conducted a follow on survey and two focus groups.

**Follow-On student questionnaire.** The Follow-On Student Questionnaire (FOSQ) was a modified version of the SQ from Part One. The changes and additions included removing some of the demographic questions and asking questions about specific courses the students had or had not taken. The FOSQ was reviewed by the instructor prior to uploading to *SurveyMonkey.com*. The FOSQ was to be delivered to students enrolled in ID courses in fall 2009, so that newly admitted and returning students could respond to it. We also allowed those who responded to the SQ from Part One to respond, but only to the new questions found in FOSQ.

**Focus group discussion agenda.** The focus groups were conducted to further examine findings about online and on campus course offerings. The moderators used a list of seven questions. The discussion topics centered around what the ideal environment would be for students (online, on campus or both), their opinions on advising, the kinds of courses offered and if the focus group participants felt they were able to take the courses they needed. The focus groups were delivered via Second Life, on Jaguarland. Using Second Life for meeting with respondents, the conversation log of the focus group became the data source for later analyses.

## **Data Collection Procedures and Results**

For clarity, the Data Collection Procedures and Results for Part One of the NA will be discussed first, followed by the discussion Data Collection Procedures and Results for Part Two of the NA.

### **Part One: Preassessment and assessment phase data procedures**

The instructor provided the documents on course availability, enrollments, and degree requirements at the beginning of the second week of the course to both teams. Additionally, she provided hard copies of two journal articles and uploaded the PowerPoint presentation to the course companion website for both teams to review and use. The two teams also gathered promotional brochures on the ID program and information on ID programs at other universities for comparison purposes.

The SQ for Part One was developed together by both teams and reviewed by the instructor. Once changes were made, the questionnaire was delivered electronically using *SurveyMonkey.com*. One member of the team sent an email announcement explaining the purpose and requesting participation through the ID program's listserv for faculty, students, and alumni. Location of the SQ and a time frame for responding was also included.

To interview faculty, the teams worked together to develop the interview questions. The instructor again reviewed the items and the teams Members selected a faculty member to contact for an interview and made an appointment with them. Each interview was recorded and then transcribed.

### **Results of Part One: Preassessment and assessment phase**

**Results of extant data analyses.** After examining the degree programs in Instructional Design and Instructional Technology at the University of Utah, Texas A & M, the University of Southern Mississippi and Capella University, the Master's and PhD program at USA are comparable to these other universities as far as hours required for coursework, and in offering a mix of online and on campus courses. The exception is Capella University, which is an accredited online institution only.

According to Clinton and Stevenson (2007), student enrollments were declining as early as 2003 and the trend continued as verified by the student enrollment records. Whereas the total number of students in fall 2005 was 119, the total number in summer 2009 was 74.

Other records also revealed that student enrollments had declined. In spring semester, 2007, 25 Master's students were taking courses and only 17 were enrolled in summer 2009. The enrollment for doctoral track students in summer 2009 was 12. Percentagewise, the enrollment in the master's program decreased by 23.5% from spring 2004 to spring 2009. For doctoral students, enrollment fell 41.9% during the same time period. However, recall that the doctoral track program is a relatively new degree offered by the ID program; obviously, no data is available prior to fall 2005. Additionally, if data for doctoral track enrollments were combined with master's student for summer 2009, then it may more accurately reflect the decline with master's students. Furthermore, doctoral track and master's students are not required to be continuously enrolled; therefore, enrollment numbers may fluctuate somewhat.

Additionally, analyses of other documents (i.e., course schedule documents) indicated two major areas of potential concern. First, it appeared that courses were offered in such a way that made it difficult for students to complete their degree in a timely manner. This included the scheduling of both on campus and online courses. Second, there seemed to be potential that if students were unable to take courses when needed in order to complete degree requirements, there may be dissatisfaction among the current student populations. This scheduling situation included core and support courses as well as research and statistics courses (Davidson-Shivers et al, 2004).

Based on the previous needs assessment 2004 (Ingram et al., 2005) indicated that students in the master's program responding to the questionnaire appeared to rate their satisfaction in course availability, content, scheduling, and the ID program lower than students in or graduates of the doctoral program. Because of the focus of the NA focus was on fact finding about the program students and alumni, the instrument used did not require respondents to explain why they held such views.

**Student questionnaire (SQ) results.** The descriptive statistics from the SQ in Part One were computed using the built-in data analysis tools provided by *SurveyMonkey.com*.

Based on the preliminary findings from the extant data, both NA teams perceived that students being unable to complete their degree programs in a timely manner. However, results based on the SQ data indicated that this might not be the case.

Twenty-five participants completed the questionnaire, with eight who identified themselves as graduates, or alumni, of the ID program. The remaining 18 were currently enrolled, which is an overall 24% return rate for current students. As shown in Table #, the vast majority respondents (96%) indicated that they were making satisfactory progress in their degree and they were satisfied with the student-teacher ratio within courses at the time and 85% were satisfied with faculty advising. With regard to course availability, only 14% indicated dissatisfaction. The majority (81%) also indicated their courses were a mixture of online and on campus course delivery; they indicated that they did this in order to graduate. Sixteen percent of those surveyed that they indicated a preference for online courses. The main reason was that their jobs prevented them from attending on campus classes. As for advising and scheduling, the majority (84%) thought a two-year course plan would be helpful for them to plan their semesters in advance.

**Results of faculty interviews.** The team members interviewed four of the ID faculty. Two faculty members stated that the declining enrollments in the Master's program were a cause for concern. One professor stated that the program could no longer offer the number of support courses that were offered in the past due to the low numbers. Two professors responded that the ID program traditionally offered core courses at least twice a year. Additionally, they stated that with the [relatively new] online master's degree, the program was required to offer enough courses online in order for the online students to meet minimum number of credit hours requirements (i.e. 40 graduate credit hours) for the master's degree. Two professors thought there should be more courses offered online, however, converting an on campus course to an online course is time consuming and they needed more time to do that.

All commented that offering a two-year calendar could help students plan and complete their Plans of Study and enable the students to graduate in a timely manner. The faculty also commented that students needed to take responsibility for these Plans of study and talking with their faculty advisors on a regular basis. One faculty member indicated that if there were enough students requesting a particular course, they could possibly offer it. Three professors responded the master's program needs more required courses and fewer support courses. All four of the professors shared comments that they were satisfied with the requirements for the doctoral and doctoral track degree programs.

In regards to reasons why the declining enrollment within the ID program were occurring, faculty responded with a variety of opinions. Two expressed a similar concern that a lack of recruitment was hurting the ID program overall. Other opinions by various faculty members were that the nationwide decline in university enrollments due to the economy, that lower numbers in the doctoral program may be due to it not being offered as a fully online program. One remarked that requirements changed for teachers pursuing the master's degree which, in turn, made it less viable for them to enter in the ID Master's. However, one faculty member indicated that 10 new students were expected to enroll in fall 2009 and was cautiously optimistic. This same person suggested that during times of economic downfall, many times students will get a graduate degree to increase their qualifications.

In sum, although the findings from Part One suggested that students were satisfied with their program and they were able to make progress. Students who said they had to substitute courses for other intended courses in order to attain their degree was a new finding and a cause for concern. For instance, some students who planned to do their program fully online found it necessary to take classes on campus. It was thought that while the findings were interesting, more/further clarification about online and on campus delivery was needed. It was thought that these other issues could be explored further.

## **Part Two: Follow-on assessment data procedures**

The Follow-on team met to discuss next steps at the beginning of fall semester. This Follow-On Assessment experience was a "learning opportunity" for two of the students; one student was assigned a primary lead in facilitating the study as part of a directed study course.

The three team members added questions based on the Part One findings and the suggested areas that could be further explored. For the FOSQ, they removed some demographic items that were found to be either unnecessary or allow for the identity of the respondent to be known. Once approved, potential student participants were notified about the location of the FOSQ with an explanation of the purpose using the ID listserv. The FOSQ questionnaire was delivered using *SurveyMonkey.com* in November 2009.

After the FOSQ was completed, potential participants were again notified of the Focus Group's time and location and its purpose through the ID listserv. As stated previously, the focus group was conducted in Second Life. Although the moderator, one of the follow-on team, and respondents were within speaking distance, the virtual

environment made it easy for the moderator to log the conversation for later review and analysis of information collected.

Due to the timing of the focus group in the fall 2009 only a few participants attended, the Follow-On team conducted a second focus group at the start of spring 2010 term using Second Life. However, this time, the participants were in different physical locations. The questions used in the focus group were similar to the questionnaires but the participants could discuss the issues more in depth.

## **Results of Part Two: Follow-On Assessment**

**Results of FOSQ.** As with the SQ in Part One, descriptive statistics from the FOSQ were computed using the built-in data analysis tools provided by *SurveyMonkey.com*.

Overall, the results from the FOSQ supported the findings of the Part One needs assessment. Of the 22 students who completed the questionnaire, 20 felt that they were making satisfactory progress in the program. One respondent selected “lack of choice of courses” and “personal responsibilities” as the reasons for lack of were satisfactory progress toward completing his/her degree and one student skipped the question.

Seventy two percent of respondents indicated that when meeting with their advisors, they discussed their plans of study more than anything else. Of the 72%, approximately 33% indicated that they met with their advisors once per semester, but another 38% indicated that they met with their advisors two or more times per semester.

As anticipated, the results indicated that 81% of the respondents felt that a set course schedule would be beneficial when considering their plans of study. This finding supported the identified need that a scheduling problem existed in which students were unable to plan their courses far enough in advance.

In the FOSQ, a list of courses was provided; respondents were asked to indicate two things: a) the courses that they were interested in taking and b) if they had taken it. Respondents marked both categories for a majority of the courses. However, we noticed a difference in responses respective to four courses about technology tools. Between five and nine students identified courses as interesting to take, but only three have take the animation course and only one had taken the course on emerging technology.

Based on the findings showing discrepancies for four technology tools courses, we could have assumed the courses were offered at an inconvenient time/day during the semester or not in the semester that students needed it. However, we referred back to extant data from Part One to discover that the four courses had not been taught in a few years. Therefore, this finding supports the concern that certain courses are not offered frequently enough to meet student interest and needs.

It was anticipated by the Follow On team that if students were dissatisfied with course availability, it would be with the availability of online courses instead of on campus courses. Of the 16 respondents that addressed course availability, 11 indicated that they were satisfied with the availability of online courses, and seven indicated satisfaction with the availability of on campus courses. Therefore, this finding does not appear to support that there is a need to address any potential imbalance in the numbers of online courses and on campus courses.

**Results of the focus groups I and II.** Participants in the focus group meetings had taken the questionnaire. The purpose of the focus groups was to follow up on questions related to the FOSQ data. In Focus Group I, five out of six participants indicated that their preference was to take both on campus and online classes rather than one or the other. The participants commented that online classes allowed more flexibility in schedule and were appropriate for project-driven classes. The group also unanimously agreed that many professors were not trained to teach online and that there was a trend toward professors of online classes to withdraw from interaction with students and not “build community.” Furthermore, their discussion suggested that in online classes that were not project-based, the lack of interaction could be problematic for them.

When asked what courses they would like to see as part of the program, two focus-group participants mentioned that they would like to see courses address gaming, animation, and simulations, which one participant thought the program “no longer offer[ed].” This comment again reflects a confirmation of FOSQ finding that respondents expressed an interest in taking a class, but for some reason did not actually take it. Three Focus Group I participants also agreed that they would like to see additional qualitative research courses.

In Focus Group II ( $n = 2$ ), the participants agreed that they liked taking both on campus and online classes. According to one participant, “on campus classes allowed for free exchange of thought among students and the professor [and] are more preferable for theory-driven classes.” Another participant indicated a preference solely for on campus classes and stated that an on campus class was “worth the drive.”

One participant in the second focus group met with their advisors at least twice a semester about various topics, including course planning. The other participant who did not meet as frequently was a new student and had



not chosen a permanent advisor. Both focus groups agreed that that a two-year course schedule would be helpful in completing their plans of study. This seemed to indicate that it would allow them to make plans far in advance rather than waiting to see what was offered during each semester.

Finally, the focus group participants were asked how the program could improve their recruitment efforts. The participants indicated that they were not aware that the program made recruitment efforts. Only one person mentioned seeing a poster in the Communications Department. Other than that, the rest of the participants heard about the ID program through their friends and former advisors.

## Conclusions

At the start of the needs assessment project, there were indications that graduate students in the ID program were not able to complete coursework in a timely manner. It was suspected that classes were not available when the students needed them; and some students had difficulty taking courses that were only offered on campus.

After collecting data from various sources in both Part One and Two, we determined that the ID program was meeting students' needs overall, but there were some areas of concern. First, course planning and scheduling was an issue in that students were unable to plan their courses far enough in advance. Faculty members had a general idea of what would be taught from semester to semester and discussed this when meeting students, but students were not always aware of this fact, especially if they did not meet with their advisors on a regular basis each semester.

Second, certain support courses were not offered frequently enough. Offering support courses, including technology tools for the master's degree, could allow students additional knowledge and skills that they viewed as interesting.

Third, we observed from the findings that the ID program needed to increase its recruitment efforts. At the very least, recruitment would increase awareness of the ID program and its field. At best, there could be an influx of new students, which, in turn, could boost enrollment in courses and, thus, increase student demand for other courses to be offered on a regular basis.

As a final note: The ID program approved and implemented a curriculum for master's level and doctoral courses for 2010-2011. The courses are sequenced over a two-year period to assist students in planning and scheduling courses. The curriculum was provided to students through the ID listserv in March 2010 and again every term.

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# **The Instructional Effects of Knowledge-Based Community of Practice Learning Environment on Student Achievement and Knowledge Convergence**

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## **Abstract**

The increased accessibility of technology and internet connections has enabled organizations to provide their workforce the opportunity to engage in distributed education. Harnessing this innovation calls for organizational and technological infrastructures that support the interplay of knowledge and knowing” (Cook & Brown, 1999, p. 381). This paper explores the evidence of knowledge convergence in online knowledge based CoPs. Learning outcomes assessed declarative knowledge, convergence, and knowledge application. A comparison group (self-paced design) was used to draw conclusions about the differential effects of knowledge-building strategies on these learning outcomes. The results show there was a difference in pretest/posttest scores, and positive evidence of knowledge convergence. Our findings pointed to higher posttest scores and higher level of convergence in the online CoP strategy.

## **Introduction**

Today, knowledge is viewed as a commodity, which enables organizations to successfully compete on a global scale. Organizations value an individual’s knowledge as evidenced by corporate use of knowledge management systems to efficiently capture and catalog explicit knowledge. Cook and Brown (1999) argue that the focus on organizational knowledge, and management of knowledge, is based on a traditional understanding of the nature of knowledge. The increasing proliferation of technology and the Internet have enabled individual and group learning opportunities to transform tacit knowledge into explicit knowledge through online communities of practice.

Tacit knowledge is the result of knowing and utilizes explicit knowledge through practice. Tacit knowledge is present in work and workplace learning and is described as ‘know how’ transferred by storytelling, conversation, and narrative. Orr’s (1999) research illustrates the importance of tacit knowledge to organizations where Xerox’s formal training programs and instruction manuals failed to provide relevant information for the service technicians to perform their jobs. In such instances, acquiring a tool (knowledge) is not the same as being able to use it (Brown and Duguid, 2001).

Explicit knowledge is easily articulated and takes the form of documents, websites, customer relationships management (CRM) databases, and manuals that can be shared, and transferred to others. Corporations construct explicit forms of knowledge such as formal procedures, manuals, training and job descriptions that in most instances do not relate to authentic employee practices. Cook and Brown, (1999) suggest that explicit knowledge is regarded as formalized and can be documented. They further argue that focusing on an individual’s explicit knowledge is insufficient; rather, it is important to focus on individual and group tacit and explicit knowledge contexts in organization learning.

In the workplace, explicit knowledge is used as a management tool to influence and control organizational knowledge. While manuals are helpful to document knowledge for the organization, explicit knowledge is dependent upon tacit knowledge to be truly effective. There is a need for organizations to go beyond the documentation of formal, explicit knowledge to reveal and reify the ‘knowing’ dimension of knowledge. The challenge for organizations is to focus on the relationship between explicit and tacit knowledge building so that an

individual's or group's experiences are reified or hardened into a more explicit form. "Harnessing this innovation calls for organizational and technological infrastructures that support the interplay of knowledge and knowing" (Cook & Brown, p. 381).

A *knowledge-based community of practice* is a type of learning environment intended to codify and convert valuable, tacit knowledge into explicit knowledge. The reification process results in a collection of permeable best practices that can be shared by others in the community of practice. Knowledge based CoPs are the vehicle in which its passengers are able to propel the advancement of collective knowledge to develop individual skills and practices by achieving full participation of the members. The following section details the characteristics of knowledge-based communities of practice.

Research on the design and development of online communities of practice is still emerging. Among the issues is that "the evolutionary pattern of CoP development is poorly understood" (Schwen & Hara, 2003, p. 262). Schwen and Hara suggest that communities of practice are fully functioning when they evolve over time, which makes them difficult to study. Questions also have been raised about the role of knowledge in communities of practice. Researchers have varied interpretations of knowledge, particularly with regard to knowing in practice, and hence is worth studying. Schwen and Hara (p. 263) state "knowledge and knowing epistemologies are two distinct processes that require different designs to support optimal community learning."

The purpose of this study was to investigate the effectiveness of varied knowledge building principles, i.e., idea improvement, real ideas, authentic sources, and community dialog when used in an online community of practice learning environment to promote the convergence, reflection, and sharing of knowledge that can be reified and incorporated into a learning organization's practices. This study investigated the following research questions:

1. What are the effects of learning environment design on pre and posttest scores of declarative knowledge?
2. What are the effects of learning environment design on employee's knowledge convergence as measured by criterion essay assessment?
3. What is the impact of learning environment design on individual on-the-job performance, as measured by customer survey performance indicators?

## **Method and Procedures**

### **Participants and Context**

The participants for this study included a sample selected from 1001 dealership Service Advisors from Subaru, of America, Inc. who are required to complete the Building Service Excellence online training course to attain customer service certification and qualify for the Service Advisor SUMMIT Recognition incentive program. Within the dealership organization, the Service Advisor has the most customer contact; therefore, he or she is pivotal in creating and maintaining customer loyalty. The participants were comprised of 68% male and 32% female. All participants graduated high school with 24% reporting some college courses. The experience level of study participants ranged from less than six months to over 35 years.

The seven-hour classroom-based training course entitled *Building Service Excellence* was converted into two different treatments for this study: (a) an online community of practice learning environment and (b) an online self-paced instruction environment. *Building Service Excellence* is the cornerstone customer service course and

required of all Subaru dealership personnel. The course material introduced Service Advisors to basic customer service skills that are essential to maintain and increase customer loyalty.

To be consistent across treatments, all instructional content material and assessments are identical. The online community of practice learning environment and the self-paced instructional environment Building Service Excellence courses contain seven customer service related topics: 1) Personal and Practical Needs 2) Steps to Service 3) Key Principles 4) Taking the HEAT 5) Walkers and Talkers and 6) Recovery and 7) Action Planning. The presentation of the instructional materials is identical utilizing WebEx Presentation Studio to produce PowerPoint-like presentation instructional modules with audio narration, Adobe Captivate modules, text and electronic documents. The two treatments of the Building Service Excellence course were developed and designed to operate in Moodle (Modular Object-Oriented Dynamic Learning Environment). Moodle is a free open source Learning Management System application developed and maintained by a consortium of educators to promote constructivist pedagogy. Moodle's functionality offers many features for the design of online instruction. Instructional designers have the ability to create comprehensive, content-rich, highly collaborative learning environments. The following table shows Moodle features.

The study was conducted online using the Learning Management System, Moodle. The study was available to approximately 1200 Subaru dealership Service Advisors across the United States. The treatment materials were available 24/7 from any computer; from either work or home environment. Computer hardware varies from student to student; however, each PC is equipped with a CD drive, mouse, sound card, flash software, and a high-speed internet connection. After students enrolled in the course, they took the same pretest. They then proceeded through the course material. The participants enrolled in the knowledge-based course proceeded through the course material at their own rate. The participants in the community-based course followed a course timeline that lasted 12 weeks. The material was delivered at the student's convenience and was a requirement for qualification in Subaru's Service Advisor SUMMIT incentive program. The study was conducted over a six-month period. There were no restrictions on the amount of access attempts, time limitations, or location once students first access the course. After the course ended, participants were asked to take a knowledge posttest and an essay posttest. After 60 days, SOLI scores were collected for participants by an automatic data processing script and exported into an Excel spreadsheet.

## Results and Discussion

The results of the study are presented in the following sections according to each research question.

### Declarative Knowledge Pre-Test

The pretest data were analyzed to determine if the two sample means were similar. Table 1 shows the descriptive statistics for pretest scores from the self-paced and knowledge based community-learning environments.

Table 1: Descriptive Statistics for Self-Paced Pre-Test Scores vs. Community Pre-Test

	N	Mean	SD	SE Mean
Self-paced Pre-Test	61	23.78	2.75	0.35
Community Pre-Test	61	23.42	2.82	0.36
Difference	61	0.364		

The pretest scores of participants from each treatment were analyzed to determine comparable population means. To test the null hypothesis that there is no difference between the pretest scores of the self-paced and

community learning environments, a two-tailed test using the t-test statistic was used to analyze variances and means of the two populations. Glass and Hopkins (1984) state that there are three t-test assumptions: “(1) the X’s within each of the two populations are normal X’s y distributed; (2) the two population variances are equal; and (3) the individual observations (X’s) are independent (Glass & Hopkins, 1984, p. 236). It is unknown whether the observed value will be greater or less than expected and a two-tailed t-test is a more conservative or demanding (Creswell 2005, p. 188) analysis on the data. The level of significance or p value is ( $p < .05$ ). Table 4 shows the two-tailed t-test statistic for the self-paced and community pretest.

**Table 2:** Two-Sample T-Test for Self-Paced Pre-Test Scores vs. Community Pre-Test

Variances	t-value	df	SE of Difference	95% Confidence Interval		p-value
				Lower	Upper:	
Equal	.72	120	0.364	-0.634	1.361	0.472

The t-test revealed equal means on the self-paced and community pretests as indicated in table 2 ( $t(120) = .72, p < .472$ ). Thus, there was no difference between pretest scores across groups and accept the null hypothesis.

It was expected that the Service Advisors would score higher on the posttest than the pretest across treatments. Additionally, it was expected that the Service Advisors who self-selected the knowledge building community intervention would have higher posttest scores than the self-paced instruction group. To address this research question, analyses of the sample’s posttest scores were investigated. The primary data sources for addressing this question came from the analyses of posttest scores from the self-paced treatment and the posttest scores from the knowledge building community.

### **Declarative Knowledge Posttest**

The multiple-choice posttests were administered after the completion of the content for the self-paced and knowledge-based community treatments. The researcher expected that Service Advisors in the knowledge-based community learning environment treatment would score higher.

The sample is considered large; greater than 30, therefore an assumption can be made that the scores are normally distributed. Table 3 shows the descriptive statistics for the posttest scores in the CoP and self-paced learning environments.

**Table 3:** Descriptive Statistics for Self-Paced Post-Test Scores vs. Community Post-Test

	N	Mean	SD	SE Mean
Self-paced Post-Test	61	25.88	1.78	0.23
Community Post-Test	61	28.638	0.664	0.085
Difference	61	-2.757		

To evaluate the statistical significance of the difference in test scores, a two-sample t-test was performed. Table 4 reports the results of these tests and shows that participants in the community of practice learning environment had higher scores by a statistically significant margin ( $t(120) = -11.31, p < 0.00$ ).

Table 4: Two-Sample T-Test for Self-Paced Post-Test Scores vs. Community Post-Test

Variances	t-value	df	SE of Difference	95% Confidence Interval		p-value
				Lower	Upper:	
Equal	-11.31	120	-2.757	-3.240	-2.274	0.00

### Knowledge Convergence

#### Essay Assessment

The case-based essay assessment was the final measurement completed by the learner. Each of the five scenario based essay questions required the learner to read an authentic workplace situation and respond in writing using storytelling to integrate course content and practical workplace experiences. The techniques used in this study attempt to measure unobservable theoretical constructs using concept mapping to determine knowledge convergence.

Clariana and Koul (2004) suggest that there is a natural relationship between concept maps and essays, and content and process knowledge. Essays can be converted into concept maps to determine sharedness among the two groups and compare “group” mental models. To analyze the essay scores, the researcher utilized a method called Analysis of Lexical Aggregates (ALA-Reader, a software application) that enables the conversion of written essay responses into concept maps. This text representation tool analyzes small text samples using specific key terms. The key terms selected and shown in Figure 1 were derived from the course content.

customer(s)	customer			
car	car	vehicle		
loaner	loan	rental		
need(s,ed)	need			
repair(s)	repair			
shuttle	shuttle	transportation	ride	pickup
complete	complete	done	ready	
time	time			
appointment	appointment			
available	available			
offer	offer			
wait(ing)	wait			
inconvenience	inconv			
contact	contact	phone	call	
take	take			
service	service			
apologize	apolo	sorry		
make	make			
know	know			
what	what			
let	let			
today	day			
explain	explain			
thank	thank			
may	may			
give	give			
ask	ask			
situation	situation			
possible	possible			
first	first			

Figure 1: Key terms derived from essays





a pathfinder network (PFNET). This approach produced an expert essay PFNET (see Figure 4—6) and four ‘group’ PFNETs including  $SP_{odd}$ ,  $SP_{even}$ ,  $CoP_{odd}$ , and,  $CoP_{even}$ .

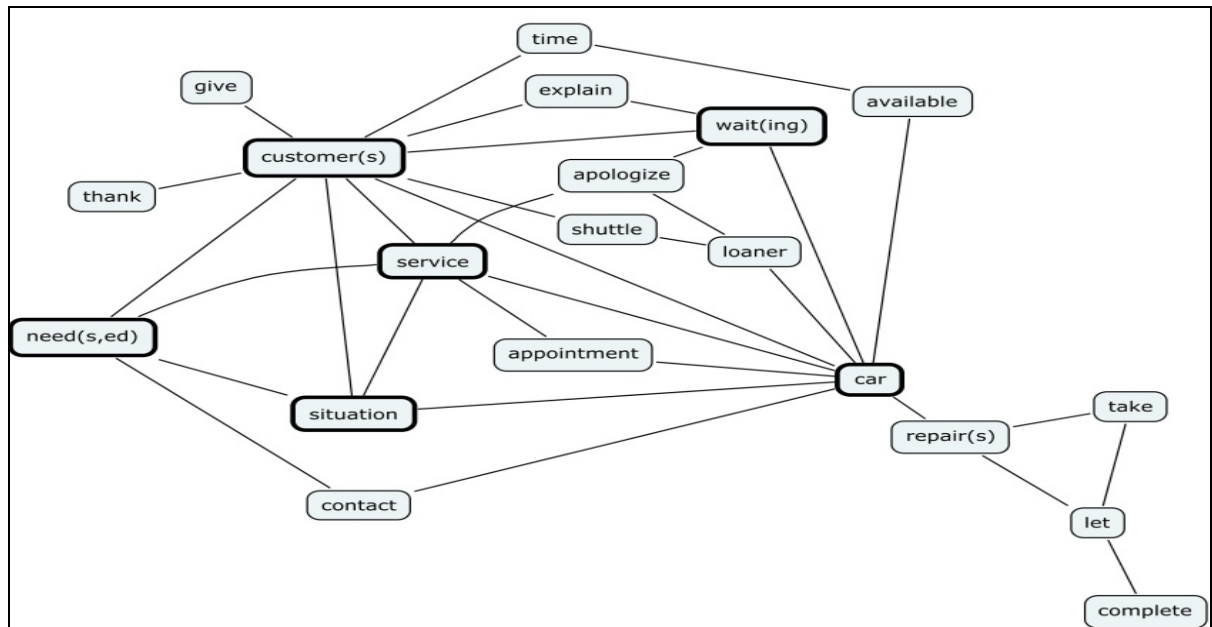


Figure 4: The PFNET Obtained for the Expert Essay Concept Map

Then KNOT software was used to compare these five PFNETs. Examination of links in common and percent overlap indicate that the CoP PFNETs were more alike (66% overlap between the even and odd CoP groups) relative to the SP PFNETs (33% overlap between the even and odd SP groups).

Research suggests that using ALA-Reader and KNOT for analyzing an individual essay with an expert essay count the common network links and that the common measure is a better predictor of knowledge convergence because incorrect associations are disregarded (Taricani & Clariana, 2006). Since these ‘group’ PFNETs are derived from the individual students’ essays, among other things, we conclude that the online community of practice strategy (CoP) led to a convergence of these participants mental models that was reflected in their essays and thus in the group PFNETs.

### Work-related Practice

The SOLI score data were analyzed to determine if the two sample means were different. Table 5 shows the descriptive statistics for customer service survey SOLI scores from the self-paced and knowledge based community learning environments.

Table 5: Descriptive Statistics for Self-Paced SOLI Scores vs. Community SOLI

	<b>N</b>	<b>Mean</b>	<b>SD</b>	<b>SE Mean</b>
Self-paced SOLI	61	93.11	3.77	0.48
Community SOLI	61	97.34	2.99	0.38

A two-tailed t-test was calculated for determining whether the difference between two independent sample means represented a true difference between populations thereby rejecting the null hypothesis of no difference between the means of the population (Shavelson, 1996, p. 339). Table 6 represents the two-sample t-test and the confidence interval for the self-paced SOLI scores and the knowledge based community SOLI scores. The t-test revealed unequal variances on the self-paced and community posttests as indicated in Table 6, with the community group outperforming the self-paced group. Table 6 reports the results of these tests and shows that participants in the community of practice learning environment had higher scores by a statistically significant margin ( $t(113) = -6.86, p < 0.00$ ). While these data were not conclusive as to direct impact, they nonetheless support the possibility that participation in the knowledge based CoP learning environment was associated with individual performance gains of those who participated.

Table 6: Two-Sample T-Test for Self-Paced SOLI Scores vs. Community SOLI

<b>Variances</b>	<b>t-value</b>	<b>df</b>	<b>SE of Difference</b>	<b>95% Confidence Interval</b>		<b>p-value</b>
				<b>Lower</b>	<b>Upper</b>	
Equal	-6.86	113	-4.227	-5.447	-3.007	0.00

### Closing

In summary, participants were able achieve knowledge convergence as the result of collaboration in a community of practice learning environment. Social learning takes place when people share a like interest, communicate, and collaborate over time to build knowledge. More recently, communities of practice have been linked with knowledge management as organizations recognize their potential contributions to human capital and organizational performance. Knowledge based CoP learning environments have the ability to drive corporate and initiative strategy, create new products and services, communicate exemplary practices, which decrease the learning curve of novices, solve problems quickly, and develop practical skills. Within knowledge based CoPs there is a tight connection between knowledge and activity. One implication for the design of knowledge-based communities of practice is how to develop and support highly collaborative activities to achieve knowledge convergence.

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# **Facilitating Students' Global Perspectives: Collaborating with International Partners using Web 2.0 Technologies**

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## **Abstract**

This research was designed to explore the impact of a wiki-based international collaboration project on students' 1) cultural competencies, 2) comfort using technology, including Web 2.0 tools, to interact and collaborate with unknown colleagues, and 3) perceptions of ideas for using technology, including Web 2.0 tools, in their future classrooms. Survey results showed significant changes in cultural competency and perceived ideas for using technology from pre- to post-semester while interview data provided support for, and greater insights into, survey results. Furthermore, students' perceived comfort for participating in Web 2.0-based international collaborations was the best predictor of cultural competency. Implications for the integration of international collaborations into on-campus courses, using Web 2.0 technologies, are discussed.

## **Introduction**

We live in a world characterized by globalization, emerging new technologies, and a knowledge-based economy. Together, these characteristics impact every aspect of our society including communication channels, legal systems, socio-cultural trends, and educational approaches (Olson & Olson, 2000; Teasley & Wolinsky, 2001). According to West (2010), the success of our future graduates depends on their abilities to be both culturally and technologically competent as they work and interact with diverse, geographically dispersed people, using a variety of technology tools.

Bielefeldt and High (2007) define cultural competency as "the ability to effectively interact with people from diverse cultures and recognize the importance of cultural differences" (p. S2-G5). As early as 1969, educators have suggested that students who are preparing to be teachers should engage in cross-cultural experiences in order to enrich and expand their understandings of "a culture different from the one in which they were born and raised" (Taylor, 1969, p. ix). More recently, a number of professional organizations have stressed the importance of producing culturally competent teachers. For example, in their most recent set of standards, the *International Society for Technology in Education* (ISTE, 2008) emphasized the need for K-12 teachers and students to participate in global learning communities and to demonstrate "cultural understanding" and "global awareness" (Standard 4.d).

In response to the call to provide increased cross-cultural experiences for undergraduates, universities have sought to expand their study abroad programs and to provide greater access to international opportunities. Unfortunately, very few students actually participate in these programs due to time or cost constraints (Bellamy, 2006). If all of our pre-service teachers are to benefit from cross-cultural experiences, educators need to provide alternative approaches that decrease traditional costs, while maintaining, or even strengthening, traditional benefits.

Web 2.0 applications have the potential to address these needs by engaging students with global partners using a variety of web-based tools. These technologies can play an increasingly important role in the development of "communities of practice" (i.e., where individuals with a common set of problems interact to devise solutions), especially when group members are globally distributed and face-to-face time is limited (Wenger, White, Smith, & Rowe, 2005). Wikis, particularly, offer a potentially effective platform for facilitating cross-institutional and cross-cultural interactions; as web documents that are automatically published, they are easy to both edit and share (see Table 1). According to Bonk, Lee, Kim, and Lin (2009), "wiki-related projects provide opportunities for learning transformation when they expose learners to new points of view or perspectives" (p. 126). Crucial to this transformation, however, are the interactions that occur among participants to facilitate development of the wiki product.

*Table 1. Wiki properties enabling cross-cultural collaboration*

<i>Wiki Property</i>	<i>Resulting Effect</i>
Web 2.0 technology	Familiar to, and within reach for, non-tech savvy students
Document co-editing	Easy to asynchronously produce content
Automatic publishing	Easy to share, exchange, and access material
Non-hierarchical	Student-centered and owned workspace

Although educators (Bonk et al., 2009; Chia, Poe, & Wuensch, 2009; West, 2010) are advocating the use of wikis as an effective means for facilitating cross-cultural collaborations, little is known about the impact of these activities on students' cultural competencies. To what extent can short-term participation impact students' ideas about working with diverse others? Although wikis make interaction among culturally diverse and geographically dispersed students more feasible, in order to truly benefit, participants must actively collaborate to achieve a common goal. According to Larusson and Alterman (2009), the key to students' success is the ability to effectively 1) *communicate* a shared understanding of the purpose of the product (e.g., wiki chapter), and 2) *coordinate* the activities, roles, and responsibilities required to create it. Unfortunately, these functions are difficult to accomplish in online communities, particularly among students who are new to both wikis and cross-cultural collaborations.

To explore these ideas, a wiki-based collaboration project was developed as a five-week unit within an introductory educational technology course in order to provide an international experience for both pre-service teachers from the United States and their partners from England, Russia, South Korea, and Sweden. The primary goal was to involve local and international students in the co-design and co-creation of a wiki repository, focused on Web 2.0 technologies for teaching and learning.

#### Purpose

This research was designed to determine the efficacy of using a shared wiki to engage students in international collaborations. More specifically, we aimed to determine the impact of this approach on students' 1) cultural competencies, 2) perceived comfort engaging in collaborations with distant others, using technology, and 3) perceived knowledge for using wikis (and other technologies) effectively in their future classrooms. Additionally, we were interested in examining the relationships among these variables to determine the extent to which changes in cultural competency could be predicted from other defined (perceived comfort; perceived knowledge) and/or demographic (age, gender, class) variables.

#### Methods

We used a mixed methods research design to examine the impact of this approach on undergraduate students enrolled in an introductory educational technology course at a large Midwestern university. To help us answer our research questions, survey and interview data were collected during Fall 2009. Data from project narratives were used to triangulate survey and interview findings.

#### Description of Site and Participants

Participants included 202 pre-service teachers enrolled in a required 2-credit educational technology course in Fall 2009. The majority of the students were female (66.5%), first (37.9%) or second-year (37.4%) students, studying to be elementary (62%) or secondary teachers (24%). On a scale from 1 to 5 (with 1 being extremely low and 5 being extremely high), students' pre-course ratings of perceived computer skills averaged 3.34 (i.e., "I feel comfortable completing most basic tasks on the computer.").

Students met weekly for a one-hour whole-class lecture and a two-hour lab, with 18-24 students assigned to each of 16 lab sections. Lab teaching assistants (TAs) divided students into smaller teams composed of seven or eight members (approximately three teams/lab for a total of 41 project teams). In addition, each team was paired with two to four international students from England (9), Russia (24), South Korea (64), or Sweden (20). Each team was tasked with creating a wiki chapter about a specific Web 2.0 tool (Twitter, Webnode, Mindomo, etc.). [A complete list of the Web 2.0 tools that have been investigated, to date, can be found at: <http://web2insite.com/>]

## Procedures

The project occurred during the second half of a semester long course and lasted approximately five weeks. Prior to the start of the project, lab TAs selected one member from each team to serve as the project manager (PM). The PM was responsible for coordinating team efforts, attending weekly project meetings, and disseminating relevant information to other team members. At the beginning of the project, team members divided up the various roles (e.g., researchers, designers, writers, lesson plan developers, wiki developers, evaluators) needed to complete the project. Although all members were encouraged to assume a primary role for one task, they often played several additional roles to ensure all tasks were completed successfully. International partners were encouraged to volunteer for roles they preferred and/or to contribute to any required tasks.

Each team investigated a specific Web 2.0 application and created a wiki chapter (using Confluence wiki software) describing the application and its potential educational uses. As a cumulating experience, teams presented posters of their Web 2.0 applications at a Showcase Event, which was attended by their peers, local teachers, college faculty, and the general public.

## Data Sources

Of the 316 students enrolled, 202 completed all pre-post survey measures: 1) a pre and post-survey measuring perceptions of cultural competency (*Miville-Guzman Universality Diversity Scale, Short Form [M-GUDS-s]*; Miville et al., 1999), 2) a pre and post-survey measuring students' perceived levels of comfort for participating in an international collaboration using Web 2.0 tools (*Perceived Comfort Survey*), and 3) a pre and post survey measuring students' perceptions of their pedagogical knowledge for using technology tools for teaching and learning (*Perceived Knowledge Survey*).

The original *M-GUDS* survey was developed by Miville and her colleagues (1999) to measure students' appreciation for similarities and differences in others, as evidenced by behavioral, cognitive, and affective components. This initial scale included 45 items; based on the results of an exploratory factor analysis, the total score (as opposed to subscale scores) was considered the most representative score to report, due to the unidimensionality of the scale. Reported alpha coefficients from early pilot studies ranged between .89 and .95 (Miville et al., 1999). The original scale was subsequently modified (Fuertes, Miville, Mohr, Sedlacek, & Gretchen, 2000) into a shorter version, *M-GUDS-s*, which consisted of 15 items, divided into three subscales: *Relativistic Appreciation* (cognitive; e.g., "Knowing how a person differs from me greatly enhances our friendship."), *Comfort with Differences* (affective; e.g., "It's really hard for me to feel close to a person from another country."), and *Diversity of Contact* (behavioral; e.g., "I often listen to music of other cultures."). (Note: Items on the affective scale were reverse coded.) Students are asked to rate their levels of agreement with each item on a scale from 1 (strongly disagree) to 6 (strongly agree). Fuertes et al. reported inter-item correlations for each subscale ranging from .59 (*Relativistic Appreciation*) to .92 (*Comfort with Differences*), while the total score had an inter-item correlation score of .77. For our study, alpha coefficients were calculated; subscale coefficients ranged from .76 (*Comfort with Differences*) to .82 (*Diversity of Contact*). The *Relativistic Appreciation* subscale had an alpha coefficient of .80; the alpha coefficient for the total score was .85, suggesting moderate – high reliability.

The *Perceived Comfort Survey* consisted of six items for which students rated their perceived levels of comfort (from 1-strongly disagree to 6-strongly agree) for participating in an international collaboration using Web 2.0 tools (e.g., "I am comfortable interacting – through Facebook, etc. – with people I've never met face-to-face."). A calculated alpha coefficient of .80 suggested that the survey was moderately reliable.

The *Perceived Knowledge Survey* consisted of seven items that assessed students' perceptions of their pedagogical knowledge (from 1-strongly disagree to 5-strongly agree) for using technology tools for teaching and learning (e.g., "I have specific ideas about how to use technology as an effective teaching tool."). The calculated alpha coefficient for this scale was .95, suggesting high reliability.

Focus groups interviews were conducted with 25 project managers, as well as 11 selected project teams in order to understand the successes and difficulties encountered throughout the project. Sample questions included, "What is the most important thing you will take from this project? For example, what was most surprising? Or what was most disappointing? What were some of the things you struggled with throughout the project as an individual or as a group? If you had a chance to do the project again, what would you do differently?" To analyze our data and answer our research questions, paired t-tests, correlations, and a multiple regression were used. Focus group interview data were analyzed using a simple pattern-seeking method to identify commonalities among students' responses.

## Results

### Changes in Cultural Competency

A two-tailed paired t-test ( $df = 201$ ) indicated significant increases on two M-GUDS-s subscales, *Comfort with Differences* ( $t = -1.94$ ;  $p = .05$ ) and *Diversity of Contact* ( $t = -6.77$ ;  $p < .000$ ), as well as on the total score ( $t = -3.64$ ;  $p < .000$ ). There were no significant changes on the *Relativistic Appreciation* subscale from pre to post-semester (see Table 2). Students' judgments on the **affective** subscale, *Comfort with Differences*, increased from a pre-project mean of 4.37 ( $SD=.69$ ) to a post-project mean of 4.5 ( $SD=.69$ ); judgments on the **behavioral** subscale, *Diversity of Contact*, increased from a pre-project mean of 3.75 ( $SD=1.3$ ) to a post-project mean of 4.48 ( $SD=.81$ ). The total M-GUDS-s score changed from 4.08 ( $SD=.57$ ) to 4.31 ( $SD=.64$ ).

Table 2. Pre- and Post-Survey Means and SDs on M-GUDS-s Assessment of Cultural Competency

N=202	<i>Diversity of Contact</i> (behavioral)	<i>Relativistic Appreciation</i> (cognitive)	<i>Comfort with Differences</i> (affective)	<i>Total Score</i>
Pre-survey Mean (SD)	3.75 (1.30)	3.85 (.76)	4.37 (.69)	4.09 (.57)
Post-survey Mean (SD)	4.48 (.81)	3.94 (.92)	4.50 (.69)	4.31 (.64)
Paired-t statistic	-6.77	-1.04	-1.94	-3.64
p-value (2-tailed)	.00	.30	.05	.00

These findings suggest that, through this project, students' intentions to engage in, as well as their actual participation in, cross-cultural activities increased. Perhaps the positive experiences they had working with international partners on this project provided new appreciation for diverse cultures and helped them become more interested in, and more comfortable, participating in cross-cultural events and/or engaging in cross-cultural collaborations. In addition, students seemed particularly amenable to incorporating similar types of interactions in their future classrooms as noted by a number of comments in students' project reflections. For example:

I think that the use of Web 2.0 tools and having my students collaborate with international partners would be beneficial to enhance the learning environment in the classroom. This gives the students the opportunity to not only get hands on experience with technology in class, but also to work with students in a different culture (Team member, Prezent.it).

I felt like this was a great learning experience and I think that my students could take a lot away from interacting with people from other countries. This can broaden a student's thought process and cultural understanding (Team member, Mindomo).

In general, students began the course with relatively high affective scores; the average score on the *Comfort with Differences* subscale was noticeably higher than the other two subscales (i.e., at least .5 point). Still scores on this subscale showed a relatively small but significant increase from pre- to post survey, suggesting that students' initial positive attitudes toward working with diverse others were enhanced through their interactions with their international partners. Although students were quick to point out some of the difficulties involved in connecting with others across time zones, cultures, and geographical distances, they were also aware of the potential benefits. As described by a Cellblock team member in his project reflection:

When working with the international partners I learned that there are many different viewpoints on how things work, and what should be done. Another thing that I learned is how difficult it is to collaborate with people on the other side of the world. I know that there is a time change, but it really became a reality when we tried to meet with them and that was quite an obstacle. The way that people think on the other side of the world is also very different than the way we think here which was interesting to think about. In seeing the way that they participated, and the way they did things it was neat to try to think from their perspectives.

Similarly, a team member from Pix.ie stated:

Working with international partners can be very stressful because of the language barrier.  
[However] I also learned allowing more minds to work on a project with a different background

better the project. The international partners have a different point of view and contributed different ideas we had not thought of.

Scores on the M-GUDS-s cognitive subscale (*Relativistic Appreciation*) did not change significantly from pre- to post-survey. This is similar to what others have reported (Strauss & Connerley, 2003); that is, changes on the M-GUDS-s cognitive and affective subscales tend to be smaller than those observed on the behavioral subscale. Still, students in this study agreed, at least “a little bit” that knowing how others differed from them “enhanced their friendships” or enabled them “to better understand their own problems.” (MGUDS-s survey items) Given the relatively short timeframe of this study, students had little opportunity to get to know, or to “become friends with,” their IPs. Thus, as indicated by the following two quotes, establishing “true” connections with the IPs was challenging:

Collaborating with international partners to create a wiki chapter is both challenging and enlightening. The distance from our international partners caused various different obstacles when creating the wiki chapter. Both the language barrier and the methods of communication prevented us from establishing a true connection with our international partners (Team member, Pix.ie).

Being online is easy to do with people of other countries because you can upload something and they can get it instantaneously. However, it is hard to get in touch with people in other countries because of the different time zones (Team member, Cellblock).

In this study, students tended to focus on the task at hand; that is, interactions with their IPs were directed toward completing the project requirements, within the allotted timeframe. As such, students tended to view the primary role of the IPs as being that of helping them meet important project deadlines. Future research is needed to examine if cognitive changes are possible after engagement in lengthier or “friendlier” collaborations.

#### *Changes in Computer Skills, Perceived Comfort, and Perceived Knowledge for Using Web 2.0 Tools*

At the end of the course, students rated their computer skills, on average, at 3.98 (i.e., somewhat high) on the same 5-point scale used at the beginning of the course. This difference, from pre-post course, was significant at the .000 level ( $t = -12.46$ ). Over 80% of the students rated their computer skills as somewhat or extremely high at the end of the course, compared to 40% at the beginning of the course. Post-course, none of the students rated their skills as being either extremely or somewhat low compared to 9.4 % at the beginning of the course.

There were significant changes, from pre- to post-course, in students’ *perceived comfort* for engaging in international collaborations via Web 2.0 tools [ $t(201) = -8.62$ ;  $p < .000$ ], as well as in their *perceived knowledge* for using technology for teaching and learning [ $t(201) = -15.37$ ;  $p < .000$ ] (See Table 3). Students’ ratings of comfort increased from a mean of 3.62/6 ( $SD=1.02$ ) to 4.37 ( $SD=.68$ ); ratings of perceived knowledge increased from a mean of 1.75/5 ( $SD=.56$ ) to 2.58 ( $SD=.65$ ).

*Table 3. Pre- and Post-Survey Means and SDs on Perceptions of Computer Skills, Comfort, and Knowledge*

N=202	<i>Computer Skills</i> (5 point scale)	<i>Perceived Comfort</i> (6-point scale)	<i>Perceived Knowledge</i> (5-point scale)
Pre-survey Mean (SD)	3.34 (.71)	3.62 (1.02)	1.75 (.56)
Post-survey Mean (SD)	3.98 (.61)	4.37 (.68)	2.58 (.65)
Paired-t statistic	-12.46	-8.62	-15.37
p-value (2-tailed)	.000	.000	.000

These changes in students’ survey ratings are supported by comments made during the focus group interviews, as well as in students’ final project reflections. Two representative comments include:

Web 2.0 tools will have a huge impact in my future classroom. I think it is extremely important to integrate technology. ... technology can definitely enhance a student’s learning experience in ways teaching through a textbook or lecture can’t. ... I think having international experiences is also extremely important in my future classroom. Students should be aware of other nationalities and by the use of technology it may be easier for them to understand. Being able to show pictures of different countries from a tool like pix.ie would be a great experience (Team member, Pix.ie).

I know I can and will use Jing in my future classroom as a means of teaching my students how to use different programs online or giving them examples of different lessons so they can review my lessons online. There are so many web 2.0 tools I know I can use eventually in preparation or in my classroom.



Some examples are blogging, file sharing, surveying tools. Not only can I use these tools for my students, my students can use them for their work and perhaps through the use of them, broaden their horizons to international experiences (Team member, Jing).

### Relationships among Variables

To investigate the relationships among the defined research and demographic variables, we conducted a correlational analysis. Since it is fairly easy to achieve high correlation coefficients with larger samples, significance levels were set relatively high in order to discount high coefficients that were not meaningful. That is, we did not consider coefficients to be significant unless the probability of occurrence was less than  $p = .005$ . Thus, based on a critical  $r$  value ( $df = 200$ ) of .25, correlations between demographic variables and pre- and post-survey measures indicated no significant relationships among age, gender, or year in school and ratings of computer skills, cultural competencies, perceived comfort, or perceived knowledge. However, students' pre-course ratings of their computer skills were significantly, but negatively, correlated with their pre-course ratings of perceived knowledge for using technology in their future classrooms ( $r = -.43$ ). This means that students with greater levels of computer skills rated their knowledge for using technology in the classroom at lower levels than students who had lower levels of computer skills. Although it is unusual to see a negative correlation between these two variables, low, insignificant correlations have been reported previously (Ertmer et al., 2003; Yildirim, 2000). One possible explanation for this finding is that students with fewer computers skills may have thought they could easily use technology in the classroom, once they gained more skills, while those with more substantial skills may have more readily recognized that, while they knew how to use technology for personal tasks, they didn't know how to use those same skills to facilitate teaching and learning.

There were no significant correlations between students' perceived knowledge for technology use and the three subscales measuring cultural competency, pre or post. However, students' perceived comfort for engaging in international collaborations using Web 2.0 tools was significantly correlated with cultural competencies (See Table 4). More specifically, students' pre-ratings of comfort significantly correlated with their pre-course ratings on the M-GUDS-s behavior subscale ( $r = .72$ ) as well as on the total score ( $r = .37$ ), indicating a strong relationship between these variables. This is not unexpected given that on the *Perceived Comfort* survey items, students rated levels of comfort for using technology to engage in cross-cultural activities. Items on the M-GUDS-s behavior subscale were worded similarly, but without the technology component. Thus, one might expect students' responses to be similar, particularly since students were generally comfortable using the Web 2.0 tools referred to in the items on the *Perceived Comfort* survey (Facebook, wikis, etc.).

Post-ratings of comfort were also significantly correlated with post-ratings on all three MGUDS-s subscales: *Relativistic Appreciation* ( $r = .32$ ), *Comfort with Differences* ( $r = .40$ ), and *Diversity of Contact* ( $r = .27$ ), as well as on the total score ( $r = .41$ ). That is, at the end of the project, students with higher ratings of comfort for using technology to engage in cross-cultural interactions also had higher perceptions of cultural competency than those students with lower ratings of perceived comfort.

Finally, significant correlations among subscales of the M-GUDS-s and total M-GUDS-s score were obtained for both the pre- and post-surveys; however, because subscales contributed to the total score this is not particularly meaningful. Interestingly, however, pre and post M-GUDS-s scores were not significantly correlated with each other for any of the subscales or the total score. Although we saw a significant increase, from pre- to post, on two subscales and the total score, the lack of correlation between pre- and post-scores suggests that students' ratings of cultural competency changed in different ways, perhaps due to their different levels of participation on the wiki project.

Table 4. Correlation Coefficients among Pre- and Post-Survey Measures (\* p < .005)

	1	2	3	4	5	6	7	8	9	10
1										
2	-.02									
3	.05	.03								
4	.11	.32*	-.08							
5	-.08	-.02	.53*	-.08						
6	.05	.40*	.01	.59*	-.06					
7	.72*	.05	.11	.10	-.16	.06				
8	-.04	.27*	-.12	.44*	-.13	.31*	-.01			
9	.37*	.06	.80*	-.01	.60*	.03	.54*	-.11		
10	.05	.41*	-.08	.87*	-.11	.77*	.06	.74*	-.04	

1: Pretest of Perceived Comfort, 2: Posttest of Perceived Comfort, 3: Pretest of M-GUDS 1 (Relativistic Appreciation; cognitive), 4: Posttest of M-GUDS 1, 5: Pretest of M-GUDS 2 (Comfort w/ Differences; affective), 6: Posttest of M-GUDS 2, 7: Pretest of M-GUDS 3 (Diversity of Contact; behavioral), 8: Posttest of M-GUDS 3, 9: Pretest of Total M-GUDS, 10: Posttest of Total M-GUDS

After completing our correlational analysis, we used a series of hierarchical multiple regression analyses to examine the extent to which any or all of these variables could predict cultural competency in terms of the cognitive, affective, and behavioral components, outlined by Miville et al. (1999). Before the analyses, assumptions of normality, homoscedasticity, independence of errors, influential observations, and multicollinearity were examined and no violations were detected. Then, correlations were examined to establish the relationship between predictors and outcomes. Direct entry method was used to input predictors, using gap scores to control for pre-survey differences among students and to allow for a more focused emphasis on the *development* of students' cultural competencies over the course of the project. For the second and the third analyses, perceived comfort was observed to have relatively higher correlation coefficients than the other variables.

Table 5. Hierarchical Multiple Regression (HMR) Analysis Predicting Cultural Competencies in terms of Comfort with Differences (CwD), Diversity of Contact with Others (DoC), and Total M-GUDS-s Score (\*p < .05)

Models and predictors	R <sup>2</sup>	ΔR <sup>2</sup>	ΔF	sr <sup>2</sup>	B	β
<i>HMR for Comfort with Differences (Affective)</i>						
Model 1	.005	.005	.48			
Gender				.001	.088	.042
Age				.003	-.015	.058
Model 2	.023	.018	1.22			
Gender				.0002	.03	.02
Age				.001	-.01	-.03
Perceived Computer Skills				.01	-.13	-.10
Perceived Comfort				.01	.06	.08
Perceived Knowledge				.001	-.05	-.04
<i>HMR for Diversity of Contact (Behavioral)</i>						
Model 1	.01	.12	1.19			
Gender				.01	.33	.10
Age				.001	.02	.04
Model 2	.34	.33	32.26			
Gender				.0002	.05	.02
Age				.004	.03	.07
Perceived Computer Skills				.00003	.01	.01
Perceived Comfort				.33	.72	.58*
Perceived Knowledge				.001	.06	.03
<i>HMR for Total</i>						
Model 1	.02	.02	2.05			
Gender				.02	.26	.14
Age				.00004	-.001	-.01
Model 2	.11	.09	6.95			
Gender				.007	.16	.09

Age	.001	.01	.04
Perceived Computer Skills	.002	-.06	-.05
Perceived Comfort	.09	.21	.30*
Perceived Knowledge	.002	-.06	-.05

Table 5 provides a summary of our findings from the three hierarchical regression analyses. With respect to *Comfort with Differences*, the M-GUDS-s affective subscale, the model including gender and age was not significant [ $F(2, 199) = .48, p > .05$ ]. After controlling for gender and age, the variables of 1) perceived computer skills, 2) perceived comfort for engaging in international collaborations using Web 2.0 tools, and 3) perceived knowledge for using technology in future classrooms were included in the model. However, this model was not significant either [ $F(5, 196) = .93, p > .05$ ].

With respect to the *Diversity of Contact* behavioral subscale, the first step involving gender and age was not significant [ $F(2, 199) = 1.19, p > .05$ ]. After controlling for gender and age, the variables of 1) perceived computer skills, 2) perceived comfort for engaging in international collaborations using Web 2.0 tools, and 3) perceived knowledge for using technology in future classrooms were included in the model. The model was significant [ $F(5, 196) = 20.06, p < .001$ ]. Together, all included variables predicted 34% of the scores on the *Diversity of Contact* subscale ( $R^2 = .34$ ). Among the regression coefficients of this model, perceived comfort for engaging in international collaborations using Web 2.0 tools contributed significantly to the model ( $B_{(IC)} = .72, t_{(IC)}(196) = 9.81, p < .001$ ) and explained 33% of variance ( $sr^2_{(IC)} = .33$ ), while the contributions of the other variables were not significant.

With respect to the M-GUDS-s total score for cultural competency, the first model including demographic variables was not significant. When other variables were added to the model, it was found to be significant. Similar to the results obtained for *Diversity of Contact*, perceived comfort for using Web 2.0 tools to engage in international collaborations was the only significant contributor ( $B_{(IC)} = .21, t_{(IC)}(196) = 4.41, p < .001$ ), and explained 9% of variance ( $sr^2_{(IC)} = .09$ ).

Comparison of the three hierarchical regression analyses reveals that pre-service teachers' comfort for engaging in Web 2.0-based collaborations is a good predictor of cultural competencies, especially behavioral aspects, as measured by the *Diversity of Contact* subscale. Thus, the findings from this study suggest that participation in a cross-cultural wiki project, which enabled interactions among both local and international peers, was an effective strategy for increasing pre-service teachers' cross-cultural awareness and acceptance of differences among others. From pre- to post-project, there was a general increase in students' attitudes of openness and acceptance of the various cultures to which team members and international partners belonged (Miville et al., 1999).

## Discussion

Findings from this study demonstrated that engaging in a five-week cross-cultural wiki-development project had a significant impact on the development of students' cultural competencies, particularly in terms of their behavioral and affective competencies. This is a promising result as cultural competencies are generally difficult to change (Nunez, 2000), especially in a short period of time. While previous work has documented, qualitatively, the impact of *immersion* experiences on cultural competency (Dekaney, 2008; Lee, 2009), this study was able to show changes, both quantitatively and qualitatively, after engagement in a relatively short-term project. This suggests that integrated course experiences such as the one described here have the potential to substitute for longer, more expensive programs, at least in terms of increasing students' awareness of and appreciation for diverse others. At the very least, wiki-based collaborations may offer a reasonable pre-cursor or follow-up to a more intensive experience.

Findings from this study also indicated that participation in a cross-cultural wiki-based collaboration had a significant positive impact on students' *perceived comfort* for using Web 2.0 tools to collaborate with diverse others around the world. Given that students of this generation are generally comfortable using Web 2.0 tools for the purposes of social networking (Project Tomorrow, 2010), it appeared relatively easy for them to envision being able to use these same tools for networking with an extended group of "friends." In addition, students' *perceived knowledge* for using Web 2.0 tools for teaching and learning increased significantly from pre-post project. According to Lawless and Pellegrino (2007), "Technological literacy has fast become one of the basic skills of teaching" (p. 580). Although most pre-service teachers graduating today are likely to be "digital natives" (i.e., comfortable using a variety of technology tools), their knowledge of how to use these tools to support teaching and learning tends to be underdeveloped (Lei, 2009). Due to the nature of this project, in which students were asked, specifically, to consider how their assigned Web 2.0 tools could be used for teaching and learning, students became aware of the potential pedagogical uses of the tools. Moreover, through the final showcase event, students gained an understanding of the great variety and number of tools available.

Finally, students' perceived comfort for participating in Web 2.0-based international collaborations was a relatively strong predictor of changes in cultural competency, explaining 33% of the variance in the behavioral subscale, *Diversity of Contact*, and 9% of the variance on the total M-GUDS-s scale. This suggests that as students become more comfortable using technology to engage in virtual collaborations, it may not be too much of a stretch to consider engaging in other types of cross-cultural activities as well. Previous research (Cone, 2009; Maleski, Phillion, & Lehman, 2005) has reported similar findings: once students have completed initial experiences in cross-cultural settings, they become more open to participating in other experiences. For example, Cone found that pre-service elementary teachers who participated in community-based service-learning in culturally diverse communities were more likely to "change their feelings about, diverse student groups before they enter[ed] their student teaching semesters" (p. 28). Similarly, Maleski et al. (2005) described how pre-service teachers, through weekly videoconferencing sessions with low-income, minority students, changed their ideas about where they wanted to teach, resulting in a greater openness to working in urban settings, which served diverse groups of students.

It is important to note that although the regression analyses accounted for a moderate amount of the possible variance, an even greater portion was not explained. What additional factors may need to be considered? For example, it is fairly clear that students in this study did not participate equally in the wiki collaboration (especially given their different roles and responsibilities) and that some teams had more robust interactions with their international partners than others. It is possible that teams who interacted with IPs whose first language was English experienced more immediate benefits than those who interacted with IPs from Russia, South Korea, or Sweden. Furthermore, we did not gather demographic data about our students' cultural or ethnic backgrounds or information about their previous cross-cultural experiences. It is quite possible that these additional factors influenced students' individual responses to the international, wiki-based collaboration and, ultimately, to their perceived willingness to go beyond the project boundaries to engage in additional cross-cultural activities.

#### Limitations and Suggestions for Future Research

Participants in this study were pre-service teachers, enrolled in a required introductory educational technology course. As such, generalizability is limited to similar students enrolled in similar courses. Additionally, the project occurred over a five-week time period, which may have limited the types of changes we were able to observe. Given that students didn't get to know their international partners on a personal basis, we saw little change in the value they assigned to these types of activities, at least as measured by the cognitive subscale of the M-GUDS-s. Future research is needed to examine changes in other groups of participants who engage in integrated course experiences, especially those involving different time frames and different course structures. Future efforts might also be directed toward providing increased opportunities or more explicit encouragement to students to interact with their IPs on a more personal level. Finally, we didn't examine the contributions of individual team members to the wiki chapters; it is possible that changes in students' post-survey scores were influenced by factors we did not measure, such as previous knowledge, skills, and/or experiences with diverse others and/or levels of participation on the wiki. It would be useful to gather this data in future studies to determine how these factors impact initial and changing cultural perceptions.

#### Implications

The results of this study have implications for colleges and universities tasked with preparing their students for a knowledge-based global economy. Given that the participants in this study were enrolled in a *required* course that engaged them in a *short-term* cross-cultural experience, observed changes in cultural competency are particularly promising. Previous studies (Causey, Thomas & Armento, 2000; Pence & Macgillivray, 2008) have demonstrated the difficulties involved in changing cultural competencies through voluntary, short-term experiences, including those with an immersion component (e.g., study-abroad). Thus, a wiki-based collaboration may offer instructors the opportunity to increase their students' appreciation for other cultures with fewer issues than a full immersion program involves (Bellamy, 2006; Willard-Holt, 2001). With careful planning and cooperative international relationships, Web 2.0 technologies have the potential to prepare our current students for the diverse populations they are likely to face in their future classrooms (Schoorman, 2002; Maleski et al., 2005). Finally, because the participants of this study were pre-service teachers, there are additional implications for their future students. That is, students in this study indicated a strong desire to incorporate international activities within their future classrooms using the tools they learned about in this project.

#### Conclusion

Regardless of discipline, today's employers are seeking graduates who possess skills and knowledge that go beyond basic technical proficiencies. According to the Partnership for 21<sup>st</sup> Century Skills (2007), the workforce of

the 21<sup>st</sup> century must be digitally literate and globally competent, possessing effective communication, collaboration, and problem-solving skills. This is particularly true of our future teachers, who will prepare our children for a workplace that depends on these skills (U.S. Department of Education, 2004). As universities heed the call to expand pathways to global education, integrative course experiences offer a cost-effective alternative to traditional study abroad programs. Particularly in the current economy, infusing international experiences into on-campus courses offers a means by which every student can participate. According to Larusson and Alterman (2009), “using collaborative technology [such as wikis] to extend the physical borders of the classroom can be of significant value” (p. 397).

As noted by Brown (2006) and his colleagues (Brown & Adler, 2008), the emergence of Web 2.0 tools has generated enormous possibilities for international collaborations by shifting attention from access to information to access to other people. Wiki technology, in particular, provides students with collaborative opportunities that, in the long run, can initiate them into a knowledge creating culture and enable them to see themselves as part of a global effort to advance knowledge (Huijser, Bedford, & Bull, 2008; Parker & Chao, 2007; Pfeil Zaphiris, & Ang, 2006). In this study, students’ wiki experiences resulted in an expanded view of working with diverse others; that is, at the end of this project team members understood and valued input from others, both locally and at a distance, who were from their own, as well as other, cultures. Students gained a greater appreciation and respect for the differences of others and other cultures. In addition, the international collaboration using Web 2.0 technologies created a greater awareness of the benefits (easiness, usefulness, and importance) that various Web 2.0 technologies can play in their future classrooms.

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# **The Decisions Influencing the Design of an Adaptive Web Based Learning Environment**

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## **Abstract**

The purpose of this study was to document the design decisions and challenges encountered by designers of an AWBLE which was developed to provide a platform for tailoring instructional strategies, content, resources, and interfaces based on two learner characteristics --motivation and prior knowledge.



## Introduction and Background

### Adaptive Web Based Learning Environments

Adaptive Web-Based Learning Environments (AWBLEs) are one form of adaptive instruction which attempt to address the issue of individual differences. AWBLEs do so by providing mechanisms for individualizing instruction (e.g., content, interface, and strategies) and providing users with a more personal experience by incorporating customized instructional strategies, resources, assessments, and interfaces (Abidi, 2009; Inan & Grant, 2008). As a general outline, AWBLEs (1) gather learner information; (2) build a learner user model based on that information; (3) make inferences based on the collected data and employs adaptive methods to accommodate each individual based on their developed user model; and (4) continuously monitor user actions and interactions in order to update the user model based on newly collected data.

Although it is quite easy to comprehend what AWBLEs are and what they do; the design and development process of AWBLEs, however, is a challenging and complicated topic. Adding to the challenges and complexities is the fact that current research is very limited in respect to documenting the decisions that AWBLE designers make in order to design their adaptive systems. These decisions can be grouped into three types: user related, system related, and user to system related decisions.

### Purpose of the Study

The purpose of this study was to document the decisions and challenges encountered by designers of an AWBLE which was designed to provide a platform for tailoring instructional strategies, content, resources, and interfaces based on two learner characteristics --motivation and prior knowledge. The researchers of this study expect that their documentation will help instructional designers develop better adaptive web-based instruction which more closely meets the instructional needs of students.

### User Related Decisions

User related decisions encompass decisions on which learner characteristics to adapt for, how learner characteristics will be measured; and how measurements will be used to define learner user models.

### Learner Characteristics

Although researchers agree on the influential effects of individual differences during learning, the question still remains as to which learner characteristics should be considered when designing AWBLEs (Scheiter, Gerjets, Vollmann, & Catrambone, 2009; Shute & Zapata-Rivera, 2007). In past research, variables have included prior knowledge (Brusilovsky, 2003), cognitive/learning style (Akdemir & Koszalka, 2008), goals (Brusilovsky, 1998), beliefs and attitudes (Hudlicka & McNeese, 2002), motivation (Far & Hashimoto, 2000), language (Carro, 2002; Espada, 2006), gender (Milne, Cook, Shiu, & McFadyen, 1997), and disabilities (Fink et al., 1996, 1998).

Due to the complexity of adapting for multiple learner characteristics simultaneously, the designers of this study limited adaptation to two learner characteristics, namely student prior knowledge and motivation. Many studies have considered prior knowledge (Brusilovsky, 2003; Chen & Paul, 2003) and motivation (Far & Hashimoto, 2000; Johns & Woolf, 2006) to be two of the most important factors which should influence the design of web-based instruction.

### Learner Characteristics Measurements and Learner User Models

In order to make inferences about the learner, researchers must determine how learner characteristics will be measured and how measurements will be used to cluster students into learner user models. For the assessment of prior knowledge, designers of this AWBLE used a locally developed 10 item multiple choice instrument. Items measured prior knowledge for each section of the tutorial. For motivation towards the material, the researchers adapted items from Keller's Instructional Material Motivational Survey (IMMS) instrument. This instrument is based on the Attention, Relevance, Confidence and Satisfaction (ARCS) motivational design model (Keller, 1987a, b) and is widely applied to the motivational evaluation of instructional materials (Chang & Lehman, 2002; Means, 1997.)

As with the number of learner characteristics, the researchers of this study limited adaptation to two discrete levels-- high and low. Combinations of these high/low prior knowledge and motivation levels served to cluster students into four learner user models: (1) low motivation and low prior knowledge, (2) low motivation and high prior knowledge, (3) high motivation and low prior knowledge, and (4) high motivation and high prior knowledge.

### System Related Decisions

System related decisions are concerned with what predefined user models the system will have, which instructional strategies will be used, what content will be taught, and how content will be designed for each system user model.

### Predefined System User Models

Because content and resources cannot design, develop, and customize themselves to users while they interact with the system, AWBLES must have predefined system user models. Each system user model should correspond to one of the possible learner user models. Having such system user models allows designers to customize content for the learners prior to instruction. For the current adaptive system, four system user models were developed corresponding to one of the four learner user models.

### Instructional Strategies for Predefined System User Models

Instructional strategies affect student learning differently depending upon their structural characteristics (Jonassen & Grabowski, 1993; Scheiter et al., 2009; Tobias, 1987). Therefore, it is essential for AWBLE designers to identify relevant instructional strategies, so that instruction can be adapted effectively (Azevedo et al., 2008; Carro, Pulido, & Rodriguez, 1999; Clarke, Ayres, & Sweller, 2005). For this study, researchers reviewed the literature for instructional strategies relating to motivation and prior knowledge. A list of sample instructional strategies, grouped by adaptive method, can be found Table 1. The symbol "X" signifies that those strategies were emphasized for the respective learner characteristic. Having such a table allowed designers to quickly retrieve and incorporate relevant strategies into the design of instruction for each system user model.

*Table 1* Instructional Strategies for Adaptive Instruction (Abbreviated)

Strategies	Learner Characteristics*			
	LK	H K	LM	HM
<b>Adaptive content presentation</b>				
1. Minimal coherent explanations (McNamara et al., 1996)		X		
2. Additional explanations, resources, and content (McNamara et al., 1996; Kalyuga et al. 1998 )	X			
3. Use of graphics /animation (Mayer & Gallini 1990; Mayer et al. ,1995; Song & Keller, 2001)	X		X	
<b>Adaptive Navigation/Control</b>				
1. Help the user to understand the structure of the overall hyperspace and his or her absolute position in it. (Chrysostomou, Chen, & Xiaohui, 2009; Shapiro, 1999)	X			
2. Rich linking technologies such as adaptive annotations and multiple link generations (Shin et al., 1994; Brusilovsky et al., 2009 )		X		X
<b>Adaptive Instructional Activities</b>				
1. Activate prior knowledge (eg., Knowledge maps, advance organizers) (Lambiotte & Dansereau, 1992; Song & Keller, 2001)		X		
2. Emphasize key/important points (e.g., illustration or visual) (Song & Keller,			X	

2001)		
3.	More elaboration (Tobias, 1976; Kalyuga et al. 1998)	X
Adaptive Assessment, Support, and Feedback		
1.	Minimal guidance or no guided practice (Tuovinen & Sweller, 1999)	X
2.	Well Guided & low paced. Guided practice before “on your own practice” (Tuovinen & Sweller, 1999)	X
3.	Question response feedback within content (Song & Keller, 2001)	X
Adaptive Interface		
1.	Use a consistent screen format (Song & Keller, 2001)	X X
2.	Intermingle information presentation screens with interactive screens (Song & Keller, 2001)	X X
3.	Use attention getters (e.g., inverse and flash in text and patterns in pictures) (Song & Keller, 2001)	X

\*LK= Low Prior knowledge; HK= High Prior Knowledge; LM= Low Motivation; HM= High Motivation

### Content Topic and Design

Before incorporating instructional strategies into the design, AWBLE designers must first decide what specific content topics will be presented. For this AWBLE tutorial, content topics came from an undergraduate statistics course where basic introductory statistics topics are introduced. These topics, separated into three sections, were:

- Section 1: Basic Theory on Probability (random phenomena, law of large numbers, etc)
- Section 2: Terminology of Sample Space (event, sample spaces)
- Section 3: Basic probability rules (Probability rules, probability of event)

For each section' page, the design of content varied dependent on which of the four predefined system user models the material was prepared for. For example, assets from pages for system user model 1 (low motivation/low prior knowledge) contained additional worked examples and incorporated attention getting resources, such as Flash guided practices with animated interactions, colorful graphics, etc.

### User to System Related Decisions:

After user related and system related decisions have been made, designers must then make user to system related decisions. These decisions are concerned with how the system will match learner user models to system user models; and how the system will monitor user actions and update learner user models.

### Matching and Updating Student' Predefined User Models

For the current system, students began by logging into the system. Once they were logged in, students were required to fill out a knowledge pretest which measured their prior knowledge, and a motivation survey which measured their initial motivation. Dependent on the results of these assessments, students were placed into one of four learner user models and given a composite factor value (CFV) for each section of the tutorial. Using respective CFVs for each section and sql statements, learners were then matched to the content which had been prepared for predefined system user models having the same CFV. For example, students belonging to learner user model 1 (low motivation/low knowledge) would be matched with system predefined user model 1 and then be presented with all the assets that incorporated relevant strategies, resources, and examples customized for students belonging to that learner user model. For each tutorial section, it was possible for students to be placed into different learner user models dependent on their assessed motivation and prior knowledge levels for the topics of that respective section.

## Discussions

In order to design an effective AWBLE there are many decisions that must be made prior to development. These decisions include user related decisions, system related decisions, and user to system related decisions. When making these decision designers encounter many challenges. Below are some of the design challenges which the researchers of this study encountered.

### Adaptive Strategies Challenges

Regarding adaptive strategies, the critical limitation came from the inadequacy of previous research regarding the implementation of adaptive strategies (Shute & Zapata-Rivera, 2007; Tsandilas & Schraefel, 2004). There continues to be inconsistencies regarding the matching of strategy with student characteristics (Federico, 1999; Lee & Park, 2007; Scheiter & Gerjets, 2007). For this study, researchers implemented research based instructional design strategies outlined in Table 3; however, it continued to remain unclear as to how strategies should be combined and/or which strategies should be prioritized with the two given factors. This challenge was a major issue because it had a direct impact on the design of the AWBLE.

### Student Assessment Challenges

Developing and implementing assessment is challenging for adaptive instruction (Shute & Zapata-Rivera, 2007; Weibelzahl, 2005). In addition to developing instruments specific to the instruction, there are significant concerns regarding the validity and reliability of instruments to measure all learner characteristics-- especially student attitudes and motivation. Compounding this issue, was the limited prior research regarding the most efficient frequency of student assessment (Burgos, Tattersall, & Koper, 2007); and how assessment measures can be used to define learner user models and matched with instructional strategies.

## Conclusion

AWBLES provide many advantages to students because they more closely address the issue of individual differences. If implemented correctly AWBLES can increase student performance, motivation, and attitudes, while at the same time decrease learning time and usability problems (Brusilovsky, Sosnovsky, & Yudelson, 2009; Dogan, 2008; Tsianos et al., 2009). However, before reaping these benefits, there are many design decisions and challenges that AWBLE designers must address.

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# **Enhancing the Connectivity and Sustainability in Asynchronous Online Discussion**

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## **Enhancing the Connectivity and Sustainability in Asynchronous Online Discussion**

### **Abstract**

Lack of connectivity and sustainability are two common problems in asynchronous online discussion. In this paper, the author proposes that the two problems may have to do with the structure of threaded forums, that is, the design of threaded forums may constrain participants from having well-connected and sustained discussions. A new discussion environment was developed to promote the connectivity and sustainability of asynchronous online discussion, and an exploratory study was conducted to test the effectiveness of the new environment.

Computer-mediated communication is becoming an increasingly important mechanism for supporting student learning (Anderson & Kanuka, 1997; Duncan-Howell, 2010; Paulus & Roberts, 2006). In particular, asynchronous online discussion provide support for community building and productive discourse (DeWert, Babinski, & Jones, 2006; Joeng, 2003). It allows learners to go beyond the space and time constraints, communicating with and learning from each other (McCrary, Putnam, & Jansen, 2008).

Researchers, however, have found it hard to establish productive interaction in asynchronous online discussion. One of the problems is lack of connectivity. Connectivity reflects how well participants connect or respond to each others' ideas. Studies show that participants do not make frequent connections to each others' ideas. Instead, they post condensed expositions of their own ideas, without attending or responding to the ideas of others (Hara, Bonk, & Angeli, 2000; Larson & Keiper, 2002). As a result, there is little negotiation of meanings and building up of ideas. Another problem is lack of sustainability. Sustainability reflects how well the discussion is maintained and developed. A high level of sustainability has been regarded as an important characteristic of productive discussion (Guzdial & Turns, 2000; Hewitt, 2005). Online discussions, however, are often brief, and the limited growth and development of discussions prevents learners from effectively constructing shared knowledge (Guzdial, 1997; Hewitt & Teplovs, 1999). In this paper, the author attempts to design a new environment that better supports the two qualities of online discussion.

### **Designing a New Environment**

The assumption is that participants are more likely to make connections and sustain conversations if the connectivity and sustainability of discussion are made easier to perceive. Two design principles based on the assumption are: (a) the connections and relations among posts should be made more visible, and (b) the development and continuity of the discussions should be made more visible.

A new environment called discussion map was developed in Mindomo ([www.mindomo.com](http://www.mindomo.com)), an online collaborative concept map site (see Figure 1). In this environment, the discussion question is presented in a bubble at

the center. When participants log in, they can respond to the discussion question and existing posts by adding sub-bubbles. A note can be attached to each bubble, allowing participants to write more elaborated posts. One can read the posts by clicking the note icons. The discussion map looks similar to concept maps, but is different from concept maps in that (a) a bubble in discussion map represents a post rather than a concept, and (b) a link in discussion map only represents one type of relationship – a reply to a previous post.

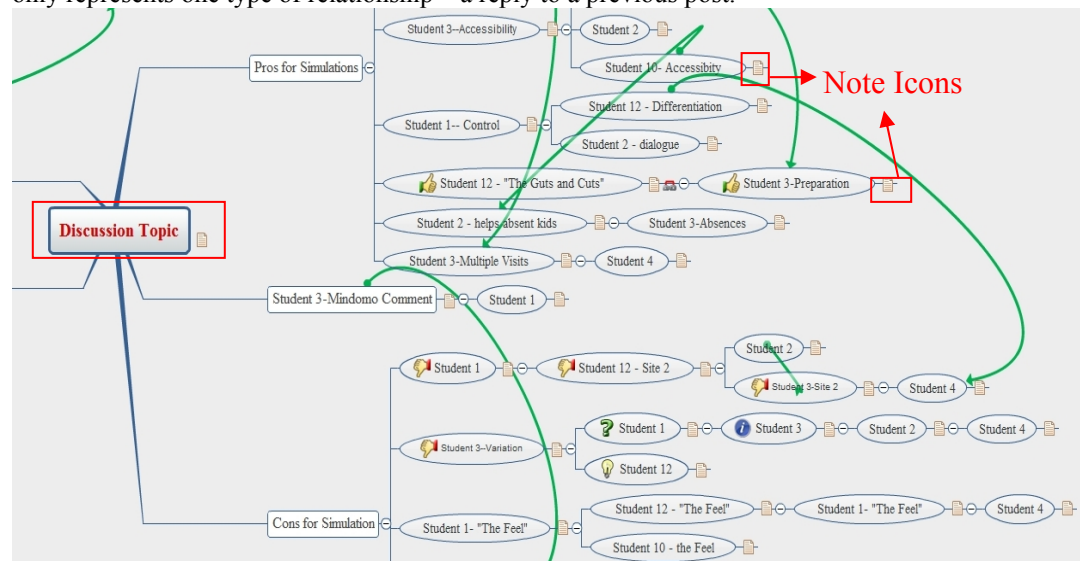


Figure 1. A new discussion environment – Discussion Map

In the discussion map, the connections and relations between posts are presented visually, making it easy to perceive. When a response connects to more than one post of different threads, green lines can be used as cross-links to indicate the connections. In addition, in the discussion map, the growth and development of threads and sub-threads can be easily seen. Participants can instantly identify a thread or sub-thread, focus on its development and further develop it.

To understand the effectiveness of the new environment, an exploratory study was conducted by comparing discussions in the threaded forum with those in the discussion map. The research questions are:

1. How did the discussions in the discussion map differ from those in the threaded forum in terms of connectivity?
2. How did the discussions in the discussion map differ from those in the threaded forum in terms of sustainability?
3. How did students perceive the discussions and learning in the two environments?

## Method

### Participants

Participants were six males and 10 females enrolled in an online master's level education course. Most (14 out of 16) were practicing K-12 teachers. Among them, 10 (62.5%) were within the age range of 26 to 35, one (6.25%) was below 25, and five (31.25%) were beyond 36. All but three had taken at least one online course prior to this one.

### Procedures

The online course was delivered via ANGEL course management system. It was structured as a series of learning units, with each unit including readings, online activities, and small-group discussions on a topic related to teaching and learning with technology. There were altogether four discussion groups. Each group consisted of four students. Prior to the study, written tutorial was provided to the students on how to have discussion in the new environment. In addition, all students had two one-week long discussions in the discussion map to get familiar with the environment. During the study, two topics were selected for discussion, and each discussion last one week. The first discussion topic concerned the educational value of simulation. Students explored and evaluated a few

simulation sites, and discussed the strengths and weaknesses of simulation. The second topic had to do with 3D virtual worlds, such as Second Life. Students discussed the strengths and weaknesses of Second Life as a potential learning experience. In discussing topic one, students in Group 1 and 2 had discussion in the Mindomo discussion map; students in Group 3 and 4 had discussion in the ANGEL threaded forum. In discussing topic two, discussion environments were reversed, with students in Group 1 and 2 using the ANGEL threaded forum and students in Group 3 and 4 using the Mindomo discussion map. At the end of the two weeks of discussions, students completed a survey focusing on their experiences and perceptions of participating and learning within the two environments.

### *Data Analysis*

*Online discussion posts.* Students' posts in the two environments were analyzed using Kear's (2001) methods to uncover the degree of connectivity and sustainability in the discussions. To measure connectivity, the number of system links and semantic connections were counted. System links were created by students when they used the "reply" function in the threaded forum or created a physical link in the discussion map. To determine whether the system links truly represented semantic connections between posts, a semantic connection was noted if a post was clearly a reply to a previous post, or a continuation of an existing discussion. The number of within-thread and cross-thread links/connections in the discussions was also counted. To measure sustainability, the following things were recorded: (a) the number of isolated (i.e. unthreaded) posts and (b) the number of posts per thread.

*Survey.* The survey contained a set of Likert-questions asking students to rate their experiences and several open-ended questions asking them to explain their ratings. Sixteen students took the survey. Their responses to Likert-questions were coded into scores ranging from -2 to 2 based on the degree to which they agreed with the statements, where -2 = "strongly disagree", and 2 = "strongly agree". The data were analyzed using MANOVA. When an omnibus difference was found, follow-up ANOVAs were conducted. Student responses to open-ended questions were used to support the findings.

## Results

### *Connectivity*

Examination of the discussions suggested that all the system links in the two environments were semantically meaningful, that is, students created these system links only when they directly replied to a previous post or previous posts. The mean and standard deviation of system links and semantic connections in the two environments were presented in Table 1. What is worth noting is that, in the threaded forum, there was no cross-thread system link, because when students use the "reply" function in the threaded forum, they can only create a system link to one post rather than multiple posts. Two posts in the threaded forum, however, were coded as cross-thread semantic connections because they made connections to posts in multiple threads by explicitly mentioning those posts.

Table 1. *Mean and Standard Deviation of Links/Connections Created by Individual Student in the Two Environments (n=16)*

	Within-Thread Connection*		Cross-Thread Connection		F	P
	Forum	Map	Forum	Map		
System	2.63 (1.75)	4.75 (3.32)	0.00 (0.00)	0.31 (0.60)		
Semantic	2.63 (1.75)	4.75 (3.32)	0.13 (0.34)	0.31 (0.60)	3.77	.04

\*  $p < .05$

A MANOVA analysis of the number of within- and cross-thread semantic connections revealed that there was an overall difference between the two environments in terms of semantic connections (See Table 1). Follow-up ANOVAs suggested that the number of within-thread connections was significantly different between the two environments [ $F(1, 30) = 5.70, p < .05$ ], but the difference in the number of cross-thread connections was not significant [ $F(1, 30) = 1.17, p > .05$ ].

### *Sustainability*

Over the two weeks of discussions, students produced 61 posts in the threaded forum with four isolated posts, and 97 posts in the discussion map with five isolated posts. On average, there were 4.41 posts per thread in the discussion map, and 2.65 posts per thread in the threaded forum (See Table 2). The ANOVA analysis suggested that



threads in the discussion map contained significantly more posts than those in the threaded forum [ $F(1, 43) = 4.63, p < .05$ ].

Table 2. *Mean and Standard Deviation of Posts Per Thread in the Two Environments (n=45)*

	Mean (SD)	F	P
Threaded Forum	2.65 (1.37)	4.63	.04
Discussion Map	4.41 (3.66)		

### *Student Perceptions*

Results obtained from analyzing student survey responses are presented in Table 3. There is a statistical difference in terms of student perceptions of the two environments [ $F(1, 15) = 12.40, p < .05$ ]. More specifically, students reported that, compared to the threaded forum, the discussion map has made it easier to see (a) how a post is connected to others [ $F(1, 15) = 9.29, p < .01$ ] and (b) the growth and development of a thread [ $F(1, 15) = 10.91, p < .01$ ]. In addition, they thought it easier to make connections [ $F(1, 15) = 60.28, p < .001$ ] and extend a thread [ $F(1, 15) = 10.21, p < .01$ ] in the discussion map than in the threaded forum. But they did not rate the discussion map as significantly better to support sustained discussion than the threaded forum [ $F(1, 15) = 3.38, p > .05$ ].

Students also reported that they were more engaged [ $F(1, 15) = 11.67, p < .01$ ], and had more fun [ $F(1, 15) = 30.77, p < .001$ ] when having discussion in the discussion map as compared to in the threaded forum. But they did not feel that they participated more actively in one environment over the other [ $F(1, 15) = 3.30, p > .05$ ]. Finally, students found no difference in terms of the level of productivity of discussion [ $F(1, 15) = 4.36, p > .05$ ], but they perceived that the discussion map helped them learn the content better than the threaded forum [ $F(1, 15) = 7.64, p < .05$ ].

Table 3. *Mean and Standard Deviation of Student Ratings for the Two Environments (n=16)*

Survey Items	Threaded Forum	Discussion Map	F	P
<i>1. Connectivity</i>				
Easy to see how a post is connected to others *	.25 (1.06)	1.44 (.96)	9.29	.008
Easy to build within-thread and cross-thread connections **	-.38 (.89)	1.69 (.48)	60.28	.000
Easy to respond to an existing post from multiple directions **	-.31 (.87)	1.31 (.87)	21.30	.000
Easy to synthesize ideas across the posts *	.25 (1.13)	1.25 (.77)	10.91	.005
<i>2. Sustainability</i>				
Easy to see the growth and development of a thread of discussion*	.38 (.89)	1.38 (.81)	10.91	.005
Easy to extend and build ideas on a thread of discussion *	.25 (.93)	1.38 (.89)	10.21	.006
Easy to have sustained discussion on a thread of discussion	.38 (.81)	1.00 (.97)	3.38	.086
<i>3. Engagement</i>				
I participated actively	.81 (.66)	1.25 (.77)	3.30	.089
I was deeply engaged *	.25 (.77)	1.13 (.81)	11.67	.004
I had fun **	-.06 (.68)	1.25 (.58)	30.77	.000
<i>4. Perceived Learning</i>				
The discussion was productive	.88 (.62)	1.25 (.58)	4.36	.054
The discussion helped me learn the content *	.69 (.79)	1.25 (.68)	7.64	.014

\*  $p < .05$

\*\*  $p < .001$

## Discussion

Kear (2001) argued that the changes in the way discussion threads are visually displayed could affect the how participants interact during the discussion. This study provided further evidence for the statement. The discussion map developed in this study is different from the threaded forum in that the discussion map did a better job in visually displaying the interconnections of posts and development of threads in discussion. Results of the exploratory study showed that discussions in the two environments were different in a few ways.

First, students made more connections when had discussion in the discussion map than in the threaded forum (4.41 versus 2.65 on average). This finding is consistent with student responses in the survey, where they identified the discussion map as a better environment for making connections than the threaded forum. One possible explanation is that, as compared to the threaded forum, the discussion map has made it easier to see how posts are connected with each other. Another reason could be that it is simply easier to make a connection, especially a cross-thread connection, in the discussion map than in the threaded forum. As one student wrote, "I guess I'm not sure how you build a cross-thread connection on threaded forums, except by mentioning it in your post. In the new environment, you can connect with graphic arrows, very cool." Interestingly, the analysis of discussion posts suggested that students did not make significantly more cross-thread connections in the discussion map than in the threaded forum (a total of five posts in the discussion map versus two posts in the threaded forum). Perhaps, making cross-thread connections requires more than a supportive environment. It also requires participants to carefully examine the themes and details of different threads and intentionally look for the connections.

Second, the discussions in the discussion map were more sustained than those in the threaded forum. A thread in the discussion map contains more posts than that in the threaded forum (4.41 posts per thread in the discussion map, and 2.65 posts per thread in the threaded forum). Students agreed that the discussion map was better in visually presenting the growth and development of discussion than the threaded forum. To use their words, "[In the discussion map,] you could see how many people responded to a post and how it connected to other posts at the same time" and "the visual concept mapping feature naturally lends itself to making connections, developing, and maintaining an atmosphere of conversation".

Based on the survey responses, students thought it easier to "extend and build ideas" in the discussion map, but they did not believe that the discussion map were significantly better than the threaded forum in supporting sustained discussion. The relatively low ratings of the two environments in terms of sustainability (0.38 for the threaded forum and 1.00 for the discussion map) suggested that students might feel discussions in neither environment had reached the optimal level of sustainability. It is worth noting that, in addition to the discussion environment, many other factors can affect the sustainability of a discussion. For example, "the absence of substantial differences of opinion on most of the issues" (p. 15) or "having the deadlines so close to the end of the discussion" (p. 21) may make the discussion less sustained (Bullen, 1998). In this study, one week might not be long enough for discussions to be fully developed. When designing such a study in the future, researchers should take other factors including the duration of discussion, the characteristics of participants, group size, and discussion topic into consideration.

Third, students felt that it was more fun and engaging when having discussion in the discussion map than in the threaded forum. When asked why, students had different answers. Some students explained that the visual display had made the discussion map more fun – "The visual set-up of Mindomo [discussion map] was more appealing and fun to work with. It also gave more opportunities to think in many directions because of the web like nature of it." Some other students thought that Mindomo allowed them to add little symbols such as question mark icons and thumb up icons to the discussion, which made discussion more fun.

Students perceived that they learned the content better through the discussions in the discussion map than in the threaded forum. Student perceived learning, however, may not truthfully reflect their actual learning. One student wrote that "being more excited to use Mindomo [discussion map], I feel I got more out of the discussions and they were more productive to me. I learned the views of my group on ANGEL [threaded forum] too, but I wasn't as excited and interested in it and therefore feel that I got less out of it". This suggested that some students felt that they learned better because they were more excited or more interested when using the discussion map. That is, their level of engagement affects how they perceived their learning. The actual learning outcomes were not measured in this exploratory study. Therefore, it remains unknown whether the discussions in the two environments made a difference in student learning.

## Conclusion

Garrison and Cleveland-Innes (2005) pointed out that online discussion must be designed and structured in a way that facilitates clear discussion threads, avoids disjointed monologues, and moves the discussion to higher levels of thinking. This paper is a contribution towards this goal. It presents the rationale for developing a new environment that has a potential to enhance connectivity and sustainability in online discussions, and reports the results of an exploratory study. Due to the small sample size, the extent to which the results can be generalized is limited. All the findings should be interpreted with caution. The study, however, is informative and has meaningful implications for future research.

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# **The Effects of Two Factors on Asynchronous Discussions in a Chinese Online Course: Types of Discussion Activities and Discussion Leaders**

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## **Abstract**

This study examined the effects of two factors on asynchronous discussions in a Chinese online course. One factor was different types of online discussion activities (problem-solving, sharing information, case study, and debating). Another factor was different discussion leaders (instructor-lead, tutor-lead, peer-lead, and no leaders). The findings indicated that debating discussion activity could facilitate students to achieve higher level of knowledge construction than sharing information activity. However, different discussion leaders showed no significant effects on students' meaningful participations.

## **Introduction**

Online discussion is a main way of communication between teachers and students in distance education. Previous studies have proposed many instructional interventions that could influence the effects of online discussion, such as discussion group effect size (e.g., Du, Zhang, Olinzock, & Adams, 2008), discussion facilitation approaches (e.g., Hew & Cheung, 2008; Schellens & Valcke, 2006), discussion group structure (e.g., Jeong, 2004; Rose, 2004), and online students' characteristics (e.g., Krentler & Willis-Flurry, 2005; Spataru, Quinn, & Hartley, 2007). For example, Kanuka, Rourke, & Laflamme (2006) applied five different instructional strategies to online discussion: (a) WebQuest, (b) debate activity, (c) nominal group, (d) reflective inquiry, and (e) invited expert activity. Their results showed that the WebQuest and debate group had higher participation and cognitive presence than other groups. Regarding group leaders, on the other hand, tutor-supported discussion yielded significantly higher levels of knowledge construction as compared to students in the role-supported group (Wever, Keer, Schellens, & Valcke, 2009).

However, little research has focused on how these factors influence discussion forum in a Chinese course. The purpose of this study is to investigate the effects of two instructional interventions: (a) different types of discussion activities, (b) different discussion leaders on asynchronous discussions in a Chinese online course. The results indicate considerable implications for designing effective online discussion activities.

## **Method**

### **Participants**

291 in-service students enrolled in the online course, "Digital Photography and Image Processing", in Fall, 2009 at a metropolitan university in Shanghai, China. The semester had five months from Nov. 2009 to Feb. 2010. Students were all K-12 teachers. During the semester, they attended all the online discussion activities voluntarily.

### **Discussion Groups**

First, based on previous research (e.g., Tenenbaum, Naidu, Jegede, & Austin, 2001; Kanuka et al., 2006), this study designed four types of discussion activities: sharing information, case study, debating, and problem-solving. In the first phase, students were randomly put into four groups and were asked to have discussions about a same topic of image processing in one month. In the second phase, all the students were randomly put into four groups too. Each group was assigned a same discussion topic about digital photography to discuss in one month. Four groups were led by different leaders, the instructor, a tutor, a peer, and no leader. The tutor had assisted the instructor to teach this online course for 3 years. The peer was chosen from the class. At the beginning of the course, the instructor posted the qualification to be a peer-leader in discussion board. Students who were interested in it could post a message to introduce and recommend themselves. The best one who mastered the discussion topic

and was good at communication was chosen and assigned the role of peer-leader to manage a discussion group. The discussion topic was posted by the instructor for all the four groups. The responsibilities of the discussion leaders were to post an initial message and answer questions.

## Instruments

In the first phase, each posting was coded by using Interaction Analysis Model (IAM)'s five phases by two researchers (e.g., Wever et al., 2009; McLoughlin & Mynard, 2009). IAM is a content analysis model based on a constructivist paradigm designed to detect evidence of knowledge construction. It was developed to understand and describe the processes of negotiating meaning and knowledge co-construction in a collaborative online discussion environment (Gunawardena et al., 1997). This model has five phases: (a) sharing/comparing of information (PHI), (b) discovery/exploration of dissonance/ inconsistency amongst participants (PHII), (c) negotiation of meaning/knowledge co-construction (PHIII), (d) testing/modification (PHIV), (e) phrasing of agreement and applications of newly constructed meaning (PHV). One posting may achieve several phases of IAM. The highest phase that one posting achieved was used to identify its level. Two coders coded all the postings and decided each posting's level together. Similar to the first phase, in the second phase, all the postings were also coded by IAM by both researchers to evaluate their levels.

## Results

In the first phase, 36 students participated in four groups and they posted 72 messages. The postings were coded with IAM. A one-way ANOVA test revealed that level of knowledge construction were significantly different in terms of different types of online discussion activities ( $F(3, 68) = 3.42, p = .029$ ) (see Table 1). A Tukey post-hoc test showed that debating discussion activity ( $M = 4.53, SD = 1.33$ ) led to a higher level of IAM phases than sharing information discussion activity ( $M = 2.00, SD = 2.00$ ). However, there was no significant difference between other types of discussion activities.

Table 1. Mean scores and results of ANOVA test

Group1: Problem Solving ( <i>N</i> = 22)	Group2: Sharing Informa tion ( <i>N</i> = 8)	Group3: Case Study ( <i>N</i> = 8)	Group4: Debating ( <i>N</i> = 34)	<i>P</i> Value	Post-Hoc (Tukey)	<i>P</i> Value
<i>M</i> = 4.09 <i>SD</i> = 1.64	<i>M</i> = 2.00 <i>SD</i> = 2.00	<i>M</i> = 3.25 <i>SD</i> = 1.26	<i>M</i> = 4.53 <i>SD</i> = 1.33	.029*	Group 1 = Group 2 Group 1 = Group 3 Group 1 = Group 4 Group 2 = Group 3 Group 2 < Group 4 Group 3 = Group 4	.100 .772 .873 .644 .023* .429

\*  $p < .05$

In the second phase, 35 students attended discussions, and there were total 70 coded postings. One-way ANOVA indicated that level of knowledge construction were not significantly different in terms of discussion groups led by different leaders ( $F(3, 66) = .329, p = .804$ ) (see Table 2).

Table 2. Mean scores and results of ANOVA test

Group 1: Instructor- lead ( <i>N</i> = 8)	Group 2: Tutor-lead ( <i>N</i> = 18)	Group 3: Peer-lead ( <i>N</i> = 22)	Group 4: No leaders ( <i>N</i> = 22)	<i>P</i> Value
<i>M</i> = 4.25 <i>SD</i> = 1.50	<i>M</i> = 3.56 <i>SD</i> = 1.74	<i>M</i> = 4.00 <i>SD</i> = 1.73	<i>M</i> = 3.45 <i>SD</i> = 1.81	0.804

## Discussion and Conclusion

The limitation of this study is the sample size was small. Since the discussion activities were not required, less than half students attended the discussion. Chinese students are used to teacher-centered and test-driven instructional format (Wang & Kreysa, 2006). On the other hand, influenced by Confucian Heritage Culture, Chinese students are cultivated to revere authority, maintain harmony, and avoid conflicts in public (Chiu, 2009). When they are asked to present perspectives on an issue or discuss with each other, they always feel nervous and reject to attend them. How to motivate more Chinese students to join online discussions is really a big challenge for Chinese online teachers. For this research, more data will be collected in the future to support and validate current findings. Rewarding students extra points, increasing the weight of the score, or extending the discussion time will be the considerable strategies to encourage more meaningful participation.

With the limitation, we found that debating discussion activity led to higher level of knowledge construction than sharing information discussion activity. Although Chinese students seek harmonious learning environment and try to avoid conflicts in public, more students were willing to attend debating discussion, rather than only sharing information in this study. This result was consistent with previous research. Kanuka et al. (2006) indicated that students who engaged in the WebQuest and debate activities showed higher participation and cognitive presence than other groups. Debate is viewed as an effective activity to facilitate students achieving higher-order thinking because it could provide students with more opportunities to find supportive evidence and synthesize others' opinions. The finding indicates that the type of discussion activities is a considerable factor when designing an online discussion.

The second finding showed that there were no significant differences among the four groups led by different discussion leaders. Although Chinese students are used to teacher-oriented instructional format, the instructor-led group did not have higher level of knowledge construction comparing other groups. Based on these findings, to encourage more meaningful participation and achieve higher level of knowledge construction on discussions, designing an appropriate discussion activity maybe more important to be considered by Chinese online teachers.

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# **Distance Learning in the F2F Classroom: Using Technology to Improve Student Retention**

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**Abstract:** With U.S. doctoral programs having attrition rates averaging 50% according to some studies, increasing attention is being given to improving retention. This case study analysis examines how one educational technology doctoral program has used design, technology, and formative evaluation toward a goal of full retention for all students admitted. Narrative data from three students facing circumstantial events that would normally have required them to leave the program illustrate the program's success to date.

## **Introduction**

While much research in distance learning focuses directly on teaching and learning, increasingly designers are recognizing that successful efforts require development of learning environments (Huang, 2002; Zhao, Lei, Yan, Lai, & Tan, 2005) and the critical role of affective context (Craig, Graesser, Sullins, & Gholson, 2004; Isen & Reeve, 2005; Pierre & Oughton, 2007). Establishing such classroom settings that improve student attitude and motivation are important to enhance student retention efforts.

The purpose of this case study is to understand how technology can provide support for successful student persistence in a doctoral program. The study examines an educational technology Ph.D. program at the University of Hawaii at Manoa and focuses on the experiences of three students who were facing life events that would normally have required them to leave the program. Through narratives of their experiences and commentary by other students in the program, issues of technology affordances are described and evaluated in terms of success in supporting student retention. In particular, the study shows how distance students can be integrated into face-to-face classes.

## **Background**

To date comprehensive statistics are not kept for doctoral program retention in the U.S, but the available data indicate a significant proportion of students do not finish. A study by the Council for Graduate Studies (2008) showed that the average student attrition rate was 23.6% by the fourth year after admission in over 400 doctoral programs from 29 universities both public and private. Earlier studies indicated higher rates looking at a broader range of fields with rates over time showing only about half of students entering doctoral studies as completing (Golde & Dore, 2001). While no reports have examined attrition in education doctorates beyond studies of single institutions, there is little to suggest the field is different.

Research results from studies on doctoral student attrition have indicated multiple and complex reasons for the high rates of students who do not complete through dissertation, including situational, program-specific, cognitive, and affective or personality factors (Golde, 2005; Green, 1997). While common wisdom holds that students who leave may not have what it takes, accrued research evidence shows that there are few differences in characteristics such as GPA, test scores, or other personal factors at the time of admission between those who finish and those who dropout, suggesting that program and institutional impacts play an important role (Council of Graduate Schools, 2009; Lovitts, 1996; Maher, Ford, & Thompson, 2004)

Multiple solutions have been proposed to the attrition problem, including reports from an ongoing study by the Ph.D. Attrition and Retention Project (Council of Graduate Schools, 2010). Based on exit interviews by program completers, factors reported as critical to success are less an issue of academics and more about environmental

factors, including not only the institutional roles of financial aid and advising, but also non-financial support by family (Council of Graduate Schools, 2009). In a recent study, socialization and integration were noted as major components to establish both student support and expectations, establishing key aspects of the affective environment (Gardner, 2010) and echoing the findings in earlier studies on attitudes and the impacts of institutional and disciplinary settings (Cooke & Sims, 1995; Lovitts, 1996). Berge and Huang (2004) note that in the various models of academic persistence in the literature, variables accounting for attrition have included personal, institutional and circumstantial factors. They proposed a framework that includes the following:

- “Encourage commitment (personal goal commitment, institutional initial and ongoing commitment)
- Enhance integration (management and support services that enhance academic and social experiences)
- Improve delivery systems (delivery of instruction and support in online, blended and in-person settings, e.g., instructional support services, student support services, staff development on proactive academic advising; institutional network)
- Increase person-environmental fit (ease stages of transition, facilitate person-institutional, person-circumstantial and institutional-circumstantial fit)
- Improve outcomes (academic outcomes such as academic performance and intellectual development, psychological outcomes such as perceived utility and satisfaction)” (Berge & Huang, 2004)

Because issues of student persistence in doctoral studies are being examined both externally by policy makers and internally by universities, doctoral programs are being urged to examine their design and improve factors that will lead to retention and completion. This concern was noted and addressed when the University of Hawaii at Manoa Department of Educational Technology (ETEC) started its new doctoral program with a goal of graduating all admitted students.

In 2007, ETEC began its program as a specialization area within the existing education Ph.D. in the College of Education. We are now in our fourth year, having admitted 32 students from diverse backgrounds and geographic locations. Students are a mix of full and part-time, with core classes being held primarily face-to-face in the evenings and most electives online. The advantage to being a relatively new program is the ability to benefit from the experiences of other programs and the research that has been done on doctoral program success over many years. The ETEC doctoral program is still young and lacks program finishers. However, after four years the program has not lost a single student and continues in its goal, perhaps unrealistic but meaningful, of 100 percent reaching degree status, far superior to figures in the national studies cited above.

While still early to determine our success at our admittedly lofty goals, this paper reports on strategies related to student retention using technology as a support for both community and learning. The case features the use of new classroom technologies through the experiences of three doctoral students, the co-authors of the paper, who provide voice for student concerns that arise when they can no longer be on campus for a location-based program.

## **Methods**

The purpose of this qualitative case study research was to determine how the application of program design and technology impacted student retention in the ETEC doctoral program. The research used a narrative approach to gather data from three students who faced situational crises that forced them to be off-campus and would normally have required each to take a leave or withdraw from what is a campus-based doctoral program.

Data collection involved responses to open-ended questions on program strengths and specific supports that assisted in continuing their studies from a distance. Each of the students wrote a narrative describing their situations and interfaces with the doctoral program during off-campus residency. In each story, this involved living on the mainland due to personal and family crises, which created both distance and time issues. In addition, twelve students from the face-to-face contingent provided additional data by briefly responding to emailed questions about their classroom experiences from a campus-based student perspective.

Data analysis involved an inductive approach to coding and thematic grouping of the resulting responses with a baseline on categories derived from frameworks in the retention and attrition studies. Results are reported primarily in narrative form to provide voice for the student perspective.

## Results

Three students are the focus of this study, each of whom moved to the mainland after beginning the campus-based Ph.D. program in educational technology at the University of Hawaii at Manoa. Two of the students were entering their second year, while the third was off-campus after only one semester. In all three cases, the variables impacting decisions to leave campus involved what Berge and Huang (2004) classify as personal circumstantial variables external to the institution. These are the life, work, and family/socio-economic circumstances which are beyond the control of either the student or the program, but are particularly prevalent among the adult students in graduate programs. One student's situation gives a sense of the complex and individualized nature of the problem.

*I took leave from my job and came to the University of Hawaii (UH) in August of 2008 to start my doctoral program in educational technology. I was excited to be starting work on a prestigious degree, to be studying in depth a subject that I enjoy, to be away from work, and to be in Hawaii. My plan was to be in residence at UH for four semesters and then return to my job. The first semester went well. I met and started working with my cohort for the first time; they are an excellent group of students. We all took classes together from our mentor. Our entire cohort learned from her how to be academics and what was to be expected from us as our programs unfolded and we marched towards our dissertation. It was a good beginning.*

*The second semester started uneventfully with our cohort reuniting after the holidays and picking up where we had left off. It was soon after that I learned a vision problem I was experiencing was caused by a degenerative disease and hard times hit me. Without specifying the details of my health problems I can honestly say that I went through the worst time of my life that semester. I didn't know if I could make it through school or if I would have to withdraw and head home to New York for recovery. It was the support I received from my fellow students and the faculty that allowed me to stay. In particular, one member of my cohort and an excellent friend, nursed me through some of the worst times. And our faculty mentor convinced me that the ETEC Doctoral Program at UH would support me and "we want you to finish." The belief in me by these two people, and the whole ETEC 'Ohana' (extended family) allowed me to stick it out through the semester. In May of 2009 I left for New York to take some time with family to help me adjust to my changing health.*

In most campus-based programs, students such as these three would have been required to take a formal leave of absence because of inability to continue with required coursework and distance from faculty advisors. This is the case in all other disciplinary doctoral programs in the UH College of Education as none are distance programs and most have no online doctoral course offerings. In fact, none of the required research courses are currently available online and these are a major part of doctoral coursework in the first two years. In the event that circumstances forced a student into a prolonged residence off island, the student would be forced to leave the program if they had not yet completed required courses.

However, with a goal of student retention, students in the ETEC program were encouraged to continue without interruption with assurances that solutions would be invented on the basis that department faculty and students were experts in distance learning and dealing creatively with change. As one student wrote,

*Leaving Hawaii did not mean that I had to leave my doctoral program. On the contrary, I was encouraged to stay and carry on my studies from a distance. Even though the program was not officially online, I was assured that I would be able to complete my studies online. The coursework fell into line. – Distance student*

The students identified with many of the program aspects that were intended to ensure retention, including committed relationships with faculty, particularly their advisor, and support from their peer cohort of students. This strong sense of community and the multiple ways it developed initially through a combination of face-to-face and technology-enabled interaction established a baseline that made it possible to remain connected when a student was no longer on campus. Throughout the program, community building was supported by technology for communications and collaboration. Such tool use went beyond classroom activities, connecting the ETEC community both socially and intellectually. As one student noted who joined the program in its second year, 2008,

*I was fortunate to make a strong bond with both faculty and my cohort during the year that I was able to reside in Hawaii. The Ning [a social networking] site that our advisor set up prior to the beginning of my course work enabled me to make connections prior to meeting people F2F. I felt as if I knew everyone prior to actually meeting them in person. Great idea to build an online community as a form of introduction. The first cohort welcomed our cohort and were assigned to be our mentors. I met the members of the first cohort during an informal book club setting. It was relaxed and welcoming to be invited to our advisor's home for the event. I am not sure I would have been able to continue my education from a distance without the support and friendship of both faculty and my peers. I am not sure a fully online program would create the support system that I have now. I was able to spend time both socially and professionally with this support system. It enabled me to build trust and a feeling of belonging.*

Innovative application of distance technology played a key role in the ability to continue coursework and research, building on the same technologies used as the core of the program for teaching, learning and social networking. For example:

*My ties with Hawaii continued from New York. I kept up with the members of my cohort, some of whom were also in my Disability Studies class, through email, chat, and Facebook. I came to know other UH students through my TA-ing the undergraduate course. That experience also led to strong bonds with the members of the teaching team with whom I met weekly online and began a research project. I also kept up with the happenings of the ETEC Doc Students through a social network site, Ning, specifically created to foster bonds among the students. I was able to participate in Book Club, a monthly event sponsored by our mentor that is held on campus, through a discussion forum in the Ning. I was still a part of the ETEC Ohana [extended family]. – Distance student*

The greatest challenge involved adapting courses that served campus-based students to include these new distance learners. Both F2F and distance classes at UH use asynchronous tools for collaboration, resource sharing, and class administrative activities. UH has a widely deployed course management system, known as LauLima, which is a customized version of Sakai, that is used in both distance and campus classes. In addition, Google Apps for Educators provides collaboration tools and shared productivity applications, while the institution provides the most common communication channels of email and listservs. Students choose to supplement these with free Web apps such as Skype, Facebook, Twitter, and SecondLife.

While interactive video-system based courses have long included multiple locations, classes specifically established for the bricks-and-mortar classroom do not have similar models for bringing in only a few students from any location using ubiquitous technologies. However, as noted in one study, “The problem involving retention of students is not due to an isolated factor that can be ‘fixed,’ but rather imagination and care must be used to carefully select interventions that are needed at various points” (Berge & Huang, 2004).

In the case of ETEC doctoral classes, the solution was the use of a synchronous audio conferencing and course tool already being used at the UH College of Education for distance classes, a commercial product called Elluminate\*. Interestingly, because this tool is advertised for distance learning, using it within the F2F class required rethinking the affordances. While initially Elluminate was used with a single computer projected for classroom sharing, it became more useful when it was used by each student individually on their own computers regardless of location.

*I like that [the instructor] has everyone log in to Elluminate even though they are F2F. Last semester I had a class where I was the only one participating from a distance. [One student] logged in to Elluminate to keep me company. Often I lost audio and if [he] wasn't logged on with me I would have been lost in cyberspace. It is difficult to make accommodations for one lone distance learner. I appreciate the effort and compassion from everyone who has tried to make it work for me. I feel so fortunate to be able to continue from the mainland. – Distance student*

Students were required to have laptops for class, but to best create a shared environment, each student logged into Elluminate on their own laptop. As a result, both F2F and distance students had access to all the tools in Elluminate during each session. One accommodation was using a single USB conferencing microphone/speaker for

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\* More information on Elluminate can be found at the company's web site, <http://www.illuminate.com> including the use of a free virtual room for up to three people.

all audio in the classroom. When a distance student was speaking, their voice was heard on the classroom speaker and students muted their own laptops to prevent audio feedback. Students in the classroom were both positive about the ability to keep their classmates within the program but recognized the importance of more synchronous inclusion.

*I think that Elluminate was a great way for the distance students to stay connected in class by participating in class discussions and group work. The greatest strength of Elluminate was its ability to foster communication between distance students and the class. The ability to have break out rooms was also a feature that was utilized often. Some of the drawbacks, however, is that things did not always go smoothly. Trying to work in groups was at time difficult because we had to keep the mic open so that the distance student could hear the discussion. Due to the limited range of the mic, there were times where the distance students couldn't hear what was being said and things would have to be repeated either in voice or in the text chat. Having to repeat yourself also happened often in whole class discussions too. Also, having multiple distance students in the class would often require the rest of the class to split up into different rooms so that multiple open mikes could be used. – F2F student*

*I think that it works very well, especially considering the great distance between us. One strength is that all our voices can be heard in real time. Ideas can be developed and shared via text or vocally. This dialogue is very similar to any shared between people sitting in the same room, or F2F. That is a distinct advantage. A drawback may be that there is no visual, but since some of the mainlanders may be in the pajamas that might be good. But we would all like to see Germany or Taiwan, where others have been :) – F2F student*

Once Elluminate was deployed within the F2F class, it not only allowed synchronous participation by the three mainland-based students but enhanced the range of tools for all, adding some capabilities which have required expensive hardware and software to implement but are seen as desirable in campus classrooms. Some useful feature of Elluminate include:

- Audio and video recording of class sessions – many campuses have spent large sums to equip lecture halls to do this but Elluminate had all the needed tools. This proved to be one of the greatest advantages, as both campus and distance students appreciated the ability to go back and review class presentations which are rarely captured in most college classrooms.
- Polling – a tool within Elluminate had similar capabilities to remote clickers for rapid feedback and quizzing.
- Back channel discussions – students could chat about the lesson and interact throughout with anyone in the class. This was also used to instantly contribute web links and journal article titles that related to a topic under discussion, increasing sharing of resources among the students.
- Screen sharing – anyone could immediately share a web site or document from their own computer without added hardware or software
- Whiteboard – by using the interactive whiteboard provided in Elluminate, PowerPoint presentations, images, and simple drawing tools could be used at any time by all class participants and recorded with the class session.
- Video - while the tool uses a computer's web camera for video, this was used only sometimes as bandwidth issues caused problems. Seeing a talking head was not always necessary but it added personality to see who was talking. However, it was a small image and not equivalent to sitting in a classroom viewing the whole space.
- Guest lectures – experts could easily participate and were brought into the classroom from multiple locations, both locally and internationally, with no specialized video conferencing equipment.

When asked what features were helpful, students had many positive comments:

*Synchronous audio and chat providing multi-sensory access to both faculty and student colleagues. Synchronous whiteboard providing real-time slide presentations. – Distance student*

*The chat box is an especially useful tool as it allows simultaneous conversations with multiple peer students allowing for ways to socialize and keep in touch with classmates. It is also a very useful tool to ask*

*for quick clarification from a classmate when the audio transmission may have been unclear, for example, about a class assignment, or group assignments. In addition, it is strongly suggested by this student that it is made a standard practice that an "in-class partner" student be assigned to monitor the chat box for questions from the student at a distance, and also periodically ask how the distant student is doing or if there are any questions to make sure they are still connected and to bring them into the classroom. –Distance student*

The tools were not only useful for distance students, but as these were implemented for support of these off-campus colleagues, the F2F class began to experiment with new uses. This included both in-class uses and as support for class tasks outside of the classroom.

*My favorite thing about Elluminate is that it's the best online collaboration tool that I've used. I once collaborated on a group project via Skype, but its application was too buggy and would often crash. We ended up switching to Elluminate because Skype could not support my group's work. I also like being able to have public text chats and private text chats. Multiple mics is also a feature that I use often in group work. For presentations, we often utilize the white board and its tools, as well as the polling feature and timers to increase interactions between the speakers and group. –F2F student*

*I like it when the class leader allows us to divide into small groups and discuss and then come back to the large group. I like that Elluminate allows for the loading of a content based power point, or just the simple sharing of ideas like a chalk board in a class room. – F2F student*

Further, with all sessions done in Elluminate, F2F students who needed to miss a class because of illness or other issues were also able to join the class virtually. This proved to be beneficial in general to classes and did not lead to lowered attendance, as other issues drew the campus students. In fact, one aspect all students noted was that the non-class related camaraderie, food (students typically bring food to share since the course meets over the dinner hour), and show-and-tell of the latest technologies was missed, even by campus students who had to be absent for a class.

*Due to my current job, I travel quite a bit during school year and I had to take advantage of Elluminate to attend a F2F class. The most recent experience was a seminar session where I participated from South Korea. Initially, I had to figure out the time difference so I can participate at the right time but once that was figured out, it was as if I was there. At times, it was difficult to hear what the classmates who were present F2F were saying but for the most part, it was a very engaging experience. –F2F student*

*I haven't taken any advantage of Elluminate to attend a F2F class. I just missed one online lesson and the recording helped me catch up with my classmates. – F2F student*

*Some aspects of positive socialization of cohort model lost in distance learning model (e.g. distant learner not able to participate in class celebrations, sharing of food, etc.)....In F2F class, socialization occurs before, during, after, and outside of class. Deepening bonds of friendship and trust create a safety net for the researcher. It becomes easier to ask "dumb" questions of this tight knit group. The group acts as a cheer squad for you as you near deadlines. There is no one to commiserate with at the beginning and ending of each class. ([One student] and I groan and moan about "the readings are killing us!") –Distance student*

Not all aspects of the distance arrangement in the F2F class worked perfectly. Even those within the classroom noted that it was too easy during intensive interactions to remember that there were students not in the room. For example, the chat feature had both pros and cons, as described by one of the F2F students,

*It worked well for those in the classroom in that it allowed for students even in F2F to 'chat' and collaborate with each other without making any spoken noise that would disrupt the instructor and those whose attention are fully on other things. One of the strengths is that it allows for any student, whether in F2F or at a distance, to be part of and included in the 'chat' conversations since the chat feature levels the playing field for all students. However, one weakness would be that the students at a distance would have to make an effort to continue manipulating the features in Elluminate, ex. happy face, chatting, clapping, or*

*anything deemed appropriate to keep those in the F2F classroom from indirectly 'leaving them out' of conversations going on. – F2F student*

Students recognize that the applications to support distance learners remain underdeveloped, with both hardware and software issues, with particular issues around audio quality. Adequately picking up all talking in a classroom without issues of feedback and sound delay remains problematic.

*Multiple microphone and speaker systems need to be investigated and improved. Distance listening is extremely fatiguing in a group conversation setting. The spontaneity of discussion means that multiple people speak at once in the f2f location. Facial cues and gestures support these communications for the F2F group, however, these communications are often garbled for distance students. – Distance student*

*On several occasions I have attended a F2F class via Elluminate and overall it has been a good experience. As long as the microphone in the class is picking up the conversation/dialogue it is a good experience. On occasion, it can be a bit of a challenge when multiple people talk at once, over each other, or not close enough to the microphone. This can result in "garbled" sound that is hard to understand. – F2F student*

One problem that arises is with time differences, particularly between Hawaii and the mainland. In fact, one student now joining from Germany in Fall 2010 faces a 12-hour difference, so that the student has early breakfast while the Hawaii students are having dinner during the evening class. This requires commitment when students have to accommodate within schedules of family and work, and class times are commonly inconvenient. As one student indicated:

*Having class until 11:30 pm is brutal. Knowing this is my last semester of full time course work keeps me going. I could not sustain this schedule throughout the entire program. – Distance student*

The contrast to the strong interactions established in the face-to-face setting can be missed, even when a student indicates a strong desire to persist and technology enables continued communication with others. The ebb and flow of face-to-face conversations is more difficult when technology stands between the communicators. This appears as an unresolved concern directly within classroom activities as well as beyond.

*When the class did group work and I am a member of a group from a distance it is difficult to "insert" myself into the conversation because I am not always sure whether I know what the conversation is. Sometimes, even in a small group of four classmates, there might be two conversations going on. When there is a time limit, the group is intent on getting the work done with the people in the room and not always watching the chat box for suggestions I am making. – Distance student*

Students felt supported both academically and affectively through their personal challenges. Each was positive about the individual support received but also had many suggestions for the future to improve communication. They noted that the close feeling of being face-to-face was missed but academically they could continue. As one student stated,

*I think that a majority of the reason that I was successful in continuing with the ETEC Doctoral Program online was that I had a year in residence at UH. My first year introduced me to the people and the culture, both academic and social, which comprised the program. I felt connected to UH because I could easily envision the faces of the people and the places on the island. It was the connection that supported me over the distance. – Distance student*

This was also noted by another:

*I am missing the daily conversations and the ability to communicate F2F. The time change makes it difficult to stay in sync with the rest of the group. Planning a time to meet for group work is a compromise for everyone. I am either way ahead of everyone or I feel as if I am behind. I still communicate using social networking sites, however, the communication is less personal and less frequent. I am starting to feel left*



*out, even though numerous people have made a point of trying to make me feel included. It is like a long distance romance. – Distance student*

## Conclusions

When a decision is being made to persist or dropout, “it is made by the individual student, influenced by his or her personal circumstances. It is based upon the student’s continual cost/benefit analysis of all social, organizational, economical, and psychological factors like those resulting from perceived opportunity, relevancy, stress, responsibility and satisfaction within the educational context” (Berge & Huang, 2004). These are responses with strong roots in the affective and environmental aspects of the learning environment. When the program has built both strong ties among faculty and students, and provided a system of supports involving advising and communication, those factors that can be controlled when circumstantial factors impact student lives allow resolution that will lead to persistence. In the examples given, both program design and creative intervention established the framework for support through difficult life circumstances, leading to persistence by these students. In particular, new applications of technologies already used in the program allowed students to continue with coursework and feel a part of their doctoral cohort even when they were no longer on campus. Technology supported both direct academic progress and community built earlier during the campus experience. This success holds potential for establishing a hybrid doctoral program designed to support non-campus based students, a great need in Hawaii where the only major public institution with graduate programs serving the state is located on a single island in the state chain.

The results of this small study are now being evaluated to incorporate the students’ feedback into program design. While one student has now returned to campus, two remain off island with circumstances that will preclude more than short visits during their remaining time in the program, yet all are making positive progress that matches their on-campus peers and are committed to persistence. Since this study was done, several additional students have left before completion of the program, but in these cases course work was completed allowing more independence in pursuing research planning and implementation towards a dissertation. While this pattern of departure from campus after coursework is not uncommon in education doctoral programs, it is one of the factors identified as positively impacting attrition and therefore an area for continued program adjustment. To meet these new issues, technology is being used to ensure both social and advising connections are maintained, including virtual participation in a dissertation support group that meets with a faculty mentor. The longer term issue of program completion remains unknown but to date all are continuing and actively working on their research.

While this research began as one to study technology for supporting distance students, the results also are meaningful in terms of broader issues of retention of doctoral students. Although faculty have often focused on class work and research in the development of doctoral students, the design of program environments and conscious understanding of affective supports may have even greater relevance for ensuring student persistence. The implementation of intentional affective strategies have often been ignored in graduate education because of attitudes that equate adult learning solely with cognitive functioning (Craig, et al., 2004; Pierre & Oughton, 2007). Even at the most advanced levels of education this element can be seen as one that will have major positive implications when intentionally addressed.

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# **What About Quality Matters?**

## **Student Perceptions of Quality Matters™ Standards in Online Courses**

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### **Abstract**

The purpose of this study was to investigate how students perceive the Quality Matters™ (QM) standards relative to their success in online classes. Quality Matters (MarylandOnline) offers a rubric with 45 standards they believe are important, very important, or essential to an efficiently and effectively designed and organized course. The rubric that Quality Matters uses is derived from an extensive review of the literature, but there is little research about how students rank these standards relative to their perception of success in an online course, and how age, online course experience, and major are related to their perceptions of the QM standards. A convenience sample of 77 participants from two mid-sized universities found that they perceived 26% of the Quality Matters elements as essential, while a Spearman's Rho showed no significant correlation between age and student perception of the Quality Matters standards, and between the number of online courses previously taken and the QM standards. An analysis of variance was performed between student major and their perception of the Quality Matters standards showing no significance, although a small, practical effect size was observed. Results from this survey can be used to inform online instructional design and course organization practices.

*Keywords:* online course standards, online course design, quality matters, student perception of online course designs

The research literature is replete with studies examining student satisfaction in online learning environments relative to their interactions with other students, the instructor, and the course content (Anderson, 2003; Moore, 1989; Swan, 2001; Thurmond, Wambach, & Connors, 2002). Additionally, there are many studies that present evidence of the qualities found in effective online courses. (Burnett, Bonnici, Miksa, & Kim, 2007; Drummond, 2008; Henry & Meadows, 2008). However, there appears to be less research regarding how students perceive their success in an online course relative to the course's instructional design and course organization.

Course instructional design and organization refers to the way the online course is structured, where links and areas are found relative to content access, discussion board participation, online chat rooms, and where students may locate additional resources (within or outside of the online class). As Simonson, Smaldino, Albright and Zvacek (2009) offer, students benefit when they have a clear understanding of course organization and student responsibilities. The authors further state that it is essential for students to "understand how the course will function so that they can be better prepared to participate" (p. 190). Aligning with course design is the role of instructional design in order to make learning more efficient, effective, and less difficult with a focus on the learner rather than on what content to cover (Morrison, Ross, & Kemp, 2007). Efficient and effective course organization in an online class means providing clear directions for navigation, and pronounced directions and cues that support student movement from one place to another within the course. The use of a site map, descriptive labels, and clearly marked work areas that inform the students where they are in the online course support efficient navigation. Course content and tools grouped appropriately under clear, consistent headers along with a concise table of contents also support efficient organization. For example, presenting students with a course structure page (like a site map) to explain how the course is organized will help them quickly see where key content and participation areas are found. Effective course design also means providing students with an explanation about the tools they will be using during the course and how to use those tools in the course (Simonson et al., 2009). While there are many ways to evaluate the quality of the design of an online course, one way is through an established rubric.

Quality Matters™ (QM), from MarylandOnline, offers online instructors such a rubric which measures critical components of a well designed online course. A rubric can be an effective evaluation and standardization tool that "combines evaluative criteria with scales that explicitly define standards of performance" (Kuh, Johnson, Agruso, & Monrad, 2001, p. 55). The QM rubric clearly outlines criteria required for an efficient, effective and engaging online course. For example, under the Quality Matters category of *Course Overview and Introduction*, one of the rubric items states, "Instructions make clear how to get started and where to find various course components"

(MarylandOnline, 2008, p. 2). This standard is further elaborated with annotations providing explicit details about this item in addition to an example of what it looks like when implemented. The QM rubric as developed, fits the definition of rubrics provided by Cooper and Gargan (2009) who describe rubrics as standards with descriptive statements illustrating how the standard is to be achieved. Jonsson and Svingby (2007) found that rubrics have the potential to improve instruction because expectations and criteria are fully developed which also facilitates feedback and self-assessment.

Because the QM rubric presents standards upon which online instructors are to focus, it offers a consistent way to evaluate a course's design and organization components. It ensures that online classes participating in the program or following the QM recommended standards will be judged using the same criteria; ensuring consistency and quality in online course design for colleges, universities, and organizations.

The Quality Matters (QM) standards are based on best practices and instructional design research which started from a Fund for the Improvement of Postsecondary Education (FIPSE) grant in the fall of 2003. The grant work resulted in the creation and implementation of a process to certify the quality of online courses and online components. The grant expired in 2006, but the organization decided to continue with their work towards "inter-institutional quality assurance and course improvements in online learning" (MarylandOnline, n.d.) As a result, the Quality Matters program currently has over 400 subscribers across 30 states ranging from four-year colleges and universities, technical colleges, community colleges, to other academic organizations. These institutions and organizations use the QM standards to evaluate the quality of the design and organization of their online and hybrid courses (MarylandOnline, 2008). These standards help guide faculty, instructors, and course developers to build efficient, effective, and pedagogically sound online courses. Faculty and instructional designers are trained and certified by the QM organization and its designated master trainers to review and evaluate online courses in accordance with these standards.

The focus of QM is to support student learning by offering standards through a faculty-driven, peer-reviewed process; a process that allows courses to be formally or informally reviewed using the QM standards. Instructors can use the rubric to guide the development of face to face classes and online classes, while peer reviewers use the rubric to examine the online course (or classroom course design) and to provide detailed feedback to the course developer about whether or not the course met the quality standards. Each of the 40 standards has a point value (assigned by the Quality Matters organization) depending on its relative importance to course/instructional design. Seventeen of the standards are considered an *essential* part of an online course and have a point value of three. Eleven standards are considered *very important* with a point value of two, and 12 are considered *important* with a point value of one. The maximum number of points that a course can earn is 85 and for a course to meet QM standards it must have an overall score of 72 points (MarylineOnline, n.d.).

These 40 elements concentrate on course design and not on course delivery or the academic content of the course, and are grouped into eight categories as follows:

- 1) Course Overview and Introduction – Addresses how the overall design of the course is made clear to students at the beginning of the course.
- 2) Learning Objectives (competencies) – Ensures that the course objectives are clearly explained and easy to understand and follow.
- 3) Assessment and Measurement – Ensures that assessment strategies used to evaluate student progress are supported by the stated learning objectives and are an integral part of the learning process.
- 4) Resources and Materials – Addresses whether the instructional materials are comprehensive enough to achieve the course goals and objectives, and that the materials are prepared by qualified persons.
- 5) Learner Engagement – Ensures that there is meaningful interaction between the instructor and students, among the students and between the students and course content. This standard is designed to support motivation and foster intellectual commitment to the course.
- 6) Course Technology – Addresses navigation in the course as it supports student access to the materials and that technology is also used to enhance engagement with the materials.
- 7) Learner Support – Ensures the course provides access to institutional resources designed to support student success.
- 8) Accessibility – Ensures students have access to all of the course components.

The 40 standards presented in the form of a rubric provide course developers, instructors, faculty, and peer reviewers with an efficient and clearly described criteria list for developing and evaluating the design of online courses.

Although the QM rubric is supported by an extensive literature review regarding best practices for online instructional design and course organization (MarylineOnline, n.d.), nowhere does Quality Matters address how online students perceive these standards relative to their success in the online learning environment. Therefore, the

purpose of this study was to examine student rankings of the QM rubric in terms of how these elements support their success in an online course. The study focuses on the following research questions:

1. In what order do students rank the Quality Matters standards in terms of the items' influence on their perception of success in the class?
2. Is there a relationship between age and student perception of the Quality Matters items?
3. To what extent does the number of online classes a student has previously taken explain their perception of the Quality Matters items?
4. Is a student's major related to their perception of the Quality Matters items?

### Rationale

Creating online courses that support student learning are critical if institutions are to provide high quality online learning experiences, maintain accreditation, and justify their distance learning programs (Simonson, et al., 2009). In order to do these three things well, institutions need to consider what the students themselves believe are key elements in course design relative to a successful online learning experience. It is possible to build sections or add course features in the online course only to find students do not avail themselves of those areas if they are hard to locate and not perceived as central to their success in the class. Creating areas that students do not use, or areas that do not support student learning, wastes instructor time and can add unnecessary elements to the online learning environment; thereby increasing complexity, cognitive load, and opportunity for confusion. Perhaps students who have more experience with online courses or more maturity may not find the QM standards as important to their success. Regardless, it is important to ask the online student how he or she perceives the QM standards in relation to how those elements support their success in online classes.

Although the MarylandOnline organization believes they have provided comprehensive standards relative to designing effective online courses, they do not discuss what course design and organization elements students believe are critical. This study begins to bridge that gap by examining how students perceive the standards found in the QM rubric supportive of their success in online courses. The results of this study offer a student perspective of the QM standards with the potential to inform online instructors and course developers regarding the design of more efficient and effective online courses.

### Literature Review

The Sloan Consortium (Sloan-C) recently reported that over 4.6 million students were taking at least one online course in the fall of 2008, representing a 17% increase over the number reported in 2007. Additionally, more than one in four college and university students now take at least one online course (Allen & Seaman, 2010). With numbers like these and continued growth for the online learning sector predicted, it becomes crucial that institutions pay attention to the quality of their online courses and that they implement some form of quality standards to ensure consistent excellence.

A salient aspect of online learning is the interaction online students have with their online peers, the course instructor, and the course content (Moore, 1989; Swan, 2001; Thurmond & Wambach, 2004). But efficient online interaction cannot take place if the course design is faulty and students stumble in the course trying to find needed materials, resources, and course objectives. Poor course design can result in frustration, decreased student satisfaction, lost effort, and attrition (Yang & Cornelius, 2004).

When students begin an online class, their immediate impression of the class is formed by the course design and layout, and the visual appearance of the course that greets them when they first log on. It is their first opportunity to see the virtual classroom and hence judge how they think the class will support them and their learning efforts. As such, instructors, faculty, and online course developers need to structure academic content in a "form suitable for study by distant learners" (Moore & Thompson, 1990, p. 4). Drummond (2008), in his report on student success in online learning, stated that a clear, well-structured and engaging presentation of concepts is a key component of a successful course (p. 44). Others discuss the need for clarity, consistency, and ease of use across the design and organization of online courses (Cheul, Junghoon, & Youngchan, 2006; Rhee, Moon, & Choe, 2006; Swan, 2001; Young & Norgard, 2006). Young and Norgard's study asked students about their preference for consistent structure and navigation across all online courses and 92% of the students queried agreed that a common structure across all online courses would be helpful to them.

Song, Singleton, Hill, and Koh (2004) found that student success in the online environment was predicated on course design and comfort with online technologies among other things. They reported that 82% of their study participants felt that the design of the course and comfort with online technologies influenced their success in the course (p. 65). Furthermore, the authors discovered that the design of the course was the most important factor

relating to students' satisfaction with the course. Goals, clearly stated objectives, and course organization were also reported as key elements to a successful online learning experience (Song et al., 2004).

In a more recent study, Ke and Xie (2009) reported that adults performed better in a structured online course where there were specifically designated areas for reading materials, lectures, assignments, sample papers, and evaluation rubrics. This aligns with work done by Tallent-Runnels et al. (2006) who reported that the literature on distance education identified well structured content as a top priority for online courses. Despite the literature supporting the need for efficient and effective online course design, and how the QM standards are becoming more widely used to assess online course design (Bogle, Cook, Day, & Swan, 2009), there is less research about how the Quality Matters standards are rated and perceived by students in terms of their perception of success in online courses. Nath and Ralston-Berg (2008) in a paper presented at the annual Conference of Distance Teaching and Learning at the University of Wisconsin, Madison, reported that participants in their study found all of the QM course design standards to be of value. Their study examined students' perceived value of the QM standards using one-sample t-tests to compare mean scores followed by a correlation analysis to look at the relationship between student rankings of QM standards and their satisfaction with the online course. This study examined students' perception of the elements of the Quality Matters standards as they were related to their perception of success in the online course, their rank order of the QM standards, and investigated whether or not a student's age, major, or number of online classes previously taken affected their perception of the QM standards.

## Methods

### Participants

Participants were invited from two public universities; one mid size university located in the west with an approximate enrollment of 14,000 and rated as a doctoral and research university by the Carnegie Foundation; the other, a larger university located in the mid west, with an approximate enrollment of 24,400 and rated as a high research activity university by the Carnegie Foundation for the Advancement of Teaching (2004). Both undergraduate and graduate degree programs including doctoral degrees, online courses, and online degrees are available from these two institutions. Non-probability convenience sampling was used based on access to faculty who were teaching online courses at these universities in the spring of 2010. Seven instructors teaching a total of 11 online classes agreed to send the survey to their students. The online classes surveyed included nursing education, Spanish, early childhood special education, managing technological change, technology and learning, and computer applications in education. The survey link was emailed to approximately 187 students, with 77 students completing the survey for a response rate of 41%. According to Rea and Parker (2005) a response rate of 50% for analysis and reporting of findings can be considered adequate as long as the researcher believes the responses are representative of the sample (p. 11). Archer (2008) suggests that a response rate of 51% is appropriate for output or impact type of evaluation surveys.

Optimal sample size was estimated to equal 126 based on Cohen's formula, (Green, 1991, p. 504) with a moderate effect size ( $R^2 = .13$ ) and 12 variables for a multiple regression analysis. The student sample was comprised of graduate and undergraduate students from a variety of subject areas such as nursing education, educational technology, Spanish, and special education, with a range of previous online course experience. Forty seven percent of the participants had taken over 4 online classes previous to this study, and over 54% of the participants were between the ages of 23 and 37. Females represented 72% of the participants and males the remaining 28%.

### Instrumentation

Because the classes were fully online courses with no face to face components, an online survey offered convenience, efficiency, and cost effectiveness for securing student input, and surveys have considerable credibility because of their widespread acceptance and use in academia (Rea & Parker, 2005). An electronic survey is also a logical way to reach students who are already using technology (the online course) in their academic endeavors.

The online survey was crafted from the original QM rubric but with the statements reworded in order to make them current and relevant to students and to remove some of the academic jargon. For example one of the QM standards states, "Instructions make clear how to get started and where to find various course components" (MarylandOnline, 2008, p. 2). This was reworded to, "Instructions for navigating the online course, such as how to get started and where to find various course components." In another example, the QM standard stated, "Minimum student preparation, and, if applicable, prerequisite knowledge in the discipline are clearly stated" (p. 2). This was reworded to, "Prerequisite knowledge or skills necessary to be successful in the course are explained." The

reworded statements were then reviewed for clarity and preservation of the intent of the original Quality Matters items by a QM representative from one of the participating universities. Additionally, to provide context for students when taking the survey, they were asked to rate the QM standard while considering how important that item was to them and their success in the online class. This directive appeared at the top of each new page of the survey.

Participants were asked to choose from a five point ordinal scale which was derived from the three point scale that the Quality Matters rubric uses. The QM rubric uses three possible evaluative responses regarding the criticality of the standard to the course: important, very important, and essential. I converted the response items to a five point scale based on research conducted by Lozano, García-Cueto, and Muñiz, (2008) who posited that the optimal range of Likert-type responses should be between four and seven because with fewer than four responses reliability and validity decrease and with more than seven responses the gains are minimal. Allen and Seaman (2007) also suggested including at least five response categories. Therefore, students were asked to rate the items on a scale from one to five as not important, somewhat important, important, very important, or essential to their success in the online class.

In revising the survey to be student appropriate, several QM standards were eliminated, such as, “The course incorporates ADA standards and reflects conformance with institutional policy regarding accessibility in online and hybrid courses” (MarylandOnline, 2008, p. 16), because students had no way of knowing whether or not this was true for their online class. These revisions resulted in a survey comprised of 35 statements, down from the original 40 Quality Matters standards. The other standards eliminated from the survey were considered irrelevant or unknown from the students’ perspective.

Additionally, in the learner engagement category, one standard contained more than two items for evaluation. In order for this survey item to be less ambiguous, the learner engagement category was broken down resulting in two additional standards’ statements. For example, the QM statement, “Learning activities foster instructor-student, content-student, and if appropriate to the course, student-student interaction (MarylandOnline, 2008, p. 10) was broken down into three less ambiguous statements: (a) learning activities support my interactions with other students, (b) learning activities support my interactions with my instructor, (c) learning activities support my interactions with course content.

Cronbach’s alpha calculated for the modified Quality Matters survey scores was .83 in the current study. According to Gliem and Gliem (2003), the closer Cronbach’s alpha is to 1.0 the greater the internal consistency of the items in the scale, noting that an alpha of .8 is a reasonable goal (p. 87). Additionally, five participant characteristic questions were presented in order to gather relevant information about the sample, and two open ended questions were added to elicit student perceptions about other items they thought important to their success in online courses.

Subscales as presented in the original QM rubric consisted of eight categories with associated standards. When re-working the standards into a student appropriate survey, every effort was made to preserve the eight original categories and their standards. Table 1 depicts the original eight QM categories (subscales) with the number of related standards alongside the number of revised survey standards, and Cronbach’s alpha of internal consistency for each revised subscale. According to Garson (2008), the “widely-accepted social science cut-off is that alpha should be .70 or higher for a set of items to be considered a scale, but some use .75 or .80 while others are as lenient as .60” (Measures of Internal Consistency, Cronbach’s alpha section). All statistical analyses were computed using SPSS/PASW version 17.

Table 1  
*Quality Matters Categories with Items, Revised Items, and Cronbach’s Alpha*

Original QM Standard Category	Original Number of standard items	Revised number of standards for survey	Cronbach’s Alpha for revised subscales
Course overview and introduction	7	7	.726
Learning objectives (competencies)	5	3	.825
Assessment and measurement	5	5	.653
Resources and materials	4	4	.621
Learner engagement	4	6	.635
Course technology	7	4	.537
Learner support	4	4	.834
Accessibility	4	2	.338

The factors (categories) of accessibility, course technology, and to a lesser degree, assessment, resources, and learner engagement all show low internal consistency which indicates a certain lack of consistency in responses to these items (scales).

In order to provide validity evidence of the QM survey scores, a principal component analysis with oblique rotation was run on the rating scales. The Promax rotation was chosen to allow the factors to correlate. The factor solution was composed of 35 items grouped into eight factors that accounted for 67% of the variance in the survey; Table 2 presents the percent variance for each of the eight factors.

Table 2

*Variance Explained by Each Factor*

Factor	% of variance
1 Course Overview	23.94
2 Learning objectives	11.27
3 Assessment/Measurement	9.26
4 Resources /Materials	5.67
5 Learner engagement	5.05
6 Course technology	4.34
7 Learner support	4.13
8 Accessibility	3.44

Not all survey statements loaded on the eight Quality Matters designated categories. Factor one, had 66% of the questions from the QM category learner support, while factor two had 66% of items from the QM category course technology. Factor three had 50% of its items loading from the QM category learning objectives, and 50% loading from the QM category course introduction. Factor four had 50% of its items loading from the QM category learner engagement, and 50% of its items loading from course introduction. Factor five had 60% of its items loading from the QM category assessment and measurement, and factor six had just two items load, one from learner engagement and one from course technology. Factor seven had 40% of its items loading from the QM category resources and materials, and factor eight had two items loading both from the course introduction category.

## Procedures

A link to the survey was emailed to each of the seven instructors who were teaching a total of 11 online classes beginning the ninth week of a 16 week semester. The instructors disseminated the link in a manner convenient for them. Once selected, the active survey link took participants to the informed consent letter, where students clicked an "I agree" button acknowledging their consent to participate and thereby launching the survey. A two week time frame was provided for participants to complete the survey, with reminder emails sent out mid way through this time frame.

## Preliminary Data Analysis

Data collected for student majors were open ended and categorical in nature. In order to investigate the relationship between major and student perception of the QM standards, I looked for general themes and repetition of key words such as special education, early childhood special education community health, instructional technology and nursing. The major themes were then coded numerically in order to examine the relationship between major and student QM ratings. This text analysis resulted in seven major categories from a total of 67 students who reported their major. These categories were: education (including early childhood ed. special ed. and deaf ed.), community health, nursing, instructional technology, psychology, library science, and others.

## Data Analysis

Descriptive statistics were computed to derive the mean and standard deviation for each of the eight original Quality Matters categories in order to begin addressing the first research question: how do students rank the QM standards in terms of the item's importance to their success in online classes. Additional descriptive statistics were used to examine student rankings of each of the 35 standards within the eight QM categories. Following that, Pearson's product moment correlations were computed across all eight of the QM categories to see whether or not the categories were related to each other.



To address the second research question regarding a relationship between age and student perception of the QM standards, Spearman's Rho was used to look at the correlation between age and scores from each of the QM categories or factors. Spearman's Rho was used again to examine the relationship between the number of online classes previously taken and scores from each of the QM categories in order to answer the question, does the number of online classes previously taken explain students' perception of the QM standards.

The fourth research question, is a student's major related to their perception of the Quality Matters standards, was addressed by performing a MANOVA to see the main and interaction effects of major (categorical variable), age range, and number of online classes previously taken on scores from each of the QM categories (multiple dependent interval variables).

Open ended responses provided insights into participants' views of online course elements and their related experiences. Common themes and text patterns were examined and then coded based on similarities and frequencies for interpretation in the context of the research questions.

## Results

To examine the relationship of each of the eight QM categories with each other, Pearson's product moment correlations were computed. Moderate to strong positive correlations were observed between course introduction and learning objectives, course introduction and engagement, course introduction and support, assessment/measurement and resources/materials, assessment/measurement and course introductions, and engagement and support. Weaker positive correlations were observed between course introduction and course technology, learning objectives and support, and learning objectives and accessibility, as well as between course technology and support, course technology and accessibility, resource/materials and support, and resource/materials and accessibility. Of note, no significant correlations were observed between accessibility and assessment/measurement, and between accessibility and resources/materials.

Salient to answering the first research question is how students rank ordered each of the Quality Matters statements within the 8 categories. Of note, participants in this study only rated nine items as *essential* out of a total of the 17 rated essential by Quality Matters; these top nine items along with the Quality Matters value for the equivalent or similar item are presented in Table 3.

Table 3

*Items Ranked as "Essential" by Students in QM Survey Compared to QM Ranking*

Item	N	%	QM Value
4.4 Instructional materials are easily accessible and useable.	49	60.49	*
3.2 It is clear how my work will be graded and how my participation will be graded.	48	60.00	Essential
6.2 Navigation throughout the entire course is logical, consistent and easy to follow,	45	56.25	Essential
1.1 Instructions for navigating the online course, such as how to get started and where to find various course components.	44	51.76	Essential
6.3 Technologies required for this course are either provided or easily downloadable	43	54.43	Very Important
2.3 The learning outcomes and objectives are realistic and achievable for the level of this course.	39	48.15	Essential
6.4 Instructions on how to access resources online are sufficient and easy to understand	36	45.00	Very Important
4.3 Instructional materials are sufficient for me to learn the subject.	35	44.30	Very Important
1.7 Minimum technology requirements are clearly stated.	32	37.21	*

\* There is no single similar item in the QM standards

Research question two examined the relationship between age and student perception of the QM items. Spearman's rank correlation coefficient ( $r_s$ ) was computed for age and each of the eight QM categories. Learning objectives had a moderate (Cohen, 1992), positive correlation with age,  $r_s = .325$ ,  $p = .004$  and resources/materials, also had a moderate positive correlation with age,  $r_s = .305$ ,  $p = .007$  (significant at the 0.01 level, 2-tailed). Cohen (1992) considers  $r$  at .30 a medium effect size, and .5 to be a large effect (p. 157). However, according to Ferguson (2009)  $r$  at .5 is considered a moderate effect while .8 is considered a strong effect (p. 533).

The third research question investigated the extent to which the number of online classes previously taken by students explained their perception of the Quality Matters items. Again Spearman's rank correlation coefficient ( $r_s$ ) was computed for each of the eight QM categories and number of online classes previously taken. Only a small negative correlation (Cohen, 1992) was observed between accessibility and number of online classes previously taken,  $r_s = -.226$ ,  $p = .045$  (significant at the 0.05 level, 2-tailed). Ferguson (2009) considers  $r$  at .2 to be a "recommended minimum effect size representing a 'practically' significant effect for social science data" (p. 533).

Prior to answering the question about whether a student's major was related to their perception of the Quality Matters standards, the data regarding majors was examined for reoccurring patterns and similarity, then similar majors were combined and assigned a numeric value. The most common major reported was instructional technology ( $n = 24$ ).

To address whether a student's major was related to his or her perception of the Quality Matters standards (research question four), a multivariate analysis of variance was calculated. A one-way MANOVA revealed no significant multivariate main effect for major; Wilks'  $\Lambda = .432$ ,  $F(48, 264.85) = 1.028$ ,  $p = .431$ , partial eta squared = .131. According to Ferguson (2009) a partial eta squared of .04 is a recommended minimum effect size that offers practical significance for social science data (p. 533), so the .13 found in this study represents a small practical effect of major on the QM standards.

The open ended questions addressed student perceptions regarding what they felt were important elements in an online class as well as what other things they believed contributed to their success in an online class. These responses were examined for similar themes and patterns and were grouped into the following categories: instructor involvement, communication and feedback, and course design.

## Discussion

The primary reason for this study was to investigate how students rank ordered elements of the Quality Matters standards compared to how the elements were ranked by the Quality Matters organization. Of the nine elements rated as *essential* by students, Quality Matters rated four of those items as essential too; they are: 1) clarity about how students will be graded (assignment and participation); 2) logical and consistent navigation; 3) instructions for where to find course materials; 4) realistic and achievable learning objectives. Interestingly, students also rated as *essential* the following five elements: 1) accessibility and usability of the materials, 2) technologies required for the course be provided or easily downloaded 3) instructions for accessing resources online be sufficient and easy to understand 4) instructional materials be sufficient for learning the subject 5) minimum technology requirements are clearly stated. The QM standards rank the following as *very important*, instead of essential 1) technologies required for the course be provided, 2) instructions for accessing resources online be sufficient, and 3) instructional materials be sufficient for learning the subject. There were no direct corresponding QM elements for the survey statements about accessibility and usability of the instructional materials, and, minimum technology requirements clearly stated.

In examining the nine statements ranked as *essential* by students, a pattern emerges that is not specifically reflected in the QM categorization of these elements. The pattern appears to be one of students expressing the need for clear instructional guidance in order to be successful in the course. Guidance for finding their way around in the online class, for accessing and using online resources, guidance regarding the technical requirements for the class in addition to guidance about how to access and use the technologies that may be required for the online class. These findings offer practical suggestions about where instructors and course designers should focus their time, direction, and effort when building and fine tuning their online courses. Because these participants have extensive online experience (75 % had taken 3 or more online classes previously) it implies a certain familiarity with the online learning environment and an understanding about what it takes to be successful in that environment. This expertise may compensate for courses that are less well organized and less directive because experienced student may know the ropes and need less guidance. As Shea and Bidjerano (2008) reported, "...more exposure to online environments may lead to a greater ability to integrate course materials, experiences, and interaction with others as an effective whole" (p. 356).

On the other end of the rankings (not important to somewhat important), 38% of the students ranked the provision of netiquette or guidelines for how to behave in the online environment as either *not important* or *somewhat important*, while Quality Matters ranked netiquette as an *important* element. Based on the online experience level of this sample, it is reasonable to posit that they are familiar with online courtesies and appropriate online discussion participation, and do not perceive online etiquette as important to their success in the class. As one student wrote, "I am less concerned about the 'netiquette' and discussion board guidelines than I am about the

assessments in a particular course. By now I should know how to behave in the online environment, and most of my courses have involved the group self-policing to a moderate extent.”

With current literature discussing the importance of creating a sense of community in the online environment, and introductions being one of the primary factors contributing to a sense of belonging, it is notable that 43% of the participants rated student self introductions in the class as *not important* to *somewhat important* to their sense of success in the class. In contrast, various studies point to online communities as contributing to student satisfaction (Shea, Li, Swan & Pickett 2005, Shea & Bidjerano, 2008, Song, Singleton, Hill & Koh, 2004 ) and an important element of community is students knowing each other virtually (social presence). Quality Matters rated student introductions as *important*.

Consistent with rating student introductions low, 38% of the participants rated learning activities that supported interactions with other students as *not important* to *somewhat important*, while QM rated this as *essential*. This finding is similar to Reisetter’s and Boris’ (2004) study which found that students placed a relatively low value on their interactions with peers, which again contrasts to current thought that student to student engagement is part of an efficient and effective learning environment.

In examining the relationship between age and each of the QM categories, only a moderate positive association was found between age and two QM categories: learning objectives, and resources/materials. Learning objectives included items addressing clear explanation of learning outcomes, easy to understand instructions about achieving course goals and the alignment of objectives with course work. As students mature, they may become more self aware about what contributes to their success online and better understand how learning objectives, when clearly written and evident, can contribute to their success.

The QM category for resources/materials depicts how materials support the stated learning objectives and that the materials need to have sufficient breadth and depth for students to learn. Similar to age and learning objectives, as students mature they may develop a more in-depth appreciation for the resources and course materials that are necessary for their success in the online class and avail themselves of these resources more frequently than what might be found in younger students. Similar to the results here, Ke and Xie (2009) found that age itself was not a predictor of adult students' learning satisfaction and performance.

Surprisingly, the relationship between a student’s previous online course experiences and their perceptions of the QM categories was almost non-existent. Only a small negative correlation was observed between accessibility and number of online classes previously taken. This most likely indicates that student new to the online learning environment or students with less online experience present a greater need for links and headings that are self describing and meaningful, as well as needing equivalent audio or visual content in lieu of the text-intensive content found in most online learning environments.

The two open ended questions were designed to elicit student input about other elements in an online course that contribute to their success as well as elements that make for a quality online course. After reviewing the student statements, three themes emerged: instructor involvement, instructor communication and feedback, and course design. Many students mentioned that instructor communication was important, and that the instructor be accessible, engaged, and provide timely feedback, although this was outside of the Quality Matters rubric. Additionally students wrote that they wanted interaction with their instructor and that the instructor needed to be organized. One student summed it up by writing, I can’t mention enough the need for timely, thoughtful feedback. I’ve had experiences where the instructor has not stuck to the published feedback schedule, and it makes it difficult to gauge whether or not I’m meeting the course goals. I don’t think there can be too much communication. I’ve not yet gotten sick of seeing an email or posting from an instructor.

A second student commented about the need for regular feedback by writing, “...if I don’t hear that I am doing well or need to work to improve specific things, [then] what am I doing all of this work for?” Another wrote, “We might see a grade but comments on the grade are essential since you can’t speak with the professor one on one.” It is interesting to note that although the Quality Matters rubric and subsequent survey were directed towards gathering student perceptions about essential course design elements, and not on content delivery or instructor presence, a majority of students who wrote comments made mention of the instructor’s role and its criticality to their success online.

Student comments about online course design further support the emphasis and importance placed by the QM standards on clear and easy navigation, and organization of content. As one student wrote, “It needs to be organized. Requirements, due dates, and activities need to be organized into sessions or modules and requirements for each session/ module need to be laid out.” Other students mentioned that having most of the content in one or two easily accessible places would contribute to their success, while another mentioned simple steps to obtain and submit assignments and consistent use of the learning platform as key to his or her success. One student aptly

summed it up, “The biggest thing to me is that the materials are easily accessible and it is not hard to find what you need for a task or assignment.”

Of particular note is despite the results showing emphasis on learning goals and objectives and the need for objectives to align with tasks and assessments, (79% of participants rated clear objectives as *very important to essential*, 89% rated instructions about how to meet learning objectives as *very important to essential*, while both are rated as *essential* by QM), there were no student comments about objectives as a specific element contributing to their success in an online class. This may be because participants perceive objectives in a more transparent manner and assume if they know where to go, what to do, and what is expected of them, then objectives become an intrinsic part of that and do not need to be called out. This has implications for future research around the role that course objectives play in student success and satisfaction in online learning environments; perhaps explicit learning objectives are not necessary if course expectations are clear and relevant.

### Limitations

Several limitations of this study restrict its generalizability to other student populations. First, there was no randomization of the sample, and secondly the sample size itself was not sufficient to provide adequate power for the statistical analysis. A few of the survey statements used “and/or” language which can cause confusion regarding how to respond to the statement (Rea & Parker, 2005). Also two survey statements about technology were confusing; it was not clear whether they were asking about the students’ prerequisite technology skills, or the technology requirements for participating in and accessing an online class. Also, placement of the survey statements in the prescribed QM categories should be reconsidered in light of the results of the exploratory factor analysis; many of the survey statements did not adhere to the QM prescribed categories. This calls for a re-examination of the QM categories as being adequate factors or aggregate representations of the various Quality Matters standards.

### Conclusion

Overall, the findings of this study lend support to the QM standards as evidenced by student perceptions of those standards relative to their success in an online course. There were a few areas where students did not rate particular elements as essential where Quality Matters did, and conversely, where students rated a few elements as essential and QM did not. Further study of the Survey Responses with Quality Matters Rankings table found in the appendix may provide additional insights into areas that students perceived as very important or essential to their success in an online class.

The survey results can be used to inform and guide instructors’ online course development efforts. For example, if students perceive that course introductions are important but not essential to their success, then does it make sense to spend much time on introductory activities? Netiquette is another area where online instructors and faculty may be able to spend less time, although in this study most participants had extensive previous online experience which may negate their need for explicit norms regarding online behavior and participation. Conversely, since students perceived instructions about accessing resources online, and the materials provided being sufficient for them to learn the content, as essential, the QM organization may want to reevaluate why they rated those elements as very important instead of essential.

Future studies should seek a larger sample size and a broader cross section of participants that is more inclusive of undergraduates, males and females, other majors, and students over the age of 40, to see if similar results are found. Additionally, researchers in future studies may want to examine instructor activities within the online course that support student success in conjunction with the course design elements offered by the Quality Matters standards. Exploring essential online instructor competencies and behaviors necessary to support student success in the online environment offers opportunities for the Quality Matters standards organization to provide additional synergistic guidelines for the enhancement of teaching and learning online.

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## Appendix

### *Survey Responses with Quality Matters Rankings*

Survey Statement	# respondents	%	QM Rating
<b>Course Overview and Introduction</b>			
1.1 Instructions for navigating the online course, such as how to get started and where to find various course components.			
Not important	2	2.35%	Essential
Somewhat important	7	8.24%	
Important	5	5.88%	
Very important	27	31.76%	
Essential	44	51.76%	
1.2 A statement that introduces me to the purpose of this course & its components.			
Not important	1	1.16%	Essential
Somewhat important	9	10.47%	
Important	18	20.93%	
Very important	35	40.70%	
Essential	23	26.74%	
1.3 “Netiquette” or etiquette guidelines for how to behave online regarding email, discussion posting and other forms of course communication.			
Not important	9	10.47%	Important
Somewhat important	24	27.91%	
Important	23	26.74%	
Very important	19	22.09%	
Essential	11	12.79%	
1.4 An introduction from the instructor telling us about himself or herself.			
Not important	3	3.57%	Important
Somewhat important	18	21.43%	
Important	25	29.76%	
Very important	31	36.90%	
Essential	7	8.33%	
1.5 All of the students are asked to introduce themselves to the class.			
Not important	11	12.79%	Important
Somewhat important	26	30.23%	
Important	25	29.07%	
Very important	18	20.93%	
Essential	6	6.98%	

Survey Statement	# respondents	%	QM Rating
1.6 Prerequisite knowledge or skills necessary to be successful in the course are explained.			
Not important	1	1.16%	Important
Somewhat important	7	8.14%	
Important	26	30.23%	
Very important	29	33.72%	
Essential	23	26.74%	
1.7 Minimum technology requirements are clearly stated.			
Not important	1	1.16%	Important
Somewhat important	4	4.65%	
Important	18	20.93%	
Very important	31	36.05%	
Essential	32	37.21%	
<b>Learning Objectives</b>			
2.1 The course learning outcomes and objectives are presented and clearly stated.			
Not important	1	1.23%	Essential
Somewhat important	4	4.94%	
Important	12	14.81%	
Very important	40	49.38%	
Essential	24	29.63%	
2.2 Instructions about how I can meet the learning goals and objectives are easy to understand.			
Not important	1	1.22%	Essential
Somewhat important	1	1.22%	
Important	7	8.54%	
Very important	44	53.66%	
Essential	29	35.37%	
2.3 The learning outcomes and objectives are realistic and achievable for the level of this course.			
Not important	1	1.23%	Very important
Somewhat important	0	0.00%	
Important	7	8.64%	
Very important	34	41.98%	
Essential	39	48.15%	
<b>Assessment &amp; Measurement</b>			
3.1 The types of assessments and work given in this course are consistent with the stated learning objectives.			
Not important	0	0.00%	Essential
Somewhat important	1	1.23%	
Important	5	6.17%	
Very important	46	56.79%	
Essential	29	35.80%	



Survey Statement	# respondents	%	QM Rating
3.2 It is clear how my work will be graded and how my participation will be graded.			
Not important	0	0.00%	Essential
Somewhat important	1	1.25%	
Important	3	3.75%	
Very important	28	35.00%	
Essential	48	60.00%	
3.3 The types of assessments and work given in this course are consistent with what I am asked to do and consistent with the resources available to me.			
Not important	0	0.00%	Essential
Somewhat important	0	0.00%	
Important	4	4.94%	
Very important	42	51.85%	
Essential	35	43.21%	
3.4 There are a variety of assessments used in the course.			
Not important	1	1.23%	Very important
Somewhat important	14	17.28%	
Important	24	29.63%	
Very important	33	40.74%	
Essential	9	11.11%	
3.5 Self check or practice assignments are provided for me with timely feedback.			
Not important	3	3.75%	Very important
Somewhat important	9	11.25%	
Important	20	25.00%	
Very important	35	43.75%	
Essential	13	16.25%	
<b>Resources &amp; Materials</b>			
4.1 Instructional materials relate to the learning outcomes and course objectives.			
Not important	0	0.00%	Essential
Somewhat important	3	3.70%	
Important	10	12.35%	
Very important	48	59.26%	
Essential	20	24.69%	
4.2 The relationship between the instructional materials and learning activities is clearly explained.			
Not important	0	0.00%	Essential
Somewhat important	3	3.75%	
Important	20	25.00%	
Very important	43	53.75%	
Essential	14	17.50%	

Survey Statement	# respondents	%	QM Rating
4.3 Instructional materials are sufficient for me to learn the subject.			
Not important	0	0.00%	Very important
Somewhat important	0	0.00%	
Important	12	15.19%	
Very important	32	40.51%	
Essential	35	44.30%	
4.4 Instructional materials are easily accessible and useable.			
			NA
Not important	0	0.00%	
Somewhat important	0	0.00%	
Important	2	2.47%	
Very important	30	37.04%	
Essential	49	60.49%	
<b>Learner Engagement</b>			
5.1 What I am asked to do (learning activities) promotes the achievement of the learning outcomes and course objectives.			
Not important	1	1.22%	Essential
Somewhat important	1	1.22%	
Important	5	6.10%	
Very important	54	65.85%	
Essential	21	25.61%	
5.2 Learning activities support my interactions with other students.			
Not important	12	14.63%	Essential
Somewhat important	19	23.17%	
Important	23	28.05%	
Very important	23	28.05%	
Essential	5	6.10%	
5.3 Learning activities support my interactions with my instructor.			
Not important	3	3.66%	Essential
Somewhat important	14	17.07%	
Important	18	21.95%	
Very important	35	42.68%	
Essential	12	14.63%	
5.4 Learning activities support my interaction with the course content.			
Not important	1	1.23%	Essential
Somewhat important	1	1.23%	
Important	10	12.35%	
Very important	47	58.02%	
Essential	22	27.16%	

Survey Statement	# respondents	%	QM Rating
<hr/>			
5.5 The requirements for interaction in this course are clearly explained.			
Not important	0	0.00%	
Somewhat important	1	1.25%	
Important	8	10.00%	
Very important	40	50.00%	Very important
Essential	31	38.75%	
5.6 Clear standards are set for instructor response time and instructor availability (turn-around time for emails, grade postings, etc.).			
Not important	0	0.00%	
Somewhat important	5	6.10%	
Important	18	21.95%	
Very important	30	36.59%	Very important
Essential	29	35.37%	
<b>Course Technology</b>			
6.1 The tools and media in the online course support my becoming an active learner.			
Not important	2	2.50%	
Somewhat important	1	1.25%	
Important	25	31.25%	
Very important	32	40.00%	
Essential	20	25.00%	Essential
6.2 Navigation throughout the online course is logical, consistent and easy to follow.			
Not important	0	0.00%	
Somewhat important	0	0.00%	
Important	10	12.50%	
Very important	25	31.25%	
Essential	45	56.25%	Essential
6.3 Technologies required for this course are either provided or easily downloadable.			
Not important	0	0.00%	
Somewhat important	0	0.00%	
Important	4	5.06%	
Very important	32	40.51%	Very important
Essential	43	54.43%	
6.4 Instructions on how to access resources online are sufficient and easy to understand.			
Not important	0	0.00%	
Somewhat important	0	0.00%	
Important	10	12.50%	Important
Very important	34	42.50%	
Essential	36	45.00%	

**Learner Support**

Survey Statement	# respondents	%	QM Rating
<hr/>			
7.1 Course instructions explain or provide a link to clear descriptions of the technical support offered.			
Not important	0	0.00%	
Somewhat important	4	5.00%	
Important	20	25.00%	
Very important	33	41.25%	Very important
Essential	23	28.75%	
7.2 Course instructions explain or provide a link to clear explanations about how UNC's academic support system can assist students in effectively using the resources provided.			
Not important	4	5.00%	
Somewhat important	8	10.00%	
Important	32	40.00%	Important
Very important	21	26.25%	
Essential	15	18.75%	
7.3 Course includes or links to a clear description of the academic support offered to students (such as advising, financial aid, the library etc.).			
Not important	10	12.50%	
Somewhat important	16	20.00%	
Important	25	31.25%	
Very important	21	26.25%	Very important
Essential	8	10.00%	
7.4 Course includes, or links to tutorials and resources that answer basic questions related to research, writing, technology, etc.			
Not important	6	7.50%	
Somewhat important	9	11.25%	
Important	32	40.00%	Important
Very important	24	30.00%	
Essential	9	11.25%	
<b>Accessibility</b>			
8.1 Course materials and online course pages provide equivalent alternatives to auditory and visual content.			
Not important	7	8.86%	
Somewhat important	12	15.19%	
Important	21	26.58%	
Very important	27	34.18%	Very important
Essential	12	15.19%	
8.2 Course pages have links and headings that are self-describing and meaningful.			
Not important	0	0.00%	
Somewhat important	4	5.00%	
Important	14	17.50%	
Very important	41	51.25%	Very important
Essential	21	26.25%	

# Learning Statistics with Cognitive and Metacognitive Strategies that Facilitate Multiple External Representations Integration

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## Abstract

The literacy of multiple external representations (MERs) (e.g., graphs, and formulas) and the ability of integrating MERs are critical to learning in the STEM fields (Science, Technology, Engineering, and Mathematics). This research investigated instruction on cognitive and metacognitive strategies with potential in facilitating students to integrate MERs. This study experimentally compared the learning performance by the four groups ( $N = 118$  undergraduate students) differed regarding the instruction on strategies each group received. The results indicated no difference on introductory statistics learning performance among groups. Analysis showed there might be potential ceiling effect due to the specific sample's high mathematics aptitude. Namely, students with high aptitude relevant to the subject of learning might not benefit from the instruction on strategies. Interpretation of the results and implications for future research were discussed.

## Purposes

Students in the Science, Technology, Engineering, and Mathematics (STEM) fields are confronted with multiple external representations (MERs) in their learning material. The ability to learn and communicate with these MERs not only has significant impact on their learning achievement, but also their future performance in workplace. Past research has indicated the integration of MERs is not automatic, and students need instructional support to master the learning and integration of MERs. While researchers have provided learning environments with pre-integrated MERs or interactive capability, results were mixed in terms of effectiveness of these environments. A few research programs have indicated that students need to be supported with instruction on strategies that help guide their cognitive and metacognitive processes during learning from MERs and integrating them, so they can engage in deeper learning. Thus, this study aims to investigate the effects of instruction on strategies, including a self-explanation strategy and an MER integration strategy, on students' learning outcomes on statistics, a domain with extensive use of MERs.

## Theoretical Framework

*Multiple external representations* refer to instructional materials that contain two or more separate representations, while *integration of MERs* refers to the cognitive processes in which the learner actively engaged in understanding, connecting, and aligning two or more external representations that were once separate (Van Meter & Garner, 2005; de Jong et al., 1998). In MER-rich materials, MERs serve different functions depending on their characteristics. Ainsworth (1999) proposed the *functional taxonomy of multiple external representations* for analyzing the benefits of learning with MERs. She argued that there are three different beneficial functions of MERs when involved in learning, including providing complementary information, constraining interpretation, and engaging in deeper learning.

Whereas Ainsworth's taxonomy describes the potential functions of MERs, Mayer has proposed a model to explain people's cognitive processes of integrating MERs, the Cognitive Theory of Multimedia Learning (CTML) (Mayer, 2005). This theory suggests that learning in the multimedia environment involves the following cognitive processes either linearly or nonlinearly: 1) selecting relevant words for processing in verbal working memory, 2) selecting relevant images for processing in visual working memory, 3) organizing selected words into a verbal model, 4) organizing selected images into a pictorial model, 5) integrating the verbal and pictorial representations with each other and with prior knowledge. Due to limited capacity of working memory, people need to select relevant information to process. Because of dual channel characteristic, the selected information needs to be processed and organized separately and then finally integrated.

## Instructional Support for Cognitive and Metacognitive Processes While Integrating MERs

Past research presented mixed results of the effectiveness of instructional support in helping learners integrate across MERs. Research studies showed promising instructional intervention implemented in pre-fabricated learning environments, such as pre-integrated MERs (Bodemer, Plotetzner, Feuerlein, & Spada, 2004), drag-and-drop technique (Bodemer & Faust, 2006), and interactive hyperlinks (Seufert & Brunken, 2006). However, the same intervention also led to different results for high school students and college students (e.g., Seufert & Brünken, 2006). It seems that simply the existence of MERs or even an environment with affordance to help integrate MERs do not necessarily lead to MER integration and better learning.

Learning with MERs and integrating them involve one's cognition and metacognition. Due to limited cognitive capacity, when processing MERs individuals are forced to decide about which piece incoming information to attend to, select, organize, and connect. This decision-making process requires one's metacognitive strategies, which are the "techniques for allocating, monitoring, coordinating, and adjusting these limited cognitive resources" (Mayer, 2005, p. 36). Mayer's claim and the support from past research indicates that there is a need to support learners' cognitive processes as well as conscious control of their cognitive activity during the learning tasks, so their learning with MERs can improve.

### Self-explanation (SE) as a Strategy for Integrating MERs

Self-explanation (SE) refers to a learning technique where individuals explain what they learn to themselves. It helps engage students in active learning, attend to learning material, and effectively monitor their own evolving understanding. The major cognitive and metacognitive processes involved in SE include generating inferences to fill in missing information, integrating information within the study materials, integrating new information with prior knowledge, and monitoring as well as repairing faulty knowledge (Roy & Chi, 2005).

Past research indicated that SE has had positive correlation with learning achievement. For example, Renkl (1997) indicated that self-explanation of solution steps in worked examples were good predictors of learning outcomes. In addition, SE has been established as a useful and teachable technique for enhancing learning across different subject areas, such as human circulatory systems (Chi, de Leeuw, Chiu, & Lavancher, 1994), basic economics (Renkl, Stark, Gruber, & Mandl, 1998), and argumentation skills (Schworm & Renkl, 2007). More research is needed to determine if SE would remain an effective technique if applied to scaffold MER integration.

Guided by the review of literature, this research aims to answer the research question, "Would instruction on cognitive and metacognitive strategies, such as self-explanation and MER integration, make a difference on students' learning performance in a STEM domain text with extensive use of multiple external representations?"

### Methods, Data Sources, and Materials

#### Sample

One hundred and eighteen ( $N = 118$ ) undergraduate students were recruited from two advanced biology courses and one introductory educational psychology course in a northeastern public university in the U.S. to participate in this study. Among the 118 students, there were 55 males and 63 females, and 73% of them were at their 3rd or 4th year. The mean SAT Mathematics score was 664.38. The students had taken an average of 2 college-level mathematics courses. Most of the students have a major in Biology (50.85%), Premedicine (31.36%), or Elementary Education (7.63%).

#### Procedure and Learning Environment

In this research, all participants completed all the required units delivered with ANGEL, a web-based learning management system hosted on the university server. The required units included: 1) demographic survey, 2) instruction on strategies, 3) statistics learning material, and 4) posttest. Also, participants followed the prescribed sequence to linearly go through the four units, with the completion of one unit activating the next unit.

#### Research Design and Treatments

This research employed a one-factor design with four instructional conditions, including one control group and three experimental group: 1) no instruction on strategies (i.e., control group-C), 2) instruction on self-explanation strategies (SE), 3) instruction on MER integration strategies (MI), 4) combined instruction on self-

explanation strategies and MER integration strategies (SEMI). The independent variable is the instruction on learning strategies, while the dependent variable is students' learning outcomes on introductory statistics content. The first experimental group received instruction on self-explanation strategies and two prompts to guide the self-explanation on the statistics material by typing in a text box. The second experimental group received instruction on MER integration strategies but was not provided with any prompts to guide explanations. Instead, this group was asked to type what they thought while studying the material. The third experimental group received a combined instruction on self-explanation strategies and MER integration strategies and also two prompts of explaining how the MERs in the material were related to each other. The control group received no instruction or prompts, but was still asked to type their thoughts while studying the material.

### Statistics Learning Material

The learning material of introductory statistics was developed through adapting statistics content from multiple sources. The statistics content included a variety of MERs: 7 tables, 11 graphs, 5 formulas, and 4830 words. The content included five major sections: *Frequency Distribution*, *Normal Distribution*, *Measure of Central Tendency*, *Variability*, and *Correlation*.

### Instruments

A posttest on introductory statistics was developed to assess students' learning performance on the major concepts covered in the learning material. While it was designed to measure concept learning, effort was also made to ensure students' need to integrate MERs to answer the questions. The MERs used in this test paralleled that of which the students were presented in the statistics learning material: text, graphs, tables, and formulas. The test included a total of 42 multiple-choice questions.

### Results and Findings

The results indicated a high reliability ( $\alpha = .775$ ) for the scores obtained from the posttest measure. The correlation analysis indicated that students' posttest scores were positively significantly correlated with their highest SAT Mathematics score ( $r = .50, p = .000$ ), highest SAT Verbal ( $r = .47, p = .000$ ), and self-reported cumulative GPA ( $r = .18, p = .048$ ). The descriptive analysis of posttest scores and demographics by condition were presented in *Table 1*.

Table 1. *Mean Scores of Posttest and Demographics by Condition*

	Condition			
	C ( <i>n</i> = 30)	SE ( <i>n</i> = 31)	MI ( <i>n</i> = 28)	SEMI ( <i>n</i> = 29)
Posttest	33.67 (4.64)	33.81 (4.93)	34.07 (4.00)	35 (3.82)
SAT Math	656.87 (94.87)	654.00 (92.57)	656.89 (93.55)	690.48 (96.55)
SAT Verbal	593.20 (123.85)	622.71 (105.79)	610.82 (102.36)	633.59 (102.05)
GPA	3.40 (0.39)	3.50 (0.31)	3.54 (0.40)	3.54 (0.23)

#### Control Group vs. Experimental Groups

There were no significant differences in statistics posttest scores between the control group and 1) self-explanation group ( $t(59) = -.11, p = .91$ ); 2) the MER integration group ( $t(56) = -.36, p = .72$ ); 3) the combined group ( $t(57) = -1.20, p = .23$ ).

#### Experimental Group vs. Experimental Group

There were no significant differences in statistics posttest scores between 1) the self-explanation group and the MER integration group ( $t(57) = -.23, p = .82$ ); 2) the self-explanation group and the combined group ( $t(56) = -1.04, p = .30$ ); 3) the MER integration group and the combined group ( $t(55) = -.90, p = .37$ ).

#### Discussions

The following were some possible explanations for the lack of effect of the treatments. First, there was a possible ceiling effect of students' SAT Mathematics scores on students' statistics posttest scores in this study. The participants' mean SAT mathematics score was 664.38, which indicated the students overall had relatively high mathematics aptitudes. It is possible that the students with stronger mathematics background might not benefit as much from the instruction on strategies for learning the material highly-related to mathematics. For future research, we suggest to consider this aspect and recruit students with lower mathematics ability to examine if those students could benefit more from the instructions on strategies. Second, it is likely that the posttest appeared to be relatively easy for this particular group of participants even though the learning material might have posed some challenges. The posttest scores did not reflect the impact of the instruction on strategies. Again, this aspect needs to be examined when the posttest is administered to the students with lower mathematics ability. Third, the treatments might not have elicited the expected cognitive processes. That is, the self-explanation group generated more high-quality explanations, the MER integration group engaged in integrating MERs presented in the material, and the combined group performed both cognitive processes. This possibility would need to be confirmed (or rejected) through an in-depth analysis of students' typed thoughts or self-explanations for the evidence of high-quality self-explanations and MER integration. The results, in turn, would have implications for revising the statistics learning materials and the instruction on strategies for future research.

#### Significance

This study aims to improve undergraduate students' learning of introductory statistics, a foundational subject that provides the mathematical tool for understanding quantitative information in science disciplines such as biology and social sciences such as sociology, psychology, and education. Theoretically, this research seeks to advance the understanding of students' use of cognitive and metacognitive strategies for learning with MERs. In practice, this research investigates the effects of instructions on strategies in helping students learn content that uses MERs extensively. In addition to experimenting and further understanding of how to support learning with MERs, this study contributes to the area of researching MER integration by developing a reliable statistics test that requires integrating MERs in the question stem and the corresponding choices in order to score. This format and development of this test can serve as a preliminary model of measurement development for future studies related to MER integration. The results of this study are expected to lead to valuable empirical results for researchers and educators in terms of exploring and improving instruction on strategy use in statistics as well as STEM domains that require MER integration in learning.



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# Correlations between Usage and technology acceptance of Web 2.0 applications

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**Abstract:** This study was conducted to investigate the relationship between the usage and technology acceptance of Web 2.0 applications among college students. 449 individuals voluntarily participated in the study in 2009. The survey consisted of 95 items drawn from selected categories from the *Unified Theory of Acceptance and Use of Technology* (UTAUT). The results indicated significant relationships between the usage and technology acceptance on seven Web 2.0 applications (blog, wiki, instant messengers, online social community/Facebook, online video sharing/YouTube, online games, immersive virtual environment/Second Life). The study also found that students were more strongly influenced by perceptions of performance expectancy and effort expectancy on the use of blogs, wikis, and immersive virtual communities. These findings of the study imply that educators should take factors of technology acceptance into consideration when integrating Web 2.0 applications in the classroom settings.

## Introduction

Web 2.0 applications such as blog, instant messenger, wiki, video sharing tool, and web conferencing tools are gaining popularity on college campuses. Students use them to create their own content on the web, contribute and collaborate with others, and develop social networks via multiple formats of media and representation (O'Reilly, 2005). Although these activities suggest the possibility of using Web 2.0 applications for instructional purposes, they also raise the question of how students are motivated to use these web-based technologies (Lee, Cheung, & Chen, 2005). Instructors should take measures of user acceptance and usage into consideration when integrating Web 2.0 applications in the classrooms, which, however, are lacking in current literature. Therefore this study was designed as an effort to better understand how college students perceive and use Web 2.0 applications when asked in the context of completing learning tasks. Specifically we were interested in which technology acceptance factors most influence students' utilization of Web 2.0 applications as an important first step for educators to design and develop an efficient learning environment (Curry, 1987; Marshall, 1987; Federico, 2000). This study intended to answer the following questions:

- How do students accept different Web 2.0 applications?
- What is the empirical relationship between the usage of Web 2.0 applications and technology acceptance?

In the following sections we provide a brief overview of Web 2.0 applications and the measurement of technology acceptance, method of the study, and preliminary data analysis and results. Then we discuss the implications of our finding and how they inform the design of an efficient Web 2.0-enriched learning environments.

## Web 2.0 Applications for Learning

Web 2.0 is a collective term describing a group of web-based technologies that broaden users' communication capabilities and options (Anderson, 2007). Millions of web users are uploading contents on YouTube, and MySpace daily, which evidences a prominent growth of Web 2.0 applications in recent years (Time magazine, 2007). Timothy O'Reilly (2005), who initially created the term, defines Web 2.0 as an active and open web architecture that values users' participation and contribution. McLoughlin & Lee (2007) suggested that Web 2.0 is more personalized and interactive than the first generation of Web applications (i.e., the web was only used by

web users to retrieve information). Proactive participation, connectivity and collaboration are main features of Web 2.0.

Amongst a variety of Web 2.0 applications, some do bear values in facilitating teaching and learning. For example, blogs are suggested to facilitate the publication of knowledge, reflection, and knowledge construction (Ferdig & Trammell, 2004). Students use them to build community, consolidate resources, share their ideas with their friends, and keep their personal journals (Kerawalla, Minocha, Kirkup, & Conole, 2008). Instant messenger is another tool that enables students to communicate in real time with two or more people based on texted messages (Saeed, Yang, & Sinnappan, 2009), which promotes collaborative learning, facilitates active interaction among team members, and encourages students to learn communication skills (Lu, Zhou, & Wong, 2009). Web 2.0 applications are also considered to be an efficient tool in conducting case studies due to their collaborative nature, which is based on an experiential learning approach (Huang & Behara, 2007). Klamka, Chatti, Duval, Hummel, Hvannberg, Kravcik, Law, Naeve, & Scott (2007) further suggested that Web 2.0 applications have great potential to facilitate and enhance lifelong learning by connecting students in collaborative environments with diminishing boundaries. There is growing evidence that many people are engaged in a wide range of technologies-based informal learning at home and in their community (Selwyn, 2007). Web 2.0 seems to have substantial possibilities for students who have various needs to enhance their learning experiences through enriched interactions (Bryant, 2006; McLoughlin & Lee, 2007). Safran, Helic, & Gutl (2007) emphasized the potential of Web 2.0 applications because they make it possible to uphold critical and analytical thinking, facilitate intuitive and associational thinking, support analogical thinking through easy access to rich information and allow the interaction of various opinions in a learning environment.

In short, Web 2.0 applications have strong possibilities to be utilized in class settings for students' learning. Educators have to consider how to integrate these unique features of Web 2.0 applications to accommodate the different factors influencing their students' technology usage. Understanding the factors influencing the utilization of technology by students is important for designing and developing effective web based learning environments (Lee, Cheung, & Chen, 2005). Therefore, exploring various motivators affecting the usage and acceptance of Web 2.0 applications for college students might provide useful insights for their integration in formal instructional settings.

#### Technology acceptance and Web 2.0 applications

Technology acceptance model (TAM) has been used to measure how users accept particular technologies. It was introduced by Davis (1968) to explain computer usage behavior. Since then, this model has been utilized to understand the acceptance of information technology in extensive empirical research (Venkatesh, Morris, Davis, & Davis, 2003).

The TAM provides a basis for discovering the impact of external variables on internal beliefs, attitudes, and intentions (Marchewka, Liu, & Kostiwa, 2007). The model assumes that beliefs about usefulness and ease of use are always the primary determinants of information technologies adopted in organizations. Davis (1989) explains that these two determinants serve as the foundation for attitudes toward using a particular system, which in turn determines the intention to use, and then generates the actual usage behavior. TAM defines the perceived usefulness as the extent to which a person believes that using a system would enhance his or her performance. On the other hand, perceived ease of use refers to the extent to which a person believes that using a system would be free of mental effort (Davis, 1989). Prior research has implemented TAM in a variety of computer-based environments. Earlier studies have explored TAM's applications in testing user acceptance of information technology, such as word processors (Davis et al., 1989), spreadsheet applications (Mathieson, 1991), e-mail (Szajna, 1996), web browsers (Morris & Dillon, 1997), websites (Koufaris, 2002), and Blackboard. Recently the model has been implemented in studies related to e-learning (Landry, Griffeth & Hartman, 2006; Masrom, 2007; Selim, 2003).

The Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al. 2003), a more recent instrument, has synthesized existing models related to the concept of technology acceptance (Oshlyansky, Cairns, & Thimbleby, 2007). The UTAUT consists of eight constructs: performance expectancy, effort expectancy, social influence, facilitator conditions, self-efficacy, anxiety, behavioral intention to use, and attitude toward using technology, which may collectively influence the usage behavior of the technology.

The UTAUT model has been applied to examine research that is related to academic settings and the workplace. It has been used to evaluate the acceptance of Web 2.0 applications (Huang, Yoo, & Choi, 2008), virtual learning environment (e.g. by Sumak, Polancic, & Heircko, 2010), podcasting (e.g. by Ho, Chou, & O'Neill, 2010), and even microblogging user acceptance by Meyer & Dibbern (2010).

## Method

The study was conducted through an online survey in 2009 in a public Midwestern university in the U.S. targeting seven Web 2.0 applications. Correlation analyses were conducted to address the aforementioned research questions. Some data were deleted because of errors or incompleteness, which resulted in the following datasets for analysis: 110 sets for blogs, 160 for wikis, 88 for instant messengers, 100 for social networking tools, 108 for online video sharing, 169 for online game, and 244 for immersive virtual environments. All data were collected via voluntary participations.

### Measuring Utilization Level of Web 2.0

This research team targeted seven Web 2.0 applications. Blog, wikis, instant messengers, online social networking (eg., Facebook), online video sharing (eg., YouTube), online games, and immersive virtual environment (eg., Second Life) are included in this study. To investigate the utilization level of Web 2.0 applications, the research team created surveys based on selected items from the *Unified Theory of Acceptance and Use of Technology* (UTAUT) (Venkatesh, Morris, Davis, & Davis, 2003) by using a 9-point Likert Scale in the following categories: Performance expectancy, effort expectancy, attitude, social influence, and anxiety. See Table 1 for survey. UTAUT is the synthesis of eight other models (ie., the theory of reasoned action, technology acceptance model, motivational model, theory of planned behavior, model of PC utilization, innovation diffusion model, and the social cognitive theory), which measures a unified technology acceptance rate expressed by individuals or organizations.

Table 1. Acceptance of Web 2.0 applications

Categorization	Questions	Code
Usage of Web 2.0 applications (frequencies and time)	• 1, How often do you use it?	1
	• 2, How much time do you usually spend each time you use it	2
Performance expectancy	• 1, I would find it useful in my learning tasks	3
	• 2, Using it enables me to accomplish tasks more quickly	4
	• 3, Using it increases my productivity	5
Effort expectancy	• 4, Learning to use it is easy for me	6
Attitude toward using Web 2.0 applications	• 5, Using it for learning is a good idea	7
	• 6, It makes learning more interesting	8
	• 7, Learning with it is fun	9
	• 8, I like learning with it	10
Social influence	• 9, People who influence my behavior think that I should use it	11
Anxiety	• 10, I feel apprehensive about using it	12
	• 11, It is somewhat intimidating to me	13

## Data Analysis and Results

### Data Analysis

Based on the research questions, this study used both descriptive and inferential statistics for data analysis. First, the research team used descriptive statistics to report the distribution of the usage of technology and Web 2.0 utilization levels. Then inferential statistics (ie., correlation analysis) was conducted to identify the relationships between participants' usage and Web 2.0 acceptance.

## Participants

The study collected responses from 449 undergraduate students in a public Midwestern university. Of the 110 completed surveys for blogs, 36 of them were completed by males (33 %) and 74 by females (67 %). 39(35.5%) participants were freshmen, 42 (38.1%) sophomores, 21(19.1%) juniors, 4(3.6%) seniors, and 1(0.9%) was a graduate student. For wiki, a total of 160 datasets were analyzed. 46(28.7%) of them were male and 114(71.3%) were female. For instant messenger, 31 of the 88 were male (35.2 %) and 57 were female (64.8 %). 33(37.5%) participants were freshmen, 33 (37.5%) sophomores, 15(17.0%) juniors, 3(3.4%) seniors, and 1(1.1%) was a graduate students. For social networking tools, a total of 100 datasets were analyzed. 32(32.0%) of them were freshmen, 38 (38%) sophomores, 22 (22%) juniors, 4(4%) seniors, and 1(1%) was a graduate students. 36 of 100 participants were male and 64 were female. A total of 108 dataset were analyzed for online video sharing tools. 47(43.5%) students were freshmen, 37(34.2%) sophomores, 17(15.7) juniors, 3(2.7%) seniors, and 2(1.85%) were graduate students. For online game, a total of 160 datasets were analyzed. 65(38.5%) of them were freshmen, 65(38.5%) sophomores, 28(16.6%) juniors, 7(4.14%) seniors, and 2(1.18%) were graduate students. For immersive virtual environment tools, a total of 244 datasets were analyzed. 78(32%) of them were male and 166(68%) were female. 93(38.1%) were freshmen, 95(38.9%) sophomores, 43(17.6%) juniors, 9(3.68%) seniors and 2 (0.8%) were graduate students.

Table 2. Academic Year of Participants

Web 2.0 applications	Frequency (percent %)						
	Blog	Wiki	Instant Messenger	Social Networking	Online Video Sharing	Online Game	Immersive virtual environments
Freshman	39(35.5)	66(41.3)	33(37.5)	32(32.0)	47(43.5)	65(38.5)	93(38.1)
Sophomore	42(38.2)	59(36.9)	33(37.5)	38(38.0)	37(34.3)	65(38.5)	95(38.9)
Junior	21(19.1)	27(16.9)	15(17.0)	22(22.0)	17(15.7)	28(16.6)	43(17.6)
Senior	4(3.6)	6(3.8)	3(3.4)	4(4.0)	3(2.8)	7(4.1)	9(3.7)
Graduate	1(0.9)	1(0.6)	1(1.1)	1(1.0)	2(1.9)	2(1.2)	2(0.8)
Others	3(2.7)	1(0.6)	3(3.4)	3(3.0)	2(1.9)	2(1.2)	2(0.8)
Total	110(100)	160(100)	88(100)	100(100)	108(100)	169	244

Table 3. Academic major of study participants

Web 2.0 applications	Frequency(percent)						
	Blog	Wiki	Instant Messenger	Social Networking	Online Video Sharing	Online Game	Immersive virtual environments
Education	68(61.8)	103(64.4)	54(61.4)	61(61.0)	71(65.7)	109(64.5)	153(62.7)
Business	1(0.9)	1(0.6)	0(0.0)	1(1.0)	1(0.9)	0(0.0)	2(0.8)
Engineering	1(0.9)	2(1.3)	2(2.3)	1(1.0)	0(0.0)	2(1.2)	2(0.8)
Science	10(9.1)	13(8.1)	7(8.0)	6(6.0)	6(0.9)	14(8.3)	21(8.6)
Liberal Arts	21(19.1)	30(18.8)	17(19.3)	22(22.0)	21(19.4)	28(16.6)	43(17.6)
Others	9(8.2)	11(6.9)	8(9.1)	9(9.0)	9(8.3)	16(9.5)	23(9.4)
Total	110	160	88	100	108	169	244

The respondents were also asked to indicate their major. See Table 3 for participants' academic major. A majority of the respondents are majoring in education.

Table 4 Gender of Participants

Web 2.0 applications Gender	Frequency (Percent %)						
	Blog	Wiki	Instant Messenger	Social Networking	Online Video Sharing	Online Game	Immersive virtual environments
Male	36(32.7)	46(28.8)	31(35.2)	36(36.0)	37(34.3)	53(31.4)	78(32.0)
Female	74(67.3)	114(71.3)	57(64.8)	64(64.0)	71(65.7)	116(68.6)	166(68.0)
Total	110	160	88	100	108	169	244

## Descriptive Statistics Analysis

The usage frequency of Web 2.0 applications was identified (see Table 4). When asked in the context of completing formal learning tasks, 138(86.3%) students responded that they have never used a wiki and 126(74.6%) students never used online games, 239(98%) of 244 total participants responded that they have never used a social virtual environment which indicated that social virtual environments are most unfamiliar to students. On the contrary, 31(35.2%) of 88 students responded that they used instant messengers more than 5 times per week. Online social networking sites were also most familiar to participants.

Table 5 Analysis of frequency of Web 2.0 applications per week

Web 2.0 applications	I have never used a tool	Less than once a week	2 ~ 5 times per week	More than 5 times per week	Total
Blog	79	28	2	1	110
Wiki	138	18	2	2	160
Instant messengers	7	25	25	31	88
Online social networking (e.g., Facebook)	7	8	13	72	100
Online video sharing (e.g., YouTube)	39	39	21	9	108
Online games	126	30	6	7	169
Immersive virtual environment (e.g., Second Life)	239	3	0	2	244

Table 6. Analysis of usage time of Web 2.0 applications per week

Web 2.0 applications	Less than 30 min	30-60 min	More than 60 min	Total
Blogs	108	2	0	110
Wiki	155	2	3	160
Instant messengers	45	29	14	88
Online social networking (e.g., Facebook)	42	28	30	100
Online video sharing (e.g., YouTube)	88	15	5	108
Online games	153	6	10	169
Immersive virtual environments (e.g., Second Life)	242	2	0	244

Table 7 shows the utilization level of Web 2.0 for learning on all seven Web 2.0 applications. On average, participants had a higher level of performance expectancy towards online video tools. Participants responded that using instant messengers, social networking, and online video sharing was very easy for them because they felt it unnecessary to put in much effort to use them. The anxiety level associated with using instant messenger and social networking tool are relative low on a 9-point Likert scale. However, participants felt intimidated by Social Virtual Environments.

Table 7. The utilization level of Web 2.0 tools (9-point Likert scale)

Usage frequencies of Web 2.0	Blog	Wiki	Instant messengers	Social networking	Online video sharing	Online games	Immersive virtual communities
Technology acceptance							
Performance	4.30	4.79	4.43	4.93	5.08	4.09	4.54
Effort	4.98	4.88	6.95	7.18	5.63	5.09	4.64
Attitude	4.63	4.80	5.43	5.91	5.85	4.80	4.64
Social influence	4.27	4.65	5.16	5.40	5.30	4.53	4.55
Anxiety	4.85	4.84	3.00	3.02	4.19	4.36	4.97

See Table 8 for significant correlation analysis results between Usage frequency and Web 2.0 utilization levels. Use codes in Table 1 to identify corresponding items in the Web 2.0 utilization level survey. There is a positive correlation between usage frequency of Wiki and performance expectancy, effort, and attitude. Instant messenger, social networking tools, and online video sharing tools were very familiar to participants. There were several positive correlations between usage and performance expectancy, effort expectancy, attitude, and social influence of instant messenger, social networking, and online video sharing. In particular, there was a negative correlation between using online games and performance expectancy. In contrast, there were no correlations between the usage and acceptance of blogs and immersive virtual environments.

Table 8. Correlations between usage frequencies of web 2.0 applications and technology acceptance (Pearson Correlation)

Usage frequencies of Web 2.0	Blog	Wiki	Instant messenger s	Social networkin g	Online video sharing	Online games	Immersive virtual environme nt
Technology acceptance	N=110	N=160	N=88	N=100	N=108	N=169	N=244
Performance	-	.414*	.427*	.252*	.384*	-.251**	-
		*	*		*		
Effort	-	.454*	.517*	.586*	.490*	.304	-
		*	*	*	*	**	
Attitude	-	.365*	.537*	.294**	.460*	-	-
		*	*		*		
Social influence	-	-	.431*	.433*	.368*	-	-
			*	*	*		
Anxiety	-	-	-	-	-	-.397**	-
				.229*	.243*		

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

\* . Correlation is significant at the 0.05 level (2-tailed).

Table 9. Correlations between usage time of web 2.0 applications and technology acceptance (Pearson Correlation)

Usage time of Web 2.0  Technology acceptance	Blog  N=110	Wiki  N=160	Instant messenger  N=88	Social networkin g  N=100	Online video sharing  N=108	Online games  N=169	Immersive virtual communiti es  N=244
Usage frequency	-	-	.667**	.523**	.585* *	.835 **	.926**
Performance	-	.348* *	.327* *	-	.253* *	-	-
Effort	-	.315* *	.357* *	.428* *	.481* *	.295 **	-
Attitude	-	.342* *	.390* *	.206*	.341* *	-	-
Social influence	-	-	.462* *	.434* *	.265* *	-	-
Anxiety	-	-	-	-	- .199*	-.234**	-

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

\* . Correlation is significant at the 0.05 level (2-tailed).

Table 9 shows the correlation between usage time and Web 2.0 applications. Performance expectancy affects the use of Wikis, instant messengers, and online video sharing tools. Students responded that they spent time using wikis, social networking, online video sharing and online game because they were easy to use. In addition, they spent time using instant messenger, social networking tools and online video sharing because they were influenced by their social environment.

## Discussion

In terms of descriptive statistical analysis, it is encouraging to learn that most students found Web 2.0 applications such as instant messengers, social networking, online video sharing, and online game easy to use. Most students were the least intimidated by several Web 2.0 applications in particular because they felt confident in using instant messenger, and social networking tool. Most students reported having a positive attitude towards using instant messenger, social networking, and online video sharing tools. However, blog, wiki, and immersive virtual environments were not familiar to participants. Most students reported the highest anxiety level in participating in blogs, wikis, and immersive virtual environment (eg., Second Life).

Correlation analysis also generated numerous interesting finding. The results suggested that most students' perceived performance expectancy on several Web 2.0 applications were correlated to the usage frequency. In the context of technology utilization motivation, this finding implied that extrinsic incentives (i.e., performance expectancy) seems to dominate the usage behaviors, which is congruent with the findings from other Web 2.0 application studies, which indicated that Web 2.0 users are often driven by factors that are extraneous to the learning process. For example, Oulasvirta, Lehtonen, Kurvinen, & Raento (2009) suggested that motivation that drives blog users' participation and contribution is mainly extrinsic (e.g., curious about others' life, being acknowledged offline for efforts). Janzik and Herstatt (2008) identified that the combination of material and immaterial incentives (i.e., extrinsic motives) is likely to outweigh the intrinsic incentives.

Although the findings suggested that students were very open towards using wiki, instant messenger, social networking tools, and online video sharing tools for learning, most students thought that using online games might affect their performance. The Digital Divide Model (Cooper, 2006, p.331) could explain this finding. The model postulates that the ongoing existence of gender difference when it comes to the utilization of computers and the Internet technology is the result of gender stereotypes. In this study since most of our participants were females,



their perceptions towards Web 2.0 applications might be influenced by such stereotypes that are so deeply rooted in their prior formal schooling experiences. Hence applications with more social support (e.g., social networking tools) are more popular than online games that are often masculine for our participants.

### Conclusion

Given the small sample size it is inadequate to generalize our findings to different instructional settings. The preliminary results, however, offer potential research directions for us to continuously improve the study in the future. First, the selection process may be the direct result of students' instructional preferences (e.g., collaborating learning activities, and individual learning activities) or the indirect consequences of available instructional resources and infrastructures. Future research needs to take both factors into consideration. Second, future studies should cultivate relationship between Web 2.0 application features and induced motivational support to create a customizable Web 2.0 learning environment design guideline in order to address different learning needs. Finally it is necessary to conduct in-depth task analysis for all seven Web 2.0 applications and align them with intended learning outcomes. As a result we will be able to optimize learners' performance in Web 2.0-enriched learning environments.

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# **Sustaining User Traffic in Open Course Ware Systems: A Case Study on the Open Knowledge Portal of Samsung Economic Research Institute**

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## **Abstract**

Open Educational Resource (OER) movement has reached its tipping point in recent years due to advancement of information and communication technologies (ICT). Among various projects, the OpenCourseWare (OCW) of MIT has inspired higher education institutions around the world to deploy OCW systems. The financial sustainability of OCW, however, has become questionable amid the economic recession. To adopt any revenue-generating models, the OCW must engage users to generate substantial user traffic. Hence, this case study, grounded in motivational theories of multimedia learning, analyzed the open knowledge portal of Samsung Economic Research Institute (seri.org), to identify features that motivate users' continuous participations. The results include three recommendations to improve the design of OCW systems to better motivate and engage users.

Keywords: Open Educational Resource, Open Course Ware

## **Introduction**

Due to advancing information and communication technologies, opportunities for open learning have become pervasive via web-based open learning systems. This phenomenon exemplifies the Open Educational Resources (OER) movement in that quality educational resources become highly accessible to general public on the collaborative Internet. Among numerous projects that advance the OER movement, the OpenCourseWare initiative of MIT (2001) has started a trend in higher education institutions around the world, to make their course materials available on the Internet for everyone (Caswell, Henson, Jensen, & Wiley, 2008). Despite OCW's popularity among general users and faculty and students in higher education in recent years, some, however, are concerned about the sustainability of open courseware systems. Issues such as the management of intellectual property, operational models of the technology, organizational and societal readiness for open knowledge sharing, and availability of infrastructure all play parts in sustaining OCW operations (Harley, 2008; Kumar, 2009; Schuwer & Mulder, 2009). A particularly pressing issue that could immediately impact the sustainability of OCW is its financial susceptibility. In the face of systemic economic downturn, institutions simply can no longer afford the operational cost of OCW (Harley, 2008; Parry, 2009). In reviewing a variety of financial models that OCW operations have adopted (Downes, 2007) and current dire financial situations of higher education institutions, relying on external sponsorship to support OCW's operational cost might be a relatively viable option in this economically challenging time.

Similar to any other online content generation operations that depend on external sponsorships (e.g., Time.com, The Wall Street Journal Online), OCW needs to rely on user participations to generate revenues. That is, the user traffic of OCW systems must reach a large volume in order to attract external sponsorships (Rappa, 2010). Among reasons that prevent OCW from gaining a high level of user traffic, users' lack of motivation to use the system was suggested to be an issue (Casserly & Smith, 2008; Harley, 2008; Simpson, 2008). To improve OCW's ability to motivate and engage users in the online open learning environment, this conjectural case study intends to analyze *Samsung Economic Research Institute (SERI)*'s open business knowledge portal (<http://www.seri.org>) with emphasis on how SERI.org sustains its user traffic via purposefully designed features that motivate and engage users. The objective of the case study is to inform OCW operations in higher education with feasible design strategies that could attract and retain a substantial level of user traffic thus enables the implementation of sustainable revenue-generating models.

## **Literature Survey**

### **Open Higher Education**

The concept of open education, for individual learners, was emerged in the early 20<sup>th</sup> century to advocate the openness of instructional climate thus promotes shared responsibility and freedom of self-expression among young learners (Peters & Britez, 2008, p.7; Walberg & Thomas, 1972). From the institutional viewpoint, open education consists of two levels of meaning. First, it represents the early era of distance education in higher education. For instance, The University of London External Study system opened its door to a wide range of people in 1836. What distinguished it from the Oxford University was its lack of residence requirement. Students of

University of London were able to conduct their academic assignments in remote locations and that was convenient for many UK citizens who were living on their colonies overseas. Today the Open University of UK continues to provide the same educational opportunities for people around the world (Tait, 2008). The second level of open education not only represents the “distance” factor of the teaching and learning process, but it also carries the mission of higher education beyond disciplinary and institutional boundaries. That is, open education should exemplify the philosophy of making educational materials readily available for the public good (Lane, 2008). With this level of open education, individuals can autonomously plan and execute their own educational processes from anywhere at anytime without any financial liabilities. This open learning approach further provides unlimited opportunities for informal and lifelong learning that benefit continuous professional development and global workforce development (Casserly & Smith, 2008; Huijser, Bedford, & Bull, 2008). Hence, many were inspired to share educational contents on the Internet and joined force with the Open Educational Resource movement.

### **Open Educational Resource Movement**

The open educational resource (OER) movement was originated from the field of software development because some believe firmly that to facilitate the development of software applications, original programming codes should be shared with the community of developers. In the past decade, issues such as sharing mechanism, content licensing, and technological infrastructure in software development have been tackled with moderate success. Apple Computer’s Application Store (<http://www.apple.com/iphone/apps-for-iphone/>), for instance, is the result of sharing original programming codes with software developers around the world, which has generated thousands of application software for Apple products.

In the meantime, the OER movement has expanded to numerous multidisciplinary collaborations for educational purposes. Practitioners and scholars from software engineering, information and communication technology, law, and policy studies have contributed greatly to advance the movement (Wiley & Gurrell, 2009). UNESCO (2002) captured the timely essence of OER by defining it as “open provision of educational resources enabled by information and communication technologies, for consultation, use, and adaptation by a community of users for non-commercial purposes.” The goal of OER movement is to level the access to knowledge via high quality and free online content for everyone in the world (UNESCO, 2009). Hylén (2005) further categorized OER into the following initiatives:

- Open courseware and content
- Open software tools
- Open material for faculty of e-learning
- Repositories of learning objects
- Free educational courses

Among these OER initiatives, open courseware has the closest tie with higher education institutions since it requires financial support from administrators and content sharing from the faculty. The OpenCourseWare (OCW) of Massachusetts Institute of Technology (MIT) is considered one of the pioneers who systematically share course materials online for free.

### **The OCW of MIT**

Conceived in 1999, as part of the institutional effort to advance MIT’s educational technology capacity, the Institute decided to publish its course materials freely and openly on the Internet for everyone to use. This innovative initiative went online in 2002 and is now known as the OpenCourseWare (OCW) (Abelson, 2008). Currently the site hosts 1,900 courses and as of October 2009, the site has 86.8 million visits from users around the world (46% of overseas traffic). Among those users, 48% identified themselves as self-learners; 32% as educators; and 17% as students. The 2009 Program Evaluation of OCW (MIT, 2009) reported that at least 89% of its visitors were satisfied with the breath, depth, overall quality, and currency of the course materials.

The launch and success of MIT OCW consequently encouraged other higher education institutions around the world to establish similar open knowledge portals. To maximize the efficiency of this inter-institutional collaboration, the OCW Consortium was created in 2005 and articulated the definition of OCW as, “a free and open digital publication of high quality educational materials, organized as courses.” (Carson, 2009). To date the OCW Consortium has 174 university members and 44 organization members from 37 countries (OCW Consortium, 2010).

### **Challenges to Sustain OCW**

OCW has generated a significant level of interest in higher education as a practice to realize the knowledge-sharing mission of universities. Such innovative institutional initiative, however, often presents new challenges on many fronts. In the OCW Project of the United Nation University (UNU), for example, content organization within the portal emerged as an issue in the early stage of the project, which has direct impact on the

developmental cost. In terms of sources of contents, providing incentives for faculty members to participate turned out to be one major obstacle to overcome by the administration. During the development process, it was crucial for UNU to configure a standardized procedure to streamline the process while maintaining the quality of the course content (Barrett, Grover, Janowski, Lavieren, Schmidt, & Ojo, 2009).

Financial concern is another major challenge for institutions to uphold OCW operations. In 2007, MIT reported a steady-state annual cost of \$4M to operate its OCW portal with 50% of which relying on external funding. But it is uncertain if the external funding would be allocated to OCW operations in the future (Abelson, 2008). Downes (2007) discussed several financial models for higher education institutions to sustain OCW projects. The majority of them, however, are only feasible when the economy is sound. For example, the Donation Model, Institutional Model, and Governmental Model, to a large extent, all depend on the goodwill of the society and communities to provide financial support. Unfortunately the funding disappears when the economy comes to a recession (Harley, 2008). The Sponsorship Model, on the other hand, could be a viable option for OCW projects to embrace in this challenging time for several reasons. First, this model has been proven effective to financially sustain similar open content operations via radio or television programming. Sponsors (or advertisers) would pay fees to post messages to promote new products or services during the program. Second, the source of funding is no longer associated with institutional and governmental resources that are continuously shrinking and are vulnerable to systemic economic risks (e.g., low employment rate). Instead, the financial support is directly from businesses and enterprises that utilize the Internet for marketing purposes. In 2009, the overall spending of online sponsorship in the U.S. was estimated as more than \$25B with the annual growth rate of at least 10% till 2013 (Shankland, 2008). The *Stanford on iTunes* project is an example of the Sponsorship Model in practice, which connects open content users with the iTunes application of Apple (Downes, 2007, p.35). Certain conditions, however, must be met in order for the Sponsorship Model to be successful.

One critical condition for the Sponsorship Model to be viable is having substantial number of user visits within a limited time period (i.e., user traffic), which demonstrates the open knowledge portal's impact level to potential sponsors (Rappa, 2010). In terms of factors affecting OCW usage and financial sustainability, it was suggested that the lack of understanding on OCW users might increase the operational cost of OCW systems. Hence it is crucial to know who the users are, why they use OCW, and how they are using OCW (Harley, 2008). Casserly & Smith (2008) further suggested that OCW users' intention in contributing and sharing the content might play a role in sustaining OCW operations. In terms of users motivation, Simpson (2008) argued that it is important to provide proactive motivational support to users of open learning systems since they might be less engaged in the learning processes. Therefore to motivate individual users in OCW, from the viewpoint of instructional system design, the interaction between OCW content and users in the open learning environments should be purposefully designed just as designing any other online learning environments. OCW's motivational support to engage users and its potential effect on users' cognitive load both need to be taken into design considerations.

### **Motivational Support and Cognitive Load of Using OCW**

The design of OCW should consider users' motivational level in order to effectively engage them. Situated in a workplace setting, Davis, Bagozzi, & Warshaw (1992) validated the relationship between intrinsic motivation, extrinsic motivation, and the usage of computer-based technology. In their study the perceived usefulness contributes to users' extrinsic motives and the enjoyment of usage accounts for the intrinsic motives. ChanLin (2009) applied the ARCS model for motivational design (Keller, 1987) in designing a web-based course and concluded that motivational design in online environments is as effective and necessary as applied in face-to-face settings. Astleitner & Wiesner (2004) asserted that only considering intrinsic motivational factors of Malone and Lepper (1987)(e.g., challenge, curiosity, rules, fantasy) is insufficient to explain the motivational outcome of the interactive and self-regulated learning process in multimedia computer-based learning. Motivational processing that illustrates the dynamic relationship between users' perceived motivation and the intended content information must also be included in the design. Furthermore, users' cognitive load also needs to be included when designing the interaction between users and the open content, to ensure that users do not get overwhelmed by the demand of cognitive processing (Ang, Zaphiris, & Mahmood, 2007; Sweller, van Merriënboer, & Paas, 1998; Warschauer, 2007), which could deter users' future visits. Therefore the design of OCW should engage users cognitively via a variety of strategies. To achieve the abovementioned design objectives, the theory of Motivation, Volition, and Performance could be utilized to guide the design process in that it integrates intrinsic motivation and cognitive information processing to explain the iterative process of motivation development in relation to learners' final learning outcome and performance (Keller, 2008).

### **Integrative theory of Motivation, Volition, and Performance**

The integrative theory of motivation, volition, and performance (MVP) argues that a complete motivational learning cycle is consisted of several stages to encompass learners' motivational, cognitive, and outcome processing (Keller, 2008, p.94). The motivational processing helps learners set up initial performance goals that are critical for sustainable learning processes. Learners at first should have sufficient level of curiosity to explore the learning task (attention); then understand the value of the learning task (relevance), and evaluate the possibility of attaining successful performance (confidence), to identify and confirm the performance goal. These processes, in turn, prepare learners for the follow-up actions of learning.

Another aspect of MVP theory focuses on learners' cognitive information processing. At the effect of motivational processing learners actively apply meta-cognitive strategies to carry out learning activities to help them create and automate transferrable mental models. The cognitive processing capacity, however, is limited by learners' working memory. The result of cognitive processing hence feeds into the outcome processing stage, which allows learners to evaluate the discrepancy between the performance consequence and their invested efforts. Learners reflect upon all previous stages' experiences emotionally and cognitively, and develop a collective sense of satisfaction towards the learning process.

In the context of designing motivational and engaging OCW systems, the implication of the MVP theory is threefold. First, since motivational processing is crucial at the early stage of the learning process, the design must be cautious to neither overwhelm users' processing capacity nor distract them with competing stimuli. Second, users' cognitive processing activities could play a substantial role in sustaining their iterative motivation. Users overloaded with cognitive stimuli, regardless of their initial motivational processing results, are still vulnerable to be unmotivated by exhausting cognitive information processing tasks. Third, the result of outcome processing could impact the engagement of OCW systems. Unsatisfied users usually do not come back to use the same system since they do not perceive the process worthwhile, which in turn, will decrease the overall user traffic to the OCW site.

#### **Purpose of the Study**

To inform the design of OCW systems, this study employs conjectural analysis to align features of existing open knowledge portals with design strategies suggested by the theory of MVP. Prior studies have utilized similar analysis approach to develop feasible design strategies for complex multimedia learning environments (Dickey, 2007; Kebritchi & Hirumi, 2008). The present study, applying the same conjectural analysis approach, discusses features of Samsung Economic Research Institute's (SERI) online knowledge portal in relation to the MVP theory. The purpose of this study is to identify applicable design strategies in open knowledge portals to motivate and engage users. It is our hope that by incorporating motivation-inducing design strategies, OCW systems are able to generate a substantial volume of user traffic, hence, will make certain financial models viable to sustain the OCW operation.

### **The Case Study**

#### **Samsung Economics Research Institute (SERI)**

Samsung Economic Research Institute (SERI) was established in 1986 by Samsung Group, the largest conglomerate in South Korea, to serve as a think tank for the country's economic policy development. Its mission is to make the society a knowledge powerhouse by creating a dynamic mass of knowledge objects (SERI World, 2009). Currently the Institute generates \$100M of revenue per year by providing human resource management and business strategy consultations and knowledge generation services to its paying clients. The characteristics of SERI's knowledge objects are described as timely, easy to comprehend, relevant to societal issues, user-centered, highly interactive with general public, and influential to governmental policy development. The critiques of SERI, however, argued that its knowledge objects tend to focus on non-serious issues and the content does not provoke in-depth debates and discussions (Chung, 2009)

#### **SERI's Open Knowledge Portal**

SERI launched its open knowledge portal (<http://www.SERI.org>) in 1996 in Korean and it has been ranked as the top "knowledge ecosystem" in South Korea. SERI.org currently has 1.68M of registered members and hosts 2.5M knowledge objects in texts, narrated presentations, video clips, and user-contributed content. The membership is open to everyone for free. Premium content is also available for a fee. Among these knowledge objects, 10% of them are produced by SERI staff; while the rest of them are contributed by SERI.org members in derivative forms. The content covers subjects from business strategies to daily problem-solving job aids for working adults (SERI, 2010).

## SERI World: The Asian Corridor

In recognizing Samsung Group's close business relationship with its international partners, SERI launched *SERI World* in 2004 to serve a wider audience around the world. The content on SERI World has the same origin of SERI.org but it is all written in English. In early 2009, after five years of operation, SERI World has acquired 55,000 members worldwide including nearly 20% who are non-Korean nationals (Han, 2009). SERI World covers international economics, management, industries, and political issues in various media formats (HTML pages, PDF, video reports).

## Design of SERI.ORG

Upon reviewing the design of SERI.org, we have identified several features that are absent in existing OCW systems (e.g. MIT, Yale University, John Hopkins University, Kyoto University). The following section will describe each feature in detail.

Open membership. Users can register for the SERI.org membership for free. The process is as simple as if you are setting up a social media account (e.g., the Facebook). See Figure 1 for the screenshot of SERI.org. Figure 2 shows the interface for SERI World. Members' account management page is shown in Figure 3. The interface design of SERI.org, as you can see from the screenshot, is fairly easy to navigate, as the content topics are not all cluttered in one column. The page also uses vivid color contrast arrangement to help users better locate the links. The graphic on the home page might also trigger users' curiosity and intentions to explore further. On the SERI World home page, users also can easily locate the Top 5 accessed knowledge objects on the top-right corner of the page. On the member's account page, the features enable users to self-monitor and manage their learning activities in SERI.org, which is essential to support users' intrinsic motivation (Malone & Lepper, 1987).



Figure 1. SERI.org home page





Figure 2. SERI World home page

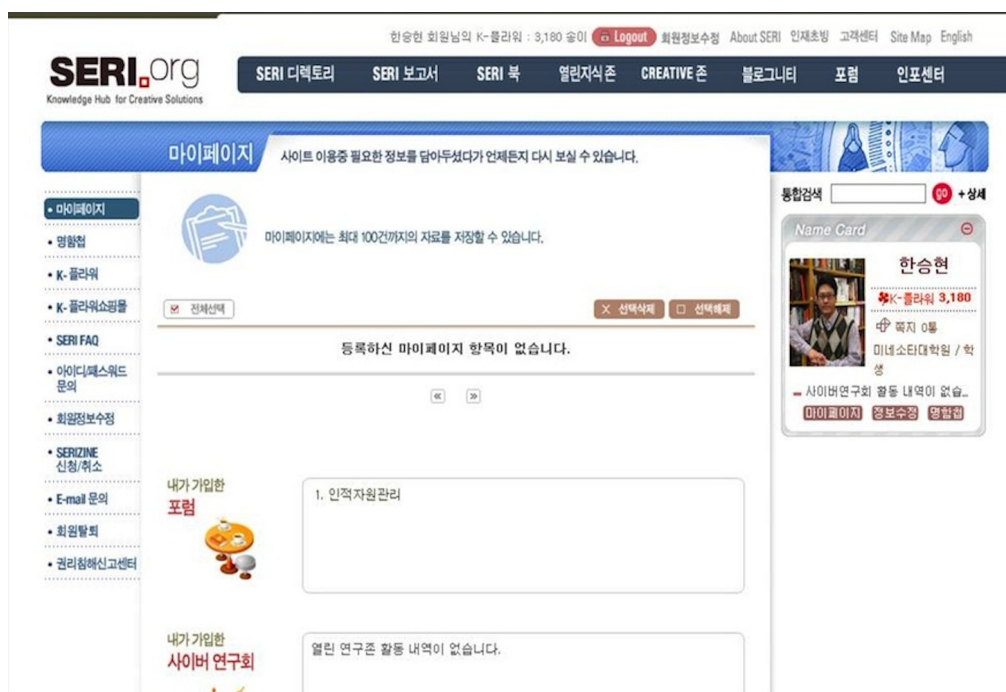


Figure 3. The My Account page

**Supporting cognitively efficient learning processes.** When delivering content, SERI.org repackages original research reports into a variety of formats. One unique approach that SERI.org takes is to condense lengthy reports into a short multimedia video clip that is directly streamed from SERI.org to user computers. This delivery method can effectively manage the cognitive load imposed on users since the video clip is purposefully designed to

have approximately five minutes in length. Furthermore, it enables users to access otherwise arcane and dull research reports by presenting the knowledge in the context that is convenient and relevant to users. If users are interested in learning more about the topic presented in the video clip, they can further retrieve the original research studies on SERI.org. Finally, users get to rate the overall quality of the video knowledge object using a rating system, which encourages users to reflect on the video viewing experiences. Figure 4 shows the five-minute video object example with rating system.



Figure 4. The 5-minute video object example

**Web 2.0 features to engage users.** SERI.org takes the advantage of Web 2.0 technologies to engage users. Users can follow certain bloggers within the SERI.org community. They also can leave comments in response to blog postings. This feature exemplifies the concept of Web 2.0 in that every user can contribute to the content collectively and new ideas might be derived from such collaborations (Anderson, 2007; O'Reilly, 2005). Figure 5 is the blog page. See Figure 6 for the user commenting function in SERI World.

In addition, similar to applications of social bookmarking systems (e.g. delicious.com), users of SERI.org can categorize the content of blogs with tags. The tagging process may facilitate learning because (1) it prompts users to reflectively summarize ideas based on his or her existing knowledge base, (2) it enhances peer interaction by allowing users to compare his or her tags with peer users, and (3) it helps users to locate relevant content by clicking on the tags (Fu & Kannampallil, in press). This feature not only enables users to retrieve content more efficiently, but also it allows users to share different perspectives on the same knowledge object. From a cognitive learning perspective, the tagging function could reduce the demand of cognitive processing for users as they can easily connect to peer users' mental models via tags (Siemens, 2005).



Figure 5. Blogs in SERI.org

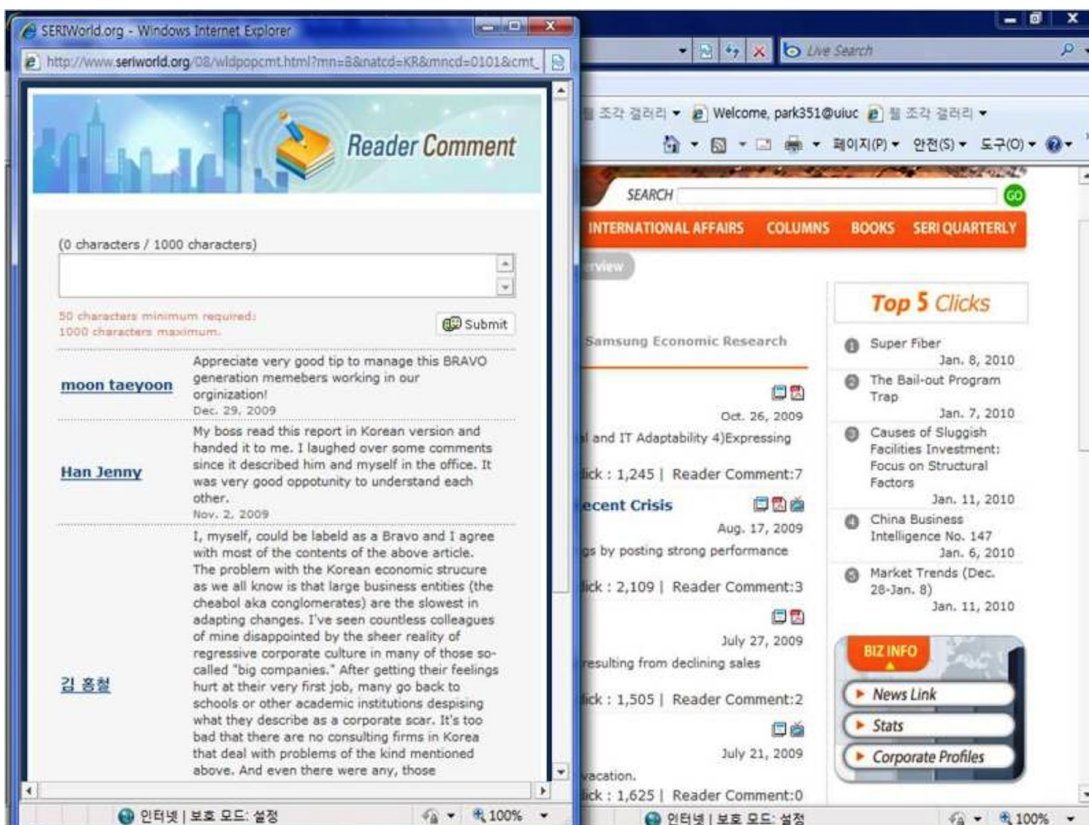


Figure 6. User comments

**Incentivizing user participation.** SERI.org uses two strategies to encourage user participations. First, users receive *Flower Points* for their participations in ongoing online postings or discussions. Different flower points are awarded to users based on different types of participations in contributions to different knowledge objects. There are two categories for users to receive flower points. In the first category users automatically receive the appreciative flower points by simply participating in the online forums. In the second category users can receive additional flower points based on the quality of their contributions to the online spaces. The SERI staff is responsible of evaluating and awarding those value-based flower points. Table 1 shows different levels of flower point awards according to contributions to different knowledge objects and activities. Once users accumulate enough flower points, they can use the points to unlock otherwise unavailable knowledge objects. For example, users can “purchase” books published by SERI with at least 200 flower points. (See Table 2) Figure 7 shows the flower point on one user’s account. Moreover, SERI.org recently launched another feature to show the ranking of members’ overall flower points. The interface was designed to mimic the trading chart of stock markets. (See Figure 8) The second strategy is that SERI.org hosts the Most Frequent Knowledge User contest every month to recognize users’ participations. The winners are introduced to all SERI.org members. See Figure 9 for a previous winner of the contest.



Table 1  
*Flower Point Awards Based on Different Levels of Contribution*

Where Menu	Flower Points to Appreciate Participation		Flower Points for the Value of Contribution **	
	Open Knowledge Zone	Cyber Forum	Open Knowledge Zone	Cyber Forum
Research Proposal	Posting (100)	Posting *M (50)+, F (100)	(1~500)	M (1~500)+ F (1~500)
Issue Debate	Posting (50)	Posting M (30) +, F (50)	(1~300)	M (1~300)+ F (1~300)
Open Research Lab	Posting (100)	Posting M (100)+, F (200)	(1~300)	M (1~300)+ F (1~300)
Cyber Research Group	Applying for starting a group (100)	Applying for starting a group M (100)+, F (200)	(1~500)	M (1~500)+ F (1~500)
	Opening the group (200)	Opening the group M (50)+, F (100)		
	Participating as a researcher of the group (30)	Participating as a researcher of the group M (30)+, F (50)		
Knowledge Expert	Posting (10)	Posting M (10)+, F (20)	(1~500)	M (1~500)+ F (1~500)
Benchmarking	Posting (100)	Posting F (200)	(1~500)	-
Survey Center	Responding to a research survey (50)	-	-	-
	Answering to an online poll (5)			
Best Forum Contents	-	-	-	M (50)+, F (100)
Updating personal information	(50)	-	-	-
Log-in to Seri.org (daily)		(100)		
Creative idea	Posting (100)	-	(300)	-
Business Model Proposal	Posting (100)	-	(300)	-
Acrostic Poem	Writing a poem (30)	-	(300)	-
Mensa Quiz	Trying (100)	-	-	-
	Solving (300)			

\*M: Member, F: Forum

\*\*The SERI staff evaluates the quality of the contribution and then rewards flower point.

Table 2  
Flower Points Needed for Advanced Knowledge Objects

Knowledge Objects	Flower Points Needed
Video clips	50 (Users have 24 hrs to view the clip.)
Books published by SERI	200 ~ 400 per book
SERI CEO annual membership (excluding offline service such as breakfast meetings)	1,000,000
SERI Spark annual membership (a paid website for young employees)	300,000



Figure 7. The Flower Point system

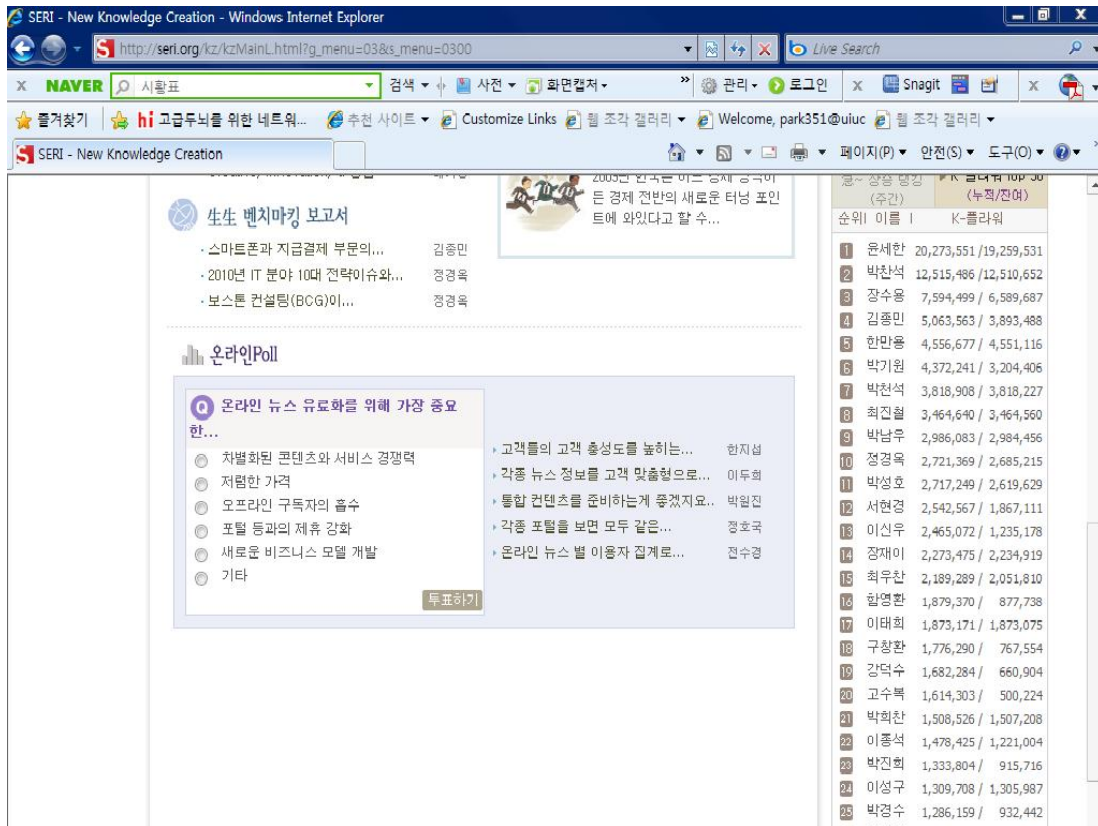


Figure 8. The Flower Points ranking



Figure 9. The Most Frequent Knowledge User of the month

## Discussion

What distinguish SERI.org from other open knowledge portals are its abilities to engage and motivate users to continuously visit the site, which would be the key element for OCW to sustain its operations with the Sponsorship Model. The following sections will discuss features of SERI.org in the context of learner motivation, efficient cognitive learning, and the MVP theory.

### Motivation to Learn, Participate, and Contribute

Goal-directed behaviors are often stimulated and maintained by the process known as motivation (Schunk, 1990), which is the essential element to initiate and sustain learning and performance. Multimedia computer-based learning environments therefore need to be designed with care to provide adequate level of motivational support (Ames, 1992; Anderman & Maehr, 1994; Bandura, 1997; Berliner & Gage, 1998; ChanLin, 2009; Sachs, 2001; Sankaran & Bui, 2001; Weiner, 1985). More importantly, one must consider features that not only attract users in the beginning, but also engage users to keep using the system for as often as they possibly can. That is, the design of the system should prompt users' frequent visits. Users' motivation to use the system needs to go beyond one single visit. The design must be able to sustain users' motivation between visits. This issue is particularly critical in OCW systems because the time gap between users' visits could be substantial. In the theory of MVP, that is why the result of outcome processing is so critical since it helps learners determine if the learning task is worth the effort thus leads to the continuation or termination of the follow-up learning tasks. A favorable outcome processing result would motivate users to continue on with the learning process using the same OCW system. To sustain this self-regulated learning processes in multimedia learning environments, the design of learning environments must consider both learners' intrinsic and extrinsic motivation (Astleitner, & Wiesner, 2004; Davis, et al., 1992).

In terms of intrinsic motivation, to achieve the optimal level, the design of learning environments should utilize elements of challenge, control, rules, and fantasy (Malone & Lepper, 1987). The design of SERI.org might have appropriate support for developing intrinsic motivation as it always adds new content to challenge users, allows users to pace themselves in going through self-selected knowledge objects, and provides clear rules in participating in the open knowledge portal. The element of fantasy, however, is lacking in its current design.

With regards to extrinsic motivation, the design of SERI.org has outperformed existing similar operations (e.g., OCW of MIT). In particular the Flower Point system of SERI.org has played a significant role in enhancing extrinsic motivation. Users of SERI.org not only receive flower points from all their activities on the site, but also they can exchange the flower points with tangible rewards (e.g., books by SERI). In the context of learning, extrinsic motivation drives learners' behaviors to attain rewards or avoid punishments that are external to learning processes (Keller, 1983). Therefore the flower points of SERI.org, to a large extent, might initially encourage user participations in different activities. More importantly, the flower points engage users with external rewards thus make them keep coming back for more. In the context of MVP theory, the Flower Point system feature might induce positive results of the outcome processing by providing tangible extrinsic rewards that are attached to all users' participation and contribution activities. Hence, users are more likely to revisit SERI.org for their future self-learning tasks. The product of such engagement could be easily translated into traffic-driven financial models, to sustain OCW operations in higher education institution.

### Cognitively Efficient Design of Knowledge Objects

As suggested by Cobb (1997), a cognitively efficient process needs to utilize multimedia to help learners process extraneous information. This position was further supported by principles of multimedia learning proposed by Mayer (2001). The short video clips of SERI.org exemplify these design principles for cognitively efficient learning processes because they are able to deliver otherwise complex and dull content with multimedia presentations that are easy for users to process and apply. With approximately five minutes per video clip, users are able to explore numerous topics within limited amount of time without overloading their cognitive processing capacity.

The other feature that supports the efficient cognitive learning process is the tagging function of SERI.org blogs. The blog content is usually stemmed from SERI's research publications, which puts the research finding in a context that readers can relate to. By allowing the tagging function on the blogs, not only can users search for the content easily, but also they can see how others might interpret the content with different tags thus promoting reflective learning (Fu & Kannampallil, in press).

In the context of MVP theory, since cognitive processing is between learners' motivational processing and outcome processing, its role in sustaining desired learning processes is crucial. A taxing cognitive processing could discount the positive result of motivational processing thus leads to unfavorable outcome processing results. The short video clips and tagging features could substantially reduce the cognitive load of learning in SERI.org.



Accordingly learners are less likely to feel overwhelmed by conglomerates of knowledge objects available on the open portal, hence enables efficient and sustainable learning processes.

### **Conclusions and Recommendations**

In light of user motivation's role in impacting OCW systems' financial sustainability, this study was set out to identify feasible design strategies that could promote user motivation in similar open knowledge portal settings. Grounded in the theory of MVP, the case study on SERI.org has reached three recommendations for a sustainable OCW system design. First, the design must utilize the power of extrinsic rewards to engage users. The OCW system must cultivate users' responses to extrinsic incentives to sustain their continuous usage of the same OCW system. The Flower Points system of SERI.org is a great example of using extrinsic rewards to engage users. Second, the design of OCW should include Web 2.0 technologies to support the interactive social learning process. Tools such as blogs, wikis, social networking tools, and user-moderating forums can easily provide opportunities for users to initiate and participate in organic social collaborations. Web 2.0 technologies further enable OCW users to create communities of practice based on common interests thus sustain the network of informal and lifelong learning (Carson, 2009). Finally, with the multimedia capacities of the Internet-based applications, the design must consider learners' limited cognitive information processing capacities. That is, the learning process induced by the open content should not overwhelm learners cognitive load. That is, the content should be easy to search, locate, retrieve, and retain. Furthermore, multimedia elements and social interactions need to be implemented based on proven design principles in multimedia learning environments.

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# **Reading Engagement: A Comparison Between E-books and Traditional Print Books in an Elementary Classroom**

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## **Abstract.**

E-books are gaining popularity for personal reading. Options for access to large selection of book titles and anytime/anywhere reading choices add to the increased use of e-books. For this study, students received satisfaction surveys on four separate reading sessions-- one print-based and three e-book titles. Indicators of reading engagement include motivation for independent reading, dialog with other students about reading materials, fluency, and comprehension as measured by a standardized tests on the print book and all three e-books. Results showed format is not as important as students' identification with setting, characters, and theme of the book, however, students indicated a preference for e-books when given the option of a wide selection of titles and the freedom to choose their own e-book.

A number of characteristics factor into the broader construct of reading engagement in elementary-aged children. Reading engagement is comprised of factors such as reading motivation (Clarke, Power, Hoffman, Kelleher, & Novak; 2003), home environment (Arzubiaga, Rueda, & Monzo, 2002), independent reading, and reading achievement (Wigfield, Guthrie, Perencevich, Taboada, Klauda, Mcrae, and Barbosa; 2008). Reading engagement is multidimensional and is influenced by a number of factors including cognitive and emotional engagement. Children who use sophisticated strategies and enjoy literacy activities are considered to be engaged readers (Wigfield, et. al., 2008). Consistently engaged readers actively seek appropriate books and become excited about learning new material (Lutz, Guthrie, & Davis, 2006). Marinak and Gambrell (2008) also found that children are motivated to read and remain engaged in reading when rewarded with the opportunity to choose their own books. Arzubiaga, et. al., (2002) found context within literacy activities to be an important factor and is crucial to reading engagement and literacy development. They discovered that the culture of the school, classroom, intervention programs, and home will all influence a child's reading achievement. The reading material that is available in the home and in the classroom will have a determining role in children's long-term reading engagement. The materials that parents decide to keep in their home (Arzubiaga, et. al., 2002) or the material that teachers elect for the classroom (Flowerday, Shaw, & Stevens; 2004) are crucial in shaping the literacy development of children. Children are more likely to become engaged in reading if they have greater access to books through home, school, or public libraries and are able to witness engaged reading by adults (Jewell, Phelps, & Kuhn, 1998). Teachers can support children's reading engagement if they provide ample opportunities for independent reading. Opportunities for independent reading will build fluency and allow children to increase their level of confidence (Kasten & Wilfong, 2007). Support for independent reading is crucial for the reading success of children with limited English proficiency (McGlinn & Parrish, 2002). Flowerday, et. al., (2004) also found that children's reading engagement is positively affected if there is high-interest material available for children even when children are not afforded the opportunity to self select their reading material.

All of these findings indicate that the material available to children will play a determining factor in how engaged children are in reading. With the influx of computers and other forms of technologies in the classroom in conjunction with programs such as Accelerated Reader™, the classroom culture is becoming enhanced through the use of digital resources (McGlinn & Parrish, 2002). Children are now being acclimated to technology in their classrooms beginning with preschool and achieving through adulthood. These technologies facilitate deep learning and critical thinking skills in children. Critical thinking with the use of the new technologies supports constructive peer collaboration and self-assessment in each learner (Hyun, 2004). This new classroom culture will ultimately play a role in children's literacy development. Therefore, computers and other technology are likely to shape the way that children will ultimately view literacy (Mioduser, Tur-Kaspa, & Leitner, 2000).

This is all taking place in the midst of a major shift in the publishing industry as many book sellers are beginning to actively promote e-books and e-book readers as a less expensive and more efficient method to read. Amazon.com introduced the Kindle in November of 2007. This device allows readers to download books, magazines, and newspapers in less than one minute (Binder, 2008). Amazon has more than two hundred thousand titles available for download. The cost of the Kindle continues to drop (Sangani, 2009). Many current bestsellers are available for at significantly reduced cost (Binder, 2008) and more than a million out-of-copyright books available completely free of charge (Lardinois, 2009). Not to be outdone, Apple and Sony have both introduced e-readers to compete with the Kindle. Apple offers the iPod, and Sony offers the PRS300 at a lower cost than the Kindle (Bairstow, 2009). Like the Kindle, these devices will enable readers to download and read PDF files and have Broad Band access (Binder, 2008).

Electronic books are available through two main sources; online websites and personal electronic devices. The importance of such devices cannot be underestimated. There are several factors influencing the transition from print to electronic format. First, authors are beginning to realize that electronic publishing gives them complete control over their artistic creations and will allow publication of their own material in the absence of an established book publisher by making books available on personal websites and charging patrons a fee to download the books to their e-reader devices. This enables them to retain 100% of the profits instead of the ten to fifteen percent that they usually earn by publishing through a book publisher (Sangani, 2009). There are even rumblings about publishing sites comparable to social networking sites such as YouTube.com where writers can share their books with a community of writers (Sangani, 2009). The increasing number of e-reading devices and the authors' embracing of e-books would indicate that the technology is more than a passing fad. Economic downturns in our society and increased use of personal computing devices have caused some lessening of the tight control of many major publishers (Kaufman, 2010).

E-readers have yet to forge their way into America's classrooms; however children are being exposed to electronic media in a variety of ways during the school day. A growing number of online resources are available for classroom use (Brown & Hill, 2009). Currently the selection of titles is somewhat limited however there are many benefits in the use of e-books available through well known publishers. One such example is Scholastic, Inc. Access through subscription makes it possible for elementary children to view popular fiction books presented through dynamic multimedia websites. Each fiction book is aligned with a nonfiction content area book that provides that provides meaningful context for the animated stories. These books are available online at Scholastic.com. Additionally, there are a number of free websites that provide well-known fiction and picture books for viewing and reading. For example, the Screen Actors Guild Foundation has developed a website with well-known movie and television artist. These "read-aloud" sites make it possible for celebrity role models to read to any child with access to a computer and an internet connection (Available online <http://www.storylineonline.net/>).

The combination of new-found popularity for electronic reading and computers in classrooms would indicate that these factors will shape children's literacy development in the next decade. Children are still being introduced to literacy through print books, but signs point to electronic reading being a greater part of their literary life as they develop and mature. If the goal of schools is to keep children actively engaged in reading, then educators need to examine the effects of electronic books on the reading engagement of children. As has been stated, engagement also impacts motivation and reading achievement (Marinak & Gambrell, 2008). If the publishing trend of promoting electronic books continues, then it is reasonable to predict these books will eventually make their way into the schools. The purpose of the present study was to examine the reading engagement and comprehension of children as they read electronic books.

## Research Questions.

The primary research question was “What are the effects of electronic books on third-grade children’s reading engagement?” Because engagement impacts comprehension and the degree of satisfaction that children gain from reading, two sub questions were examined. First, “What are the effects of electronic books on third-grade children’s reading comprehension?” and second, “What are the effects of electronic books on third-grade children’s reading enjoyment?”

## Significance.

The study has the potential to determine if the features of electronic books will actively engage children in reading material. Many electronic books are accompanied with features such as audio of entire text or audio of specific vocabulary terms. Definitions of such terms are also provided. The books are therefore interactive and allow for children to become actively engaged in the text. By introducing children to electronic books at an early age they will gain experience with all of the characteristics of such technology and become acclimated to twenty-first century devices for reading. Children will also gain valuable twenty-first century skills in the area of information and communication technology (ICT). The ability to use digital resources is a major factor in the success of the future workforce.

## Methodology.

The participants were 22 third-grade children in a single self-contained classroom at an urban school in the southeast region of the United States. The students consisted of 11 boys and 11 girls. Four of the students were Caucasian, one student was Asian-American, and all of the remaining students were African-American. Most of the students read on grade level, although a few read below grade level. The students were divided into four groups for the study with a mixture of boys and girls in each group. The students were also grouped homogeneously by reading level. The children were ultimately rewarded with a free pencil and cupcakes for their participation in the project.

## The Procedure.

Permission was obtained from the parents of each participant. The teacher, school principal, school division, and university Institutional Review Board also all granted permission for the study. All supplies were provided by the two researchers with the exception of the laptops which belonged to the school. The participants were introduced to the project, and verbal assent was obtained from the students.

Phase I: The project began with the students reading a traditional print version of *The Yellow House Mystery* (The Boxcar Children, No. 3) by Gertrude Chandler Warner and Mary Gehr. The children read aloud in their respective groups with either a researcher or one of two undergraduate research assistants to monitor their reading. The participants read the first three chapters of the book using a process called “bump reading” in which a child reads aloud as long as she or he wants and then calls on another child in the group to read. The process continues until the passage has been completed.

Wigfield, et. al., (2008) found that reading engagement was a construct that could be measured primarily based on the combination of reading achievement and reading motivation. Those researchers developed the Reading Engagement Index (REI) to measure engagement in elementary-aged children. Using the criteria described on the REI the researchers developed an observation instrument to be used during read-aloud sessions for both print books and ebooks used in the study. Researchers videotaped the sessions and made note of particular reading skills. The noted skills, as identified on the REI were as follows: 1) Works hard in reading; 2) Engaged during the lesson; 3) Works at decoding skills; 4) Is a confident reader; 5) Decoding skills applied; and 6) Fluency. A running tally was recorded each time a participant displayed one of the skills while reading aloud.

Upon the completion of each of the first two chapters of *The Yellow House Mystery*, the student groups were given a reading activity by the classroom teacher to measure their comprehension and predicting skills. The students worked in their respective groups to complete mapping activities and presented their maps to the class. Students then read chapter three silently. After reading chapter three, students were administered a comprehension test on chapters one through three and an enjoyment survey of the first three chapters. Students were asked to enter

their name on the survey so information could be cross tabulated with their comprehension score and observation data. Since students may have concerns about impact on reading grades, the researcher assured students that the scores on the comprehension test or survey would not affect their school grade in any way.

During Phase II of the study, each student was provided with a school-owned laptop. Participants were then introduced to the website Raz-Kids.com and provided instructions for the login process. Each participant was given login identification and a password. Students were also informed that they would be able to log into the site and read books at home on their own time. A researcher provided instruction in interactive features of the books on the website. Students were then given opportunities to investigate and experiment with the online features. These included electronic page turning, vivid color, graphics, and access to a library of approximately 100 titles grouped by reading level. Each title had two options for viewing. The students could listen to a computerized read-aloud version or view text and pages as ebooks with links to glossary and selected words that include audio pronunciations. The design of the study required students to access only the assigned books while data was collected, however, it was later discovered that access to a library title was a strong motivator for engagement.

After instruction on the website and its features, students were then instructed to rejoin their original groups and to bump read a story called *The Mystery Wind* by Cheryl Ryan and Hough Armstrong from the website. One student read at a time, while others followed along. The student who read aloud at any given time was the only one with permission to use the interactive features at the time. Others in the group were instructed to continue reading along silently until it was their turn to read. Again, the observers videotaped the sessions and made notes on the aforementioned reading behaviors. After completing *The Mystery Wind* students were again assigned a comprehension activity by the classroom teacher. Students completed the activity in their respective groups and shared their ideas with the class. Students then completed a comprehension test in the same fashion as the test in Phase I. They also completed a survey to measure their enjoyment of *The Mystery Wind*.

During Phase III of the study, students silently read another book from Raz-Kids.com entitled *The Sweet Potato Challenge* by Vera Ogden Bakker and Joel Snyder. Students were allowed to use any of the interactive features while reading the book. Upon completion, students were then given a comprehension test and administered an enjoyment survey of the book. Students were also administered a fourth survey to gauge their overall enjoyment of reading electronic books. Students were finally given an opportunity to read or listen to any book from the website and play with all of the features as they read. All materials were then collected by the researchers and undergraduate students. Students were informed that they would be able to read books from Raz-Kids.com from home using the same login I.D. and password.

#### Data Analysis.

The primary data were the scores on the comprehension tests and the answers to the survey items. The observation data were secondary. All comprehension tests were created by the researchers based on research by Johns and Lenski (2005). These authors concluded that effective assessment of reading comprehension hinges upon students being able to a) preview the text, b) activate prior knowledge, c) identify main ideas, d) sequence, e) make predictions, f) make inferences, and g) draw conclusions. At least one question was included in the comprehension tests to assess each one of the aforementioned cognitive skills. The researchers also scored each assessment and entered the data into a statistical processing program. The initial three surveys were designed to measure the a) students' level of enjoyment with each selection, b) the ease with which they read, c) their self assessment of comprehension, d) their motivation to read more of each selection, e) their desire to read other comparable books, f) the likelihood of reading the book outside of school, g) the recommendation they would give to a friend about the selection, and h) their satisfaction with the selection. The final survey was designed to measure their preference for traditional print books or e-books. The survey items were assigned a value and entered into the same software program. A repeated measure ANOVA was performed on the comprehension test data to measure the variation in test scores depending upon the format of the book. The survey data were cross tabulated with the comprehension data to measure the interaction between their enjoyment of the books and their comprehension scores. Chi-Square was used to identify any relationships between preferences for selected titles and format of books.



## Results.

The repeated measure ANOVA revealed no significant difference in the mean scores between comprehension tests one and three. However the mean score on comprehension test two differed significantly from the other two tests. Table 1 provides mean scores for the three tests.

Table 1. Comparison of mean scores for the three reading comprehension tests.

Estimates				
Measure: MEASURE_1				
Test	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	80.262	3.805	72.348	88.175
2	65.800	3.735	58.032	73.568
3	81.625	3.990	73.328	89.922

The post hoc test was used to conduct pairwise comparisons. The pairwise comparisons revealed levels of significance among the three mean scores. The difference between test one and test two yielded a significance value of 0.023,  $p > .05$ . The mean score on test two also yielded a significant difference from test three with a significance value of 0.002,  $p > .05$ . The mean scores from tests one and three were not significantly different. The level of significance was 1.00,  $p > .05$ .

Table 2. Pairwise tests providing level of significance in mean score differences.

Pairwise Comparisons						
Measure: MEASURE_1						
(I) Test	(J) Test	Mean Difference (I-J)	Std. Error	Sig. <sup>a</sup>	95% Confidence Interval for Difference <sup>a</sup>	
					Lower Bound	Upper Bound
1	2	14.462*	4.889	.023	1.744	27.180
	3	-1.363	3.536	1.000	-10.561	7.835
2	1	-14.462*	4.889	.023	-27.180	-1.744
	3	-15.825*	3.930	.002	-26.050	-5.600
3	1	1.363	3.536	1.000	-7.835	10.561
	2	15.825*	3.930	.002	5.600	26.050
Based on estimated marginal means						
*. The mean difference is significant at the .05 level.						
a. Adjustment for multiple comparisons: Bonferroni.						

The participants scored significantly lower on test two even though it assessed comprehension of a book delivered in the exact same format as the book for test 3. Test one assessed comprehension of a print book, and test three assessed the comprehension of an e-book. However, the scores for test 1 (print book) compared with test 3 (e-book) were nearly identical. Test items were written using standardized tests typically used in the subjects' classroom.

Unlike the test items, the survey items were intended to measure the level of enjoyment that the participants experienced while reading the books in the various formats. Additionally, Chi-square cross tabulations were conducted to reveal any interaction among the four surveys. The first three surveys measured enjoyment of each book, and the fourth survey measured their preference for reading books in either print or electronic format. The only significant interaction among the first three surveys was the question regarding enjoyment of the books. The participants indicated an equal level of enjoyment regardless of the book format.

The survey items regarding ease, self-assessed comprehension, motivation, self-selected reading, and recommendations did not yield any significant interaction results. The final survey measured their preference for reading books in either of the two formats. Most of the students indicated that they would prefer to and would continue to read books in either format. The students showed no particular preference for reading the books in either format. There is one item of interest-- subjects indicated that they were impressed with reading the wide selection of e-books and the various features of the computer program. They also indicated that they would like to log into the Raz-Kids website from home and read books from home. The students did not have difficulty with navigating the books on the computer, and they did not find it confusing.

Nonparametric analysis.

Survey 1 measured the enjoyment for Yellow House, and Survey 3 measured enjoyment for Sweet Potato. In terms of the enjoyment question on Survey 1 compared to Survey 3 Sweet Potato, the response to Enjoy is 62.5% for Yellow House compared to 71.4% for Sweet Potato. See also the response to somewhat true at 25% for Yellow House compared to 33.3% for Sweet Potato. This shows more students responded at a higher level of enjoyment for Sweet Potato e-book than for the level of enjoyment for Yellow House print book.

Table 3. Compare surveys on enjoyment for Yellow House print book with enjoyment for e-book Sweet Potato. Survey 1 Yellow House Mystery Print version “enjoy” with Survey 3 Sweet Potato e-book “enjoy.”

Compare Survey 1 with Survey 3			Not True	Somewhat True	True	Total
	True	Count	1	2	5	8
		Expected Count	1.5	3.0	3.5	8.0
		% within Survey 1 Enjoy	12.5%	25.0%	62.5%	100.0%
		% within Survey 3 Enjoy	33.3%	33.3%	71.4%	50.0%
			6.3%	12.5%	31.3%	50.0%

Compare this to Table 4 as shown below. Students’ response to the enjoyment question for Mystery Wind compared to enjoyment question for Yellow House is the same. The format print book compared to e-book does not appear to be a factor. This leads us to the conclusion that content, theme, setting, and plot may have a stronger effect on children's reading motivation than format.

Table 4. Compare student response to enjoyment for Yellow House book compared to Mystery Wind book (e-book). Students respond to survey enjoyment of print book at the same rate as e-book enjoyment.

Survey 1 to Survey 2 Enjoy			Not True	Somewhat True	True	Total
Survey 1 to Survey 2 Enjoy	True	Count	1	0	6	7
		% within Survey 1 Yellow	14.3%	.0%	85.7%	100.0%

		Enjoy				
		% within Survey 2 Mystery Enjoy	25.0%	.0%	85.7%	46.7%
		Total	6.7%	.0%	40.0%	46.7%

In Table 5., Chi Square reports a significant relationship between students' response to Survey 3 Sweet Potato enjoyment with Survey 4 Choice ( $r = 12.97$ ,  $p < .01$ , 2-tailed). The variable Choice refers to being able to choose from many book titles. There is a strong correspondence in survey response between those students who enjoyed the e-book Sweet Potato with students' who liked being able to choose from a wide selection of book titles. This suggests that students who enjoyed the e-book Sweet Potato are motivated when given the opportunity to choose their own reading materials.

Table 5. Chi Square analysis showing relationship between student response to enjoyment of e-book Sweet Potato with student response to being able to choose own reading materials.

Chi-Square Tests for Pearson correlation between "Enjoy" Sweet Potato with "choice of titles"			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	12.974 <sup>a</sup>	4	.011*
Likelihood Ratio	9.709	4	.046
Linear-by-Linear Association	4.532	1	.033
N of Valid Cases	18		

Reading motivation and engagement are enhanced when students have choice in reading materials. These findings are consistent with the findings of Flowerday, et. al. (2004). The wide selection of titles possible through online e-book websites is motivational for children. This is similar to the freedom of choosing any book from the classroom or school library collection. One benefit in use of e-books is improved access to a greater number of reading selections. Currently most e-books for K12 classrooms are limited to subscriptions sites with several restrictions. First, in most schools the district technology director must grant privileges for download of e-books to any particular school server. This is a minor obstacle but does require time and effort on the part of the teachers. In addition, the authors discovered very few current titles available online, paid or free. Older book titles that do not require copyright are available in abundance. Most children in this study, however, preferred books that relate to their own culture and environment. Finally, Chi Square showed a perfect correspondence between enjoyment scores for the print book Yellow House compared to the e-book Sweet Potato. This suggests that format is not important as the content, theme, and general writing style of the book. Although students responded favorably to such features as popup windows with definitions and word pronunciation, this study showed no significant effect on students' reading comprehension. Earlier research in multimodal learning reports positive effect on learning when more than one modality is used for reading instruction. Why then, was there little effect on reading comprehension scores with multimedia interactive e-books used in this study? This opens the door for continued work in how special features in e-books might enhance reading motivation and ultimately comprehension.

## Discussion.

The results of the ANOVA yielded interesting results since the students scored significantly lower on the second test based on a book that was read in the same electronic format at the third book. The survey results also indicated that the participants enjoyed the first and third books better than the second book. The mean enjoyment score for book one was 2.32 which was identical for the mean enjoyment score for book three. The mean enjoyment score for book two was 2.11 which was significantly lower. This coincidentally, coincided with the significantly lower score on the comprehension test for book two, while the comprehension scores for books one and three were nearly identical. These findings would indicate that the format of the book did not matter as much as the level of enjoyment that the children received from the storyline. All three books were read in the same fashion with the children “bump reading” in the same reading groups for each session. The groups also had the same facilitator for each session. The groups also all engaged in the same extension activities after reading each selection. The homogeneous groupings also ensured that their reading levels were comparable. The only difference in the study design was the format of the books. Readings of the print book and the second e-book resulted in comparable amounts of enjoyment and comparable comprehension scores.

The first reading selection was the first three chapters of *The Yellow House Mystery*. This is the third book in a series of mysteries about four children who live with their grandfather and fashion themselves as young detectives. In this book, the children must solve the mystery of a man who disappeared long ago while living in a house on their grandfather’s property. The first three chapters of the book were read in groups, and participants were subsequently tested on those three chapters. The remainder of the book was read aloud to the students with the teacher reading a chapter a day after recess.

The third book that the participants read in electronic format was entitled *The Sweet Potato Challenge*. This e-book was about a cooking contest and contained recipes for various desserts. This book centered on children living in America and challenging each other to make the best sweet potato pie. The children “bump read” this entire book and were also able to click on highlighted vocabulary words to either have the word pronounced or have the definition displayed. The facilitators ensured that the only child who was allowed to use the interactive features was the child who was reading aloud. The book also contained a feature that would allow children to change pictures without changing the page. Therefore, some children click the “enter” button expecting the page to change while only seeing a different picture. The text remained the same. In responding to the survey, children did not find this feature difficult or annoying.

The second book was also read in electronic format. This book was entitled *The Mystery Wind*. Again, the research design remained the same. Children bump read and used the interactive features. One difference was that this was the first book that the children read using the electronic format. They were allowed to explore and the other books in the Raz-Kids site before reading *The Mystery Wind*, but this was the first e-book that the children had ever read. Another notable difference between this book and the other two was that *The Mystery Wind* was about a little girl in Africa who discovers a mysterious wind that brings good fortune to her village. The program offered sound effects of the wind blowing and had other similar features to the third book that the participants read in electronic format.

The most notable difference between this book and the other two was that this book was not set in America and did not contain a setting that was automatically familiar to the participants. The huts in which the characters lived and the oxen that roamed around the village may not have been as easy to understand as the settings of the other two books. The students also did not enjoy the story as indicated on the survey. Their lack of enjoyment was also reflected in their comprehension of the score. It is possible that their reading engagement was lower because of their lack of interest in the story.

A central finding in these data was the strong correlation between enjoyment of the final e-book that the children read and their preference for a choice of books. As Flowerday, et. al., (2004) found, children are highly motivated to read and remain engaged in literacy activities when afforded a choice of what to read. The participants in this study all rummaged through the Raz-kids cite to find other books which might interest them when given the opportunity to do so. This correlation between enjoyment of Sweet Potato, an e-book, and a preference for self-

selecting reading material suggests that the electronic format combined with the opportunity for choosing books was a highly motivating factor for children to read.

According to data from the fourth survey, the participants had no preference for reading in either format. Over half of the participants wanted to continue to read both print and e-books. Only three participants indicated that they would only like to read e-books in the future, while just one participant indicated a future preference for print books only. Three participants also indicated no preference at all for either format. The interactive features of the e-books did not sway them to a desire for using electronic formats as their sole source reading. The observation data revealed that the children clearly displayed an interest in the interactive features such as having the books read to them, having vocabulary words pronounced for them, viewing various pictures, and sound effects. The data also revealed that they thoroughly enjoyed roaming through the vast selection of e-books and reading selections of their own choosing. However, they still indicated that they would like to continue reading books from both formats.

The results from both the comprehension tests and the surveys indicated that the format in which children read the material is not an important indicator for this study. The e-book format did not significantly increase comprehension, enjoyment, or engagement. The data clearly indicate that children prefer to have a choice of reading material and that the format was not as central to reading engagement as a connection with the story's characters and setting. As publishers and teachers begin to introduce electronic reading to younger children, strong consideration must be given to the quality and quantity of the books provided for children to read. The results of this study indicated that the format in which the book was delivered did not matter as much as the suitability of character, theme, and setting of the books and how these align with personal preferences of the reader. A second outcome is further evidence which suggests a wide variety of reading choices and the opportunity to select books does impact reading engagement and ultimately reading comprehension.

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# **Changes in the Self-Efficacy of Student Teachers Engaged in a Technology-Supported Field Experience**

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## **Abstract**

The purpose of this study was to examine the changes in self-efficacy of student teachers engaged in a technology-supported instructional program as part of their field experience. The program was designed to introduce the elements of cognitive apprenticeship (modeling, scaffolding, coaching, reflecting, and community building) into the supervision process. Eighteen participants completed a pre- and post- measure of self-efficacy. After controlling for differences in their experience with the cooperating teacher, ANCOVA on post-efficacy mean scores with pre-scores as a covariate indicated a statistically significant difference favoring those in the program. Interviews were conducted to determine the role that technology played in building efficacy knowledge and engaging with the sources of self-efficacy. Implications for creating technology-enhanced cognitive apprenticeships and improving the supervision of student teachers during the field experience are discussed.

## **Introduction**

Teacher self-efficacy – that is, a teacher's belief in his or her ability to achieve specific results in a given context (Tschannen-Moran, Hoy, & Hoy, 1998) – plays a role in a teacher's performance. A teacher's efficacy beliefs affect what they are willing to attempt in the classroom and how persistent they will be at succeeding as a teacher (Mulholland & Wallace, 2001; Tait, 2008; Tschannen-Moran & Hoy, 2001). Tschannen-Moran et al. (1998) describe the interplay between self-efficacy and performance as cyclical. For example, a positive teaching experience can help improve a teacher's beliefs in his or her abilities. This, in turn, increases the likelihood of more positive experiences in the future. Similarly, a negative experience might lower a teacher's beliefs in his or her abilities, which would increase the likelihood of more negative experiences in the future.

Bandura (1997) identified four sources of efficacy knowledge: mastery experiences, vicarious experiences, verbal persuasion, and physiological arousal. In the context of student teaching, the first three sources have been thoroughly established by several researchers. For example, mastery experiences are described as teaching tasks that inform a teacher's knowledge of his/her own abilities, such as regularly and successfully planning and implementing instruction (Knoblauch & Hoy, 2008; Tschannen-Moran & Hoy, 2007). Vicarious experiences are described as the observation of modeled instruction, including observing one's self, or self-modeling, and learning about the experiences of others (Knoblauch & Hoy, 2008; Mulholland & Wallace, 2001). Verbal persuasion entails receiving feedback about one's performance or emotional support from colleagues, administrators, students, or the greater community (Liaw, 2009; Tschannen-Moran & Hoy, 2007). Mastery experiences that are informed by the other two sources of efficacy are suggested to be the most likely to shape a teacher's efficacy beliefs (Bandura, 1997; Knoblauch & Hoy, 2008; Mulholland & Wallace, 2001).

The field experience is an opportune time to positively influence and shape novice teacher efficacy (Liaw, 2009; Mulholland & Wallace, 2001). Student teachers frequently engage in activities that are believed to improve their self-efficacy, such as observing a variety of competent models (Knoblauch & Hoy, 2008), sharing experiences with others (Liaw, 2009; Main & Hammond, 2008), and receiving recognition for their successes (Mulholland & Wallace, 2001; Tschannen-Moran & Hoy, 2007). They also have ample access to all three sources of efficacy knowledge – mastery experiences, vicarious experiences, and verbal persuasion – at a time when they are most open to them. Tschannen-Moran and Hoy (2007) found evidence of this in a regression analysis that included contextual factors, verbal persuasion, and mastery experience as predictors of self-efficacy. In that study, both mastery experiences and verbal persuasion made a significant contribution to the efficacy beliefs of 75 novice teachers, whereas only mastery experiences made a significant contribution to the efficacy beliefs of the remaining 180 experienced teachers.

Technology may play an important role in positively impacting the self-efficacy of novice teachers. The activities that cultivate self-efficacy, such as guided interaction with experts (Tschannen-Moran & Hoy, 2007) and receiving ample support (Capa & Woolfolk-Hoy, 2005), have been achieved through technological interventions. Researchers have used telecommunications technology (Barnett, Keating, Harwood, & Saam, 2002; Hew & Knapczyk, 2007), electronic performance support systems [EPSS] (Barnett, et al., 2002; Hew & Knapczyk, 2007; Liu, 2005; Wild, 1998), and video (Bannink, 2009; Sherin & van Es, 2005) to increase interaction and support

between novices and expert teachers so that novices receive more frequent support during teaching tasks. However, prior studies on the use of technology with novice teachers focus more on participant perceptions of the tool and less on student outcomes such as efficacy (Gentry, Denton, & Kurz, 2008).

The purpose of this study was to examine the teaching self-efficacy of students who participated in a Technology-Enhanced Student Teacher Supervision [TESTS] throughout their field experience. TESTS the traditional field experience using telecommunications technology, EPSS, and video reflection to support the cognitive apprenticeship between novice and expert teachers. The research questions were:

1. How does the self-efficacy of student teachers who participate in TESTS differ from students who do not?
2. What role do TESTS technologies play in cultivating self-efficacy?
3. Are the student teacher's reported levels of self-efficacy reflected in their actual performance?

## Method

### *Instructional Program*

The TESTS instructional program is a series of five online learning modules that incorporate telecommunication technologies, video, and EPSS during the field experience. In order of completion, the five modules were *Analyzing the Teaching Context*, *Classroom Management*, *Planning Instruction*, *Engaging the Learner*, and *Assessing the Learner*. The instructional activities in those modules were designed around the elements of cognitive apprenticeship (Collins, Brown, & Holum, 1991). Prior evaluation of TESTS suggested a number of positive results (Alger & Kopcha, 2009, in press).

The instructional activities found within those modules are summarized here:

- 1 *Asynchronous discussion*. Triad members (student teachers, cooperating teachers, and university supervisors) use the online discussion boards to share experiences and/or receive feedback and advice on relevant classroom issues, such as classroom management, instructional strategies, and assessment methods. Student teachers are asked to post to the discussion boards on a bi-weekly and are encouraged to write about topics they find relevant. Experts in TESTS regularly read and often reply to the postings of student teachers other than their own.
- 2 *Guided observation including video reflection*. Student teachers in TESTS are observed a total of six times per semester; three times by the supervisor and three times by the cooperating teacher. When they are observed, the observers use a downloadable form that is completed electronically and then shared with the others in the triad. The form contains a variety of Likert-type and open-ended items that focus the observation on the planning, instruction, assessment, and reflection [PIAR] of student teachers. In addition, student teachers videotape and observe themselves delivering a lesson once per semester. The self-observation is completed using a guided reflection form and both the video and reflection are reviewed with an expert for feedback.
- 3 *Lesson planning*. Student teachers regularly create lesson plans using an Electronic Performance Support System [EPSS]. Student teachers using the EPSS complete an online form that contains key reminders of how to plan effective lessons. They then submit lessons electronically to the cooperating teacher and supervisor for feedback. Each lesson stored and published to an online searchable database, and all members in TESTS can use the database to search for and view student lessons at any time.

### *Participants*

Eighteen student teachers participated; half (9) received the TEIP. Both groups were geographically placed in urban districts with similar demographics that included a large proportion of English Language Learners and high numbers of students eligible for free or reduced lunch.

All students at this university engage in two semesters of the field experience and participate in the same university coursework. Both groups were beginning their second semester of student teaching; students in TESTS, however, were placed in a new classroom with a new cooperating teacher, whereas the non-TESTS group remained with the same classroom and cooperating teacher. Students engaged in TESTS were trained to use the required technology tools.

### *Measures*

- 1 *Teachers' Sense of Efficacy Scale [TSES]*. The primary measure of teacher self-efficacy was the short form (12 items) of the *Teachers' Sense of Efficacy Scale* [TSES] (Tschannen-Moran & Hoy, 2001). Student teachers reported on how much they felt they could do with regard to a number of common teaching tasks (class management, student motivation, delivery of content) on a nine-point scale with descriptors at every



odd number, from 1 (nothing) to 3 (very little) to 5 (some influence) to 7 (quite a bit) to 9 (a great deal). A sample item from the measure is, "How much can you do to control disruptive behavior in the classroom?" The short form of the TSES has been established as a valid and reliable measure of teacher efficacy beliefs (Fives & Buehl, 2009). The reliability of this instrument was .87 in this study and has been reported at .90 or higher in prior studies (Fives & Buehl, 2009; Tschannen-Moran & Hoy, 2001).

- 2 *Learning to Teach Scale*. The original survey, which contained 10 items, measured both the level of guidance from the cooperating teacher and the amount of imitation the student teacher engaged in. Student teachers in this study reported on the 5 items associated with the level of guidance they received from their cooperating teacher. Responses were given on a six-point scale with the following descriptors: never (1), almost never (2), sometimes (3), often (4), almost always (5), and always (6). A sample item from the measure is, "My cooperating teacher offers me guidance to improve my teaching." The scale has been established as both valid and reliable. The reliability of this measure in this study was .93.
- 3 *Student Teacher Interview Protocol*. Student teachers reported on the changes in confidence they experienced with regard to common teaching practices (planning, implementing, and assessing instruction) over the semester and the role technology played in facilitating those changes. Sample items from the protocol are, "In what ways did technology have an impact on your ability to: Plan lessons? Implement them? Assess them? Reflect on your teaching?" and "Do you think that the technology you used as part of learning to teach helped or hindered your growth this semester? Why / why not?" The interviews were semi-structured and lasted an average of 20 minutes.

### *Procedures and Timeline*

One cohort of 18 student teachers received the intervention of TESTS and the other cohort of 20 teachers did not. The cohort that received TESTS was selected because the instructor of the seminar for that cohort's field experience volunteered to use TESTS. Students, however, were assigned to TESTS in a random fashion. All students in the entire secondary single subjects credential program at this university were placed randomly into one of four cohorts at the beginning of the year. In this way, students were equally likely to be placed in the cohort that received TESTS or in the comparison group.

Student teachers in the TESTS group engaged in the instructional program over the course of two semesters. Because they participated in TESTS as part of an on-campus seminar course that met once per week, the seminar leader set the pace for completing the activities in TESTS. The seminar leader also participated in online discussions and was responsible for monitoring and promoting expert participation in TESTS. Non-TESTS students participated in a similar seminar course for their own cohort; however, this seminar had no instructional program like TESTS as part of the coursework. Instead, they participated in a series of face-to-face, in-class discussions that focused on resolving issues that were specific to the cohort.

Although the participant pool consisted of 38 student teachers, only 18 volunteered to participate in our study. Student teachers were solicited for participation at the beginning of their second semester and completed the TSES at that time as a pre-measure. One week prior to the end of the second semester, they once again completed the TSES as a post-measure, and also completed the *Learning to Teach Scale*. Both student and cooperating teachers participated in telephone interviews shortly after student teachers completed the surveys; the interviews were recorded and transcribed for analysis.

### *Design and Analysis*

TSES post-survey mean scores were analyzed between eSupervision and non-eSupervision groups using ANCOVA with the pre-survey as a covariate. ANCOVA was used to correct for initial differences (Iacobucci, 2001); eSupervision students may have had different levels pre-efficacy due to the fact that they were placed in a new classroom with a new cooperating teacher. *Learning to Teach* mean scores were compared using ANOVA to rule out differences due to the relationship with the cooperating teacher.

Because of the small sample size, student teacher interview data were analyzed by case to add validity to ANCOVA results (Yin, 1994). They were analyzed in a qualitative manner, organizing responses into common themes. Cooperating teacher interview data were examined to determine whether student teachers accurately described their changes in confidence in the light of their cooperating teacher's observations of their performance.

### *Results*

The mean scores for the *Learning to Teach Scale* by group fell between the rating of "often" and "almost always". Specifically, the scores were 4.70 for the TESTS group and 4.29 for the non-TESTS group, a non-

significant difference. These scores indicated that student teachers from both groups experienced similar interactions with their cooperating teachers, and with similarly high frequency.

Analysis of covariance [ANCOVA] on the 18 post-TSES scores with pre-TSES scores as a covariate revealed a statistically significant difference between the TESTS ( $M = 7.06$ ) and non-TESTS groups ( $M = 6.77$ ),  $F(1, 16) = 7.67, p < .05, \eta^2 = .35$ .

A total of 9 student teachers (5 TESTS, 4 non-TESTS) were interviewed to give them the opportunity to describe the role that technology played in their student teaching field experience and in developing their teaching skills. Both TESTS and non-TESTS students were included in the interview sample to determine what technologies both groups did use and any commonalities with regard to how those technologies were used.

Both groups reported using a variety of technologies to help them learn to teach during their field experience. Both TESTS and non-TESTS participants reported using email and video reflection; TESTS participants also reported using discussion boards, the online lesson plan EPSS, and observation templates. The results associated with email, the video reflection, the lesson plan EPSS, and the observations forms are summarized in Table 1 and are presented in detail below.

*Electronic mail.* Students from each group used email with similar frequency and for similar purposes. All stated that they infrequently used email with their supervisor, primarily to arrange site visits and triad meetings. With regard to the cooperating teacher, email contact varied in frequency from daily (1 TESTS, 1 non-TESTS) to weekly (2 TESTS, 3 non-TESTS) to only several times a semester (2 TESTS, 1 non-TESTS). These varied in nature from planning to classroom management issues to the organization of the school. The two participants who used email daily with the cooperating teacher were the only two that reported using it to receive advice about lesson plans and share classroom experiences with the cooperating teacher.

*Video reflection.* Students in both groups used video technology to record themselves teaching a lesson and review the videotaped lesson. Students in the TESTS group used a standard protocol to reflect on the lesson, and then received feedback on the videotaped lesson from their supervisor. All TESTS students found that the feedback they received was a powerful source of information about their ability to implement instruction.

The video experience afforded TESTS students with two opportunities to improve their efficacy. First, the act of observing themselves functioned as a vicarious experience through self-modeling, which created an opportunity to challenge their own thinking about their level of mastery with regard to teaching. One described: "I was like, 'Wow! My kids are being really well-behaved and that's something really smart that this kid just said, and I don't even know if I acknowledged that he said it'." Another student noted that the observation template helped guide this self-modeling in a purposeful manner, stating, "I tend to be hard on myself. So having specific areas [of PIAR] to watch for, and thinking, 'Oh, I think I'm actually ok with doing this' makes me more confident as a teacher".

The second opportunity to improve their efficacy came from the feedback from the supervisor provided student teachers, which acted as a form of verbal persuasion that informed their level of confidence in their ability to teach. One student explained,

I think what [the video reflection] helped most with was that [my supervisor] pointed out things that I missed even watching it. He saw a different perspective but he came back with a few things and I was like, 'Wow! I didn't notice this before.'

All non-TESTS students videotaped themselves teaching. Similar to the TESTS group, watching the video provided non-TESTS students with an opportunity to engage in a vicarious experience of self-modeling. They were able to observe their own performance and gauge their success with their own teaching ability. One student explained, "I could see the strategies [I was using] and see that they were working." Unlike the TESTS group, however, they did not have an opportunity to receive feedback, or verbal persuasion, from an expert but rather from peers in a large-group setting. They reported that the feedback helped them identify and change some issues in their own teaching, but felt that overall it was superficial and uninformative.

*Lesson Plan EPSS.* TESTS student teachers were required to post daily lesson plans using the Lesson Plan EPSS. This appears to have acted as a mastery experience for the TESTS participants, who all reported that the repeated use of this tool helped them internalize and master the process of planning. One student stated, "While I hated [planning daily lessons], it actually turned out to be a good thing because I felt I got better and better at it as I did it more and more."

Table 1

*Interviewed students' use and impact of technology on self-efficacy by group*

Technology	eSupervision	Non-eSupervision
Electronic Mail	<input type="checkbox"/> 1 Likely to have had similar impact as non-eSupervision due to similar frequency and purpose	
Video Reflection	<input type="checkbox"/> <input type="checkbox"/> Received feedback from supervisor <input type="checkbox"/> <input type="checkbox"/> Provided a vicarious experience of self-modeling that informed level of mastery <input type="checkbox"/> <input type="checkbox"/> Verbal persuasion regarding performance was a powerful source of efficacy information	<input type="checkbox"/> <input type="checkbox"/> Received feedback from peers <input type="checkbox"/> <input type="checkbox"/> Provided a vicarious experience of self-modeling that helped identify issues with teaching <input type="checkbox"/> <input type="checkbox"/> Student teachers felt the verbal persuasion they received was superficial and uninformative at times
Lesson Plan EPSS	<input type="checkbox"/> <input type="checkbox"/> Repeated use of tool acted as a mastery experience <input type="checkbox"/> <input type="checkbox"/> EPSS less useful as ability to plan improved	<input type="checkbox"/> 1 Lacked any formal instruction with regard to planning
Discussion Boards	<input type="checkbox"/> 11 Expert comments prompted reflective practice <input type="checkbox"/> 1 Experiences shared online provided vicarious experiences that informed own level of teaching mastery	<input type="checkbox"/> 1 No discussion boards used to support the field experience
Cooperating Teacher Observation Forms	<input type="checkbox"/> 1 Cooperating teacher formally observed student teacher 3 times a semester with an observation form <input type="checkbox"/> 1 Provided useful and specific feedback <input type="checkbox"/> 1 Created opportunity to receive verbal persuasion and inform mastery about PIAR	<input type="checkbox"/> 1 No formal observation by cooperating teacher

It was clear, however, that as mastery levels increased, student teachers felt the need to use the tool less. One student summarized this trend:

It helped me to really get the hang of the whole 'planning every day' and everything. By second semester, I had already gotten the idea of how it flowed and it was just an extra thing that I didn't participate in much.

In contrast, the non-TESTS group reported that they lacked any formal mechanism for learning to plan lessons and relied heavily on the cooperating teacher for assistance with this task. Several noted that this was due to a lack of instruction at the university level regarding the planning of lessons.

*Discussion boards.* TESTS students reported using the discussion boards to support their learning to teach during the field experience; in contrast, non-TESTS students did not report using any type of discussion board related to the field experience. For TESTS students, the discussion board functioned as an opportunity to use vicarious experiences to judge their own level of mastery with regard to teaching. One student stated, "I really wanted to know if other people were having the same issues that I was, and [the discussion board] was a huge way to communicate that." Another similarly noted, "I appreciated seeing things that were going on with other student teachers and seeing they were in the same place as me." Similar to the lesson plan EPSS, TESTS students reported using the discussion boards as a tool for measuring their own abilities more when they were less confident, and less when they became more confident.

*Cooperating Teacher Observation Forms.* The use of the observation form by the TESTS group created a formal and guided opportunity for student teachers to improve their self-efficacy through verbal persuasion. Discussion guided by the observation form provided valuable information that informed their level of mastery with a specific focus on PIAR and helped them discern the positive attributes of their performance from the negative ones. One student concisely summarized this, stating, “I tend to be hard on myself, so having specific areas where I know I’m actually doing ok with something makes me more confident.”

#### Discussion

TESTS students scored significantly higher on the TSES at the conclusion of their field experience than non-TESTS students. This difference is likely due to the manner in which TESTS students used technology during the field experience. TESTS students had greater access to positive feedback from a greater variety of experts and novices than non-TESTS students due to technology. They received both advice and support through the discussion boards – often from a supervisor that was not their own or from any number of peers. In addition, they were formally observed by and received feedback from their cooperating teachers in addition to their supervisors. It may be that the difference in self-efficacy between the two groups is also due to the fact that TESTS students received a greater variety of positive feedback during the field experience. This would be consistent with others (Bates & Khasawneh, 2007; Wu & Lee, 2004) who found that feedback from experts played a role in shaping the efficacy beliefs of preservice teachers in online settings. It also supports researchers who suggested that the performance and attitudes of student teachers would be improved by connecting novices and experts using technology (Joia, 2001; Owston, Wideman, Murphy, & Lupshenyuk, 2008; Wang & Bonk, 2001).

TESTS students also had more opportunities to inform their level of mastery with many teaching tasks due to their use of technology. For example, they reported that their ability to plan lessons became both internalized and routine due to the Lesson Plan EPSS, indicating a high level of mastery associated with the skill of planning. They reported reading about the experiences of others on the discussion boards, a form of vicarious experience, which they used to judge their own level of success with several aspects of teaching. They also received feedback from an expert on their videotaped lessons that informed their perception of mastery associated with implementing instruction. These experiences were likely to have had a powerful impact on the self-efficacy of TESTS students. Mastery experiences that are informed by other sources of self-efficacy are noted as one of the most powerful influences on a teacher’s level of efficacy (Bandura, 1997; Mulholland & Wallace, 2001; Tschannen-Moran, et al., 1998). Others have similarly found that student teachers have used feedback from others to evaluate their own ability as a result of using discussion boards (Liu, 2005), felt more confident with regard to planning tasks due to using EPSS (Hacker & Sova, 1998; Wild, 1998), and were better able to identify and change issues with their own teaching as a result of video reflection paired with expert feedback (Lee & Wu, 2006).

While the cooperating teacher clearly plays one of the largest roles in shaping student teacher self-efficacy (Knoblauch & Hoy, 2008), the results of this study suggest that an instructional program like TESTS can be effective at augmenting that influence. Teacher educators interested in using technology to support the supervision of student teachers during the field experience should note that the primary purpose of TESTS is to support a cognitive apprenticeship – technology is merely the vehicle for accomplishing this task. The activities that student teachers completed in this study, such as guided observation and feedback, online discussion of issues among peers and experts, lesson plan EPSS, and video reflection, are likely to be ways to support the triad during the field experience. This supports others (Bates & Khasawneh, 2007; O’Neill & Harris, 2004; Owston, et al., 2008) who have noted that learning outcomes are likely to improve for students in online settings when the goal is to use technology to connect them more purposefully with experts.

The most noticeable limitation of this study is the small sample size. However, there are several reasons to believe that similar results would occur with a different group of students. The interview data support the statistical findings with regard to teacher self-efficacy – TESTS students engaged more frequently with a variety of sources of self-efficacy knowledge. Researchers have found that technology can improve the quality of student teacher supervision and improve the performance and attitudes of teachers learning to teach (Liu, 2005; Pianta, Mashburn, Downer, Hamre, & Justice, 2008). The results of this study are consistent with those findings, suggesting that they are valid in light of the small sample.

This paper was an initial attempt to examine the impact of technology on both teacher performance and self-efficacy in a single context. While the results are encouraging, the sample size limits any future research should begin with a replication study that improves the size of the sample and thus the power of the statistical analysis. Other research could include examining the individual influences on teacher performance and self-efficacy within a technology-rich learning environment such as TESTS. Both technological and non-technological influences should

be examined to determine which effectively shape teacher performance and self-efficacy, and, more importantly, to what degree. Such studies would help us further develop effective strategies for preparing teachers for the classroom and address the need noted by several researchers to examine the connection between efficacy and performance (Labone, 2004; Wheatley, 2005) and the impact of technology on both (Gentry, et al., 2008).

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# **The Relationship between Accuracy and Attributes in Students' Causal Diagrams, Total links, Temporal Flow, and Node Positions**

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## **Abstract**

This case study examined three structural attributes observed in students' causal maps (total links, temporal flow, horizontal location of outcomes nodes) and their relationship to the accuracy of students' maps (number of correct root causes, number of root cause links) to determine the attributes that should be emphasized during map construction. The findings from regression analyses suggest that increasing temporal flow can substantially increase accuracy in number of correctly identified root causes, and placing limits on the total number of causal links can increase the number of correctly identified root cause links. Implications of these findings on how to manipulate the causal mapping task and tools and directions for future research are discussed.

## **Introduction**

Causal maps, a network of nodes and links that define the causal relationships between nodes, can be used in science education as a tool to teach and assess learners' systemic understanding of complex problems and phenomena (Ruiz-Primo & Shavelson, 1996). Given that causal maps in theory represent learner's cognitive structures, their complex reasoning, and conceptual development (Jonassen, 2008), causal maps can be and have been used to elicit, articulate, refine, assess, and improve understanding, analysis, and the identification of the causes and causal mechanism underlying complex problems. Improvements in students' understanding have been observed particularly when students work both individually and collaboratively to construct their own maps as opposed to simply presenting students the instructor or expert maps (Nesbit & Adesope, 2006). Maps can be used to support collaborative learning when students compare their maps to identify, trigger, and focus group discussions around key differences in viewpoints and understanding (Jeong, 2009 & 2010a).

A growing number of studies on causal maps and other types of maps (e.g., concept maps) have formulated various metrics to measure the accuracy *and* structural attributes of students' maps (parsimony, temporal flow, total links, connectedness) – particularly attributes believed to be correlated to map accuracy and attributes that can be potentially used to generate guidelines or constraints to help students create more accurate maps (Scavarda et al., 2004; Ifenthaler, Masduki & Seel, 2009; Jeong, 2009; Plate, 2010). Studies have been conducted to determine how different constraints imposed on the map construction process affect student's maps and learning – constraints like imposing hierarchical order by allowing students to move and re-position nodes (Ruiz-Primo et al., 1997; Wilson,

1994), providing terms for nodes (Barenholz & Tamir, 1992), providing labels for links (McClure & Bell, 1990), and allowing more than one link between nodes (Fisher, 1990).

In addition, studies have been conducted to develop software tools to automate and reliably measure both the accuracy and the structural attributes of maps. Software programs like HIMATT (Ifenthaler, 2008) and jMAP (Jeong, 2010b) are being used to address issues of rater reliability and validity by using software to automate measurements that can be used to test the correlation between different structural attributes and accuracy of students' maps (Ifenthaler, Madsuk & Seel, 2009), and to measure how maps change over time and how observed changes over time contribute to convergence in shared understanding between learners (Jeong, 2010a).

However, students' maps can vary widely in accuracy when maps are compared to expert maps (Ruiz-Primo & Shavelson, 1996; Scavarda et al., 2004). The critical question here is whether the variance in accuracy is a reflection of students' lack of knowledge and understanding of the topic under study, or is it more a reflection of student's lack of understanding and skills with drawing causal maps? Based on their review of the empirical research, Ruiz-Primo & Shavelson (1996) concluded that maps (including the assessment rubrics) should not be used in the classroom for large-scale assessments until students' facility, prior knowledge/skills with using maps, and associated training techniques are thoroughly examined. In other words, researchers must examine how differences in causal mapping skills and processes lead to differences in map accuracy between students with equal knowledge and understanding of the concepts/problems they are trying to articulate with causal maps. Ruiz-Primo et al. (1997) also found in their study that requiring students to hierarchically structure their maps did not produce any gains in the match between students' and experts' maps. However, Ruiz-Primo et al. conceded that they had difficulties in developing a clear operational definition and measure of hierarchical structure. As a result, more studies are needed to developing and articulating measures of hierarchical structure and how such measures ultimately reflect students' level of learning and understanding.

Given all of the above, new research is needed to: a) identify tendencies and potential weaknesses in the way students construct causal maps with minimal or no prior instruction on causal mapping; and b) determine to what extent each noted weakness affects the accuracy of students' maps while controlling for students' level of knowledge and understanding of the concepts/problems they are trying to articulate via causal maps. A clear understanding of the weaknesses and their effects will provide the foundation on which to identify the most appropriate guidelines, constraints, and interventions for improving the map construction process and quality/accuracy of students' causal maps.

Using the case study method, this study examined the accuracy of students' maps based on the ratio of correctly/incorrectly identified *root causes*. This study also examined accuracy in terms of total number of correctly identified *root links* (links stemming from root causes) to gauge how well students understand the causal chains, mechanisms, and mediating factors underlying cause-effect relationships between root causes and outcomes. These measures were tested for their correlations with three attributes: total number of causal links (*total links*), ratio of right/left pointing links (*temporal flow*), and distance of outcome node from left edge of screen (*location* of the node representing the final effect/outcome).

The purpose of the study were to determine to what extent do these three attributes (number of links, temporal flow, and location of outcome node) are correlated with (and possibly contributes to) level of accuracy. The findings can then be used to identify which attributes to emphasize to students by imposing specific constraints within the causal mapping software interface (e.g., limit total number of links, each newly created link points by default from left to right, position by default final outcome nodes at right most portion of screen) – constraints that can be implemented in future versions of our mapping software called jMAP (Jeong, 2010b), specifically developed and used for this case study. To address these discussions, this case study examined two research questions:

1. Which structural attributes (total links, temporal flow, outcome node location) are correlated with accuracy?
2. What is the relative magnitude of each attribute's impact on accuracy?



## **Method**

### **Participants**

Nineteen graduate students (8 male, 11 female) enrolled in a Masters level online course on computer-supported collaborative learning at a large southeastern university participated in this study. The participants ranged from 22 to 55 years in age, and the majority of the participants were enrolled in a Master's level program in instructional systems/design.

### **Procedures**

The course examined factors that influence collaborative learning and instructional strategies associated with each factor. In week 2 of the course, students used a Wiki webpage to share and construct a running list of factors believed to influence the level of learning or performance achieved in group assignments. Students classified and merged the proposed factors, discussed the merits of each factor, and submitted votes on the factors believed to exert the largest influence on the outcomes of a group assignment. The votes were used to select a final list of 14 factors that students individually organized into causal diagrams.

In week 3, students were presented six example diagrams to illustrate the characteristics and functions of causal diagrams. Students were then provided a MS Excel-based software program called jMAP (pre-loaded by the instructor with nodes for each of the 14 selected factors) to construct their first causal map (see Figure 1). The purpose of each student's map was to graphically explain their understanding of how the selected factors influence learning in collaborative settings. Using the tools in jMAP, students connected the factors with causal links by: (a) creating each link with varying densities to reflect the perceived strength of the link (1 = weak, 2 = moderate, 3 =

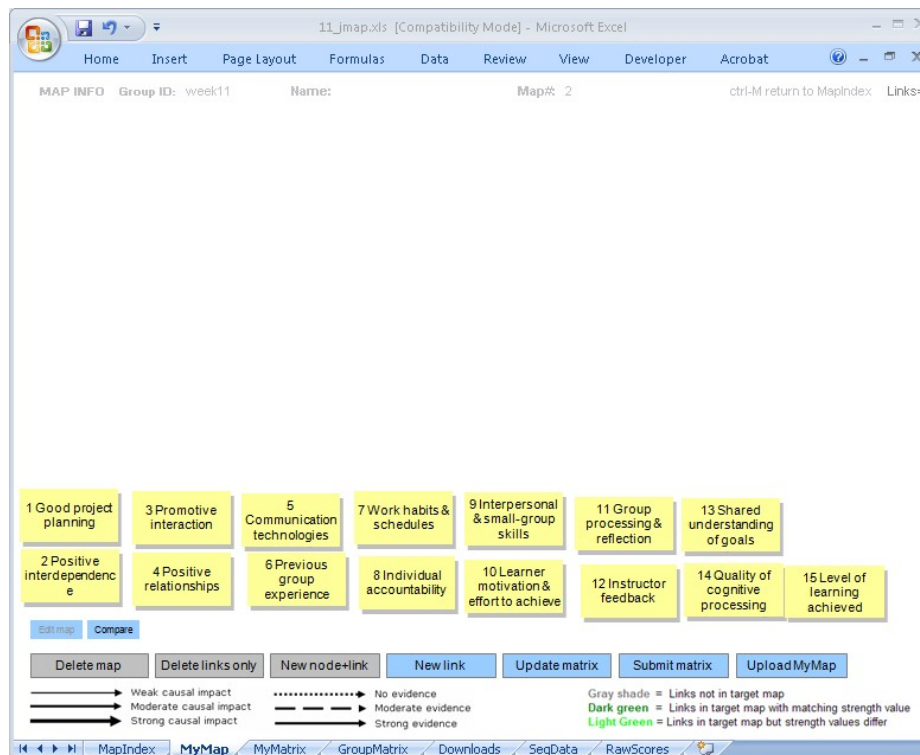


Figure 1. jMAP template preloaded with 14 factors and outcomes.

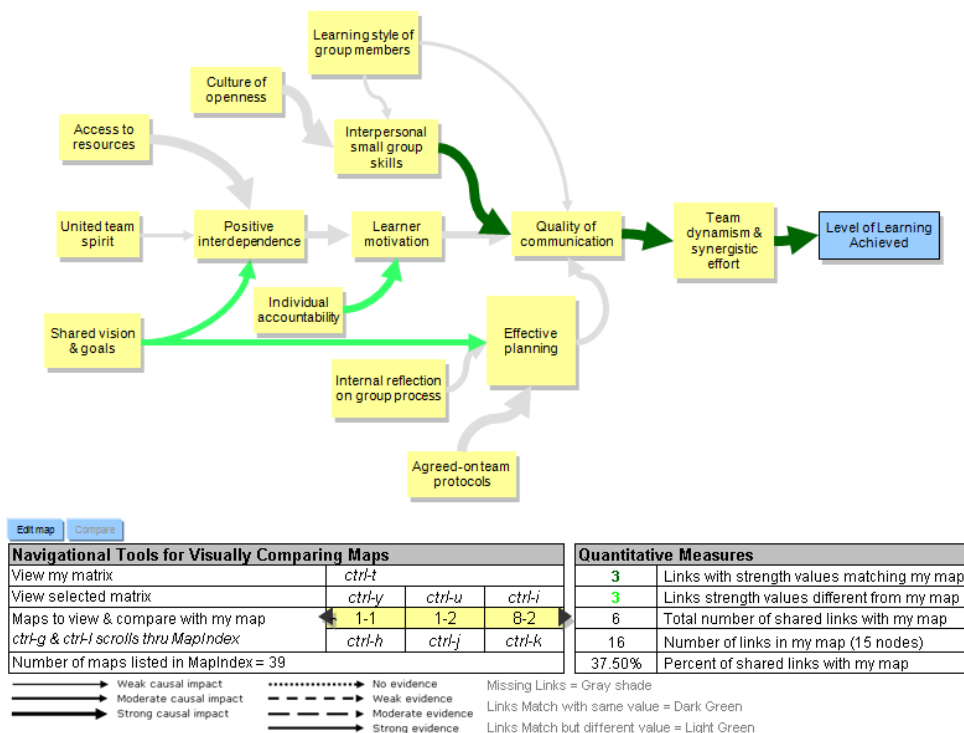


Figure 2. Student 8's map is superimposed over the instructors' map to reveal green and gray links that identify those in the instructor's map that are presenting and missing in the student's map.

strong); and (b) selecting different types of links to reveal the level of evidentiary support (from past personal experiences) for the link. The course instructor also used jMAP to construct an expert map that was used in this study to assess the accuracy of students' maps (see Figure 2). Students were permitted to omit any factors that he/she did not believe to directly or indirectly influence the learning outcome. Personal diagrams were completed and electronically uploaded within a one-week period to receive class participation points (class participation accounted for 25% of the course grade). The diagrams were also used to complete a written assignment describing one's personal theory of collaborative learning (due week 4, and accounting for 10% of course grade).

Once all the students submitted their first causal map, the instructor used jMAP to download and aggregate all diagrams ( $n = 17$ ) to produce and share with students a matrix conveying the percentage of diagrams that possessed each causal link. For example, the matrix in Figure 3 shows that the causal link between 'Individual Accountability' and 'Learner Motivation' was observed in 47% of students' diagrams. The links highlighted in yellow in the matrix above (on the right) identifies the common links observed in 20% or more of the students' diagrams (note: this criterion was specified by the instructor when aggregating diagrams in jMAP). Presented in the left matrix are the mean strength values of only those links observed in 20% or more of the diagrams. The highlighted values reveal links that are present or absent in the expert's map (i.e., dark green = links and strength values match, light green = links match, but strength values do not, gray = missing target links).

In week 9, students were presented the matrix revealing the percentage of diagrams (map 1) that possessed each link. Students posted messages in online threaded discussions to explain the rationale per link. Each posted explanation was labeled by students with the tag 'EXPL' in message subject headings. Postings that questioned or challenged explanations were tagged with 'BUT.' Postings that provided additional support were tagged with 'SUPPORT.' In weeks 9 and 10, students searched and reported quantitative findings from empirical research in a Wiki to determine the instructional impact of each factor.

Finally, in week 10, students reviewed the discussions from week 9. Within each discussion thread for each examined link, students posted messages to report whether they rejected or accepted the link (along with explanations). At the end of week 10, students revised and submitted their causal maps (map 2) based on their analysis of the arguments presented in class discussions.

## Measurement

The number of total links was measured by counting all links in each student's diagram. Temporal flow was computed by dividing the number of right pointing links to the number of left pointing links. Links that were perfectly aligned in a vertical position (pointing straight up or straight down) were not included in the computation. Position of outcome node was based on the number of pixels separating the left edge of the screen to the left edge of the outcome node. By using the matrices automatically generated by jMAP (see Figure 4) to identify the causal root links and root cause nodes shared between each student's map and the instructor's map, the ratio of correct/incorrect root nodes and the number of correct root links were computed.

## Analysis

The study applied the linear regression via SPSS 17.0. The diagrams produced *before* and *after* discussions were analyzed by using two regression models:

Model 1: Ratio of correct root causes $_i = \beta_0 + \beta_1(\text{number of total link}_i) + \beta_2(\text{ratio of temp flow}_i) + \beta_3(\text{outcome node location})$

Model 2: Number of correct root links $_i = \beta_0 + \beta_1(\text{number of total link}_i) + \beta_2(\text{ratio of temp flow}_i) + \beta_3(\text{outcome node location})$

Student Maps: 1-1 2-1 3-1 4-1 5-1 6-1 7-1 8-1 10-1 11-1 12-1 13-1 14-1 15-1 16-1 17-1 18-1																
<i>n</i> = 17 (mean scores rounded to zero decimals)																
Selection criteria: 20% or more of maps with given links																
Mean Link Values	Percent of Maps with Given Links ( <i>n</i> = 17)															
	Shared vision & goals	United team spirit	Effective planning	Learning style of group members	Access to resources	Culture of openness	Agreed-on team protocols	Internal reflection on group process	Learner motivation	Individual accountability	Interpersonal small group skills	Positive interdependence	Quality of communication	Team dynamism & synergistic effort	Level of Learning Achieved	
Shared vision & goals	6															
United team spirit																
Effective planning					2											
Learning style of group members																
Access to resources	2															
Culture of openness																
Agreed-on team protocols	2															
Internal reflection on group process																
Learner motivation																
Individual accountability																
Interpersonal small group skills																
Positive interdependence																
Quality of communication																
Team dynamism & synergistic effort																
Level of Learning Achieved																

Figure 3 Matrix displaying percentage of students' maps with each causal link and mean impact values assigned to causal links observed in 20% or more of the students' maps

Factors & Link Values	Shared vision & goals	United team spirit	Effective planning	Learning style of group members	Access to resources	Culture of openness	Agreed-on team protocols	Internal reflection on group process	Learner motivation	Individual accountability	Interpersonal small group skills	Positive interdependence	Quality of communication	Team dynamism & synergistic effort	Level of Learning Achieved
Shared vision & goals		2 3										2 1			
United team spirit													2 2	1 2	
Effective planning							2 3								
Learning style of group members															
Access to resources															
Culture of openness													3 3		
Agreed-on team protocols													2 3		
Internal reflection on group process													2 3	1 2	
Learner motivation		2 2													
Individual accountability									3 3						
Interpersonal small group skills													2 3		
Positive interdependence	2 3	2 3													
Quality of communication														2 3	3 3
Team dynamism & synergistic effort													2 3		2 2
Level of Learning Achieved															

Figure 4. Matrix representation of student 8's causal map (causes listed by row, effects listed by column with green cells representing causal links correctly identified and blank columns identifying root causes. Student explanations for causal links are stored in comments that can be accessed by placing the mouse over the red triangles.

## Results

### Correlations between attributes and accuracy

In the student's initial maps (map 1) produced *prior* to discussion, temporal flow was *negatively* correlated to the number of correct root links ( $r=-.461, p=.047$ ), and outcome node position was *negatively* correlated to the number of correct root links ( $r=-.465, p=.045$ ). In the maps produced *following* discussion (map 2), temporal flow was *positively* correlated with ratio of correctly/incorrectly root causes ( $r=.688, p=.003$ ), while total causal links was *negatively* correlated with number of correct causal root links ( $r=-.523, p=.037$ ).

### Relative magnitude of attribute impact

The regression model for the ratio of correct/incorrect root causes following online discussions was found to be statistically significant ( $F(3,12)=5.025, p=.017$ ). The model explains 44.6 % of the variance (Adjusted  $R^2=.446$ ) and power was 0.73. In this model, temporal flow was the most highly and positively correlated to the ratio of correct/incorrect root causes ( $\beta=.772, p=.004$ ), while total causal links showed relatively stronger negative correlation than the outcome node position.

Regardless of model significance, the regression model for the number of correct root links following online discussion explains 28.1% of the variance (Adjusted  $R^2=.281$ ). In this model, total causal links was the most highly and negatively correlated to the number of correct root links ( $\beta=-.554$ ,  $p=.028$ ), while temporal flow showed relatively stronger positive correlation than outcome node position.

Table 1 Correlations between variables

Variables	TL	TF	NP	RC	RL
Prior to online discussion					
Total causal links (TL)	1				
Ratio of temporal flow (TF)	.028	1			
Outcome node position (NP)	.334	.254	1		
ratio of correct/incorrect root causes (RC)	-.213	-.432	-.381	1	
number of correct root links (RL)	-.165	-.461*	-.465*	.541*	1
Following online discussion					
Total causal links (TL)	1				
Ratio of temporal flow (TF)	.023	1			
Outcome node position (NP)	.159	.303	1		
ratio of correct/incorrect root causes (RC)	-.261	.688*	.085	1	
number of correct root links (RL)	-.523*	.352	.153	.492	1

\* $p<.05$ . \*\* $p<.001$ .

Table 2 The unstandardized and standardized regression coefficients for the variables

Variables	ratio of correct/incorrect root causes			number of correct root links		
	B	SE	$\beta$	B	SE	$\beta$
Prior to online discussion						
Total causal links	-.448	1.606	-.065	-.015	.037	-.089
Ratio of temporal flow	-.805	.508	-.362	-.020	.012	-.372
Outcome node position	-.040	.037	-.267	-.001	.001	-.341
Following online discussion						
Total causal links	-2.935	2.176	-.263	-.247	.099	-.554*
Ratio of temporal flow	.796	.223	.722**	.014	.010	.321
Outcome node position	-.021	.047	-.092	.001	.002	.143

\* $p<.05$ . \*\* $p<.001$ .

## Discussion

The findings in this case study (though not conclusive) suggests that asking students to position nodes in temporal sequence might inhibit students' ability to identify the correct root causes when students are producing their *initial* causal maps (before discussion). It is possible that when students re-position one node closer to another node (but farther away from other nodes) based on the consideration of their temporal relationship, the nodes increased distance from *other* nodes (and reduction in visual proximity) may lead students to skip and omit from consideration other possible relationships with a given node. In other words, imposing temporal flow early in the map construction process may inhibit the brainstorming process and consideration of all possible relationships between nodes. As a result, this might push students to prematurely take specific courses of actions that lead to less accurate maps.

However, the findings also suggest that once students are given the opportunity to discuss and compare their maps (and have winnowed down in number the possible cause-effect relationships), imposing temporal sequence may actually help students correctly identify root causes. The results show that an increase in temporal flow by one standard deviation while holding total causal links and outcome node location constant can potentially increase the ratio of correct/incorrect root causes by .722 standard deviations. One possible explanation for this

finding is that the process of positioning nodes in temporal sequence creates new options or opportunities to articulate and refine the causal chains and identify the causes that mediate root causes and outcomes. This finding is somewhat contrary to previous findings where hierarchical structure was found to have no effect on accuracy (Ruiz-Primo, 1997). However, computing temporal flow in each student's map in this particular case study did not pose any methodological problems as it did in the study conducted by Ruiz-Primo et al. The differences in measures between this study and the study by Ruiz-Primo et al. may have contributed to the differences in findings.

The other main finding in this study suggests that if a limit is imposed on the number of causal link within a map to promote parsimony (or if students are encouraged to reduce the number of causal links in their maps), students are better able to correctly identify root cause links. This finding was consistent with the negative correlation found between total links and ratio of correct/incorrect root causes. A plausible explanation for this finding is that the students that tended to insert excessive numbers of links into their maps may have been the students that: (a) tended to link all nodes that are causally related regardless of whether they are directly or indirect related; and (b) are not able to identify the correct causal chains and mechanisms underlying the complex phenomenon/problem.

### Future Research & Development

The findings in this study are not conclusive. Nevertheless, the preliminary findings provide ideas as to what and when to impose specific types of tasks and/or software constraints on the causal mapping process. Some directions for further research are the following: a) control for individual differences in knowledge and understanding of the concept/problem under study in order to fully determine the effects of students' knowledge and skills with causal maps on map accuracy; b) increase size of sample and data corpus; c) set the default location of the outcome node at the center of the screen rather than to the right portion of the screen in order to fully assess the effects of initial node location; d) measure final node location relative to the right edge of the screen (rather than left edge) if temporal flow is left to right rather than right to left; e) integrate these rules/constraints into jMAP to conduct a controlled experimental study to test and determine the effects of limiting number of links, manipulating the option to create links that can point in any or in only one direction, and intentionally varying the default location of outcome nodes; f) consider how the effects of each constraint vary when examining causal maps across different domains or topics that are or are not naturally temporal in nature; and g) test other metrics for assessing the accuracy of students' maps in relation to an expert map or in relation to a map representing that of the collective group.

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# **The effects of guided inquiry questions on students' critical thinking skills and satisfaction in online argumentation**

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## **Abstract**

The purpose of this study was to examine the effects of scaffolding in a form of inquiry questions on students' critical thinking and satisfaction in online argumentation. Twenty-two graduate students in a distance learning course were randomly assigned to one of two groups. Each student in the experimental group participated in an online discussion activity a) with guided inquiry questions or b) without these questions. Results indicated that although providing guided inquiry questions had a positive effect on students' critical thinking, it did not have an effect on students' satisfaction. These findings and previous research in this area imply that scaffolding such as guided inquiry questions can be used to promote students' critical thinking in online learning environments and increase students' positive attitudes toward online learning.

## **Introduction**

In online settings, it is important that instructors provide scaffolding to enhance students' critical thinking skills and maintain learner motivation, especially when students are involved in a task that requires higher order processes such as critical thinking. Online argumentation is widely used as a strategy enhancing students' critical thinking process (Nussbaum & Schraw, 2006) and facilitating students' understanding of content. In most cases,

however, online students are asked to communicate with learning materials alone. There are many challenges confronting instructors in online discussion settings, such as lack of efficiency of conversation, interactive guidance, and immediacy of feedback (Wang & Woo, 2007). Without well structured guidance and instructional supports, students may therefore not achieve their learning goals and lose learning motivation.

Providing guided inquiry questions may supports students' critical thinking skills in learning contexts where the instructor's involvement is limited (King, 1992; Belland et al., 2008; Gillies & Khan, 2009). Guided inquiry questions are a set of questions that require students to focus on key factors in learning materials. These questions help students gather information and construct evidence-based arguments. Several studies have investigated the effect of using the inquiry questions in online discussion and argumentation (e.g., Bradley et al., 2008; Ge, Chen, & David, 2005; Golanics & Nussbaum, 2008; Oh & Jonassen, 2007). The Ge, Chen, and David (2005) study showed that the elaborated features in inquiry questions helped students to consider, compare, and determine a reasonable solution as well as to evaluate those thinking processes in ill-structured complex contexts. Furthermore, providing these questions also may increase students' satisfaction, because guided inquiry questions may decrease students' cognitive load which in turn increases learner achievement. Palmer and Holt (2008) found that providing instructional supports in online courses has a positive effect on students' satisfaction.

Although recent studies have attempted to show the effect of the questioning technique in online argumentation reflecting a complex problem (Cho & Jonassen, 2002), few empirical studies provided content-oriented inquiry questions. Earlier studies mostly provided procedural-oriented inquiry questions which only provide directions on how to participate in online argumentation. In addition, no studies have assessed students' critical thinking skills through a separate post-test based on a case analysis problem. Furthermore, few studies have investigated students' satisfaction with online learning activities using guided inquiry questions.

The purpose of this study was to examine the effects of guided inquiry questions on students' critical thinking skills and satisfaction in online argumentation. One group of students in our study received guided inquiry questions while they participated in an online discussion; the other group did not receive these questions. Students' critical thinking skills were measured by an essay writing test. This study defined the critical thinking skills as students' ability to gather and analyze relevant information in order to draw evidence-based conclusions and generate solutions. In addition, the study evaluated students' satisfaction with their online learning activities.

The study hypothesized two results. First, students who were provided guided inquiry questions would score significantly higher on the posttest than their counterparts. Existing research has found that inquiry questions promote critical thinking in online argumentation (Zydney, 2008; Ge & Land, 2003). Second, students who participated in online argumentation with guided inquiry questions would indicate higher satisfaction than students who participated without inquiry questions. Without these questions, students should expend more cognitive effort, which may cause cognitive load and decrease students' motivation.

## **Method**

### **Participants**

The participants in this study were 22 graduate students enrolled in an online graduate course at one of the state universities in Florida. Five students were attending the doctoral program and 17 students were attending the masters program in the College of Education. Nine students were male and 13 students were female. There were 3 international students (all from East Asia) and 19 Americans. All students gave their consent to participate in this experimental study. One student did not participate in the manipulated activity and one student did not submit the post-test. Since this study regarded those two participants as missing data, there were a total of 20 data sets.

### **Materials**

This online course was served by its own website embedded in BlackBoard which is widely used as a learning management system in many universities in the US. The course website serves text-based weekly instruction including learning objectives, hyperlink resources, and activity descriptions. During week 7, students

were required to read book chapters and journal articles about needs and barriers in developing distance education. All students had opportunities to review what they read in a summary page which contained important information excerpted from the week 7 readings. The information in the summary page guided students to consider key factors in developing a distance education program. To make sure students understood all the key factors, an optional quiz was provided. In the subsequent online argumentation, the case analysis problem required that students argue whether or not a make-believe country should develop a distance education program. Online discussion forums were developed by functions in BlackBoard system.

## Independent Variable

The independent variable in this experiment was the set of guided inquiry questions for the online argumentation. The guided inquiry questions, constructed by synthesizing given reading materials, were designed to guide students in applying important information to a situated learning activity. Students in the treatment group participated in online argumentation with the guided inquiry questions, while students in the control group participated in online argumentation without the guided inquiry questions.

The set of guided inquiry questions (totaling 19 questions) was developed by an instructor and three graduate assistants. The questions covered nine key factors and one supplementary factor, so that students could justify their decision-making on the case analysis problem by responding to those questions. Given factors in content-oriented inquiry questions were matched with the information presented in the summary page. The questions were expected to assist students in elaborating rationales for supporting their arguments. For example, having a question such as “what kind of media may support the delivery of a distance program?” might lead students to reason whether the make-believe country has an appropriate delivery condition for distance education or not. A set of inquiry questions was provided on the left side of the screen as a separated frame (see Figure 1), so that students could follow the questions without changing the screen while analyzing the given case and writing evidence-based arguments.

**Elaborated Questions**

Following questions will guide you to think more deeply on the given debate topic. Determine your position whether NED should develop distance education or not. *Provide your rationales and reasons to support your position. Try to elaborate your thoughts about the pro and cons by considering the following questions.*

- From the **administrative structure** point of view:
  - Does NED have sufficient financial support to develop distance education?
  - Do you think NED has decent national regulation on educational budget?
- From the **delivery system** point of view:
  - What kind of technology (media) or infrastructure may support the delivery of distance programs?
  - Do NED people possess appropriate devices (e.g. radio, TV, computer and so on) that can be used for distance education?
- From the **demographic variables** point of view:
  - How might age distribution of NED population affect the needs for distance education?
  - How might various occupations in NED affect the needs for distance education?
  - How might differences in educational background affect the needs for distance education?

**Course Discussions: Activity 7.3 (Debate) Assess & analyze needs, learners & context**

	Date	Thread	Author	Status	Tags	Unread Posts	Total Posts
<input type="checkbox"/>	10/3/09 11:44 AM	<a href="#">Instructor Comments</a>	Woon Jee Lee	Published		0	4
<input type="checkbox"/>	10/2/09 3:48 PM	<a href="#">OPPOSING ARGUMENTS to develop program</a>	Woon Jee Lee	Published		27	28
<input type="checkbox"/>	10/2/09 10:54 AM	<a href="#">SUPPORTING ARGUMENTS to develop program</a>	Woon Jee Lee	Published		26	37

Figure 1. Screen capture of the BlackBoard discussion forum with guided inquiry questions

## Dependent Variables

This experimental study measured students' critical thinking skills and students' satisfaction after finishing the required online argumentation activity.

Students' critical thinking skill was measured by a post-test which asked students to write an essay of at least 300 words. In the essay test, students were given a new case analysis problem in which they were asked to determine whether a different make-believe country should develop a distance education program or not. The test instructions indicated that students should provide a rationale for their position. To evaluate the essay, the instructor and three graduate assistants developed a standard assessment rubric based on McLean's (2005) criteria for evaluating the quality of critical thinking: clarity, relevance and breadth (or depth). The standard assessment rubric contains 10 items: one item for evaluating clarity in posing the position and rationale; one item for evaluating relevance of focus on the topic and the case; and eight items for evaluating how broadly or deeply the evidence is considered in their reasoning process. To ensure a fair assessment, required elements in the last eight items were matched with the key factors in the summary page, which every student could access. The score range for each item was 0 to 2 points. The possible maximum score was 20 points.

The students' satisfaction survey was conducted by an online assessment tool in BlackBoard, using 10 items. Seven items focused on learner-content interaction and three items on general satisfaction, based on Strachota's (2006) five constructs of measuring student satisfaction with online learning. Learner-content interaction is satisfaction with the subject matter which includes course content, lessons, learning activities, assignments, and the course website. General satisfaction focuses on whether students' needs have been met (Strachota, 2006). Responses to the items were in the form of a five-point Likert scale: strongly agree, agree, neither agree nor disagree, disagree, and strongly disagree.

## **Procedures**

Stratified random assignment was used to allocate subjects to the treatment group with guided inquiry questions and the control group. Because of the small sample size, pure random assignment potentially threatened the homogeneity between the two groups. In this experiment, gender and level of participation were used in the stratified random assignment. In particular, the number of messages posted in the previous online discussion was used to determine the stratification of high and low participation. Each group had 11 students. After eliminating the missing data, the number of participant in each group was 10 subjects.

During week 7, students in both groups were asked to finish given readings and to review the readings through the summary page and the optional quiz. They were then required to participate in online argumentation with the same case analysis problem, but using two different web pages. Students could access only one of two group discussion forums. The activity description indicated that students in both groups should write their rationale to support their determined position by posting a minimum of 4 messages in the discussion forum. In the online argumentation, only those students working with the guided inquiry questions were asked to answer each question to support their arguments, while students in the control group made their arguments without guided questions.

During week 8 and week 9, as a portion of the midterm exam, students were required to write an essay of at least 300 words about the new case analysis problem. Two graduate assistants evaluated the students' essay writings based on the standard assessment rubric. In addition, students were asked to complete the online satisfaction survey.

## **Results**

All statistical tests were conducted using an alpha level of .05. No serious violation of normality or homogeneity of variance was found. The data were analyzed using an independent-sample t test for each dependent variable.

### **Critical thinking skills**

Two raters separately evaluated the post-test. Both raters used a blind grading method and followed the standard assessment rubric for the essay writing. The score range in the standard assessment rubric was 0 to 20 points. The allowed rate of score difference was 15% (3 points) in this experiment. Based on Pearson's Correlation, the inter-rater reliability for the post-test was .876. A review of the data revealed that there was no violated

assumption of normality and homogeneity variance ( $p=.331$  based on Levene's Test). With alpha set at .05, two-tailed condition, and 10 participants per group, the probability of detecting a difference between means was .62.

Table 1 presents the means and standard deviations on the post-test scores of critical thinking skill across the two groups, with and without the guided inquiry questions. *T* test analysis was applied to compare the mean difference between two groups. The group provided with guided inquiry questions scored significantly higher on the essay writing test than the group not provided with inquiry questions,  $t(18) = 2.392$ ,  $p=.028$ . Effect size was  $d=1.07$ , indicating a large effect (Cohen, 1988). Consistent with the first hypothesis, students who participated in the online argumentation with guided inquiry questions demonstrated higher critical thinking skills than students who participated without inquiry questions in the post-test.

Table 1  
*Means and standard deviations of students' critical thinking skill across groups*

Groups	Essay writing test <sup>a</sup>	
	Mean	SD
Without guided inquiry questions (n=10)	13.40	2.97
With guided inquiry questions (n=10)	16.35	2.53

<sup>a</sup> Maximum possible score was 20.

### Satisfaction

Of the 10 items in the students' satisfaction survey, the first 3 items measured general satisfaction and the last 7 items measured satisfaction with the learner-content interaction. Each item was answered using a five-point Likert scale. Based on Cronbach's Alpha, satisfaction survey items had a reliability of .894.

Table 2 presents the means and standard deviations for the satisfaction survey for the two groups. *T* test analysis was applied to compare the mean difference between two groups. The groups did not differ significantly on general satisfaction,  $t(18) = .109$ ,  $p=.362$ , on learner-content interaction,  $t(18) = .113$ ,  $p=.635$ , or on total satisfaction,  $t(18) = .116$ ,  $p=.467$ . Students who participated in online argumentation without guided inquiry questions expressed a level of satisfaction with their learning activities as high as students who participated in online argumentation with guided inquiry questions.

Table 2  
*Means and standard deviations of students' satisfaction across groups*

Groups	Satisfaction survey <sup>a</sup>					
	General satisfaction		Learner-content interaction		Total	
	Mean	SD	Mean	SD	Mean	SD
Without guided inquiry questions (n=10)	4.17	.63	4.16	.53	4.16	.54
With guided inquiry questions (n=10)	4.20	.76	4.19	.58	4.19	.62

*Note.* Among total 10 items in satisfaction survey, item1 through item 3 asked general satisfaction and item 4 through item 10 asked satisfaction of learner-content interaction.

<sup>a</sup> A five-point Likert scale ranged from 1 (strongly disagree), to 5 (strongly agree).

### Discussion

Supporting the first hypothesis of the study, students provided with guided questions showed a higher level of critical thinking in their evidence-based arguments than students not provided with these questions. The positive effects of guided questions on critical thinking were believed to be because students were able to use various points

of view. This finding is consistent with past studies which have shown that guided questions stimulate students' deep thinking process to generate evidence-based arguments in solving a complex problem (Bradley et al., 2008; Ge, Chen, & David, 2005; Golanics & Nussbaum, 2008; Oh & Jonassen, 2007).

This positive effect of the guided inquiry questions can be explained by the fact that responding to inquiry questions helps students' cognitive and metacognitive activities. The process of responding to inquiry questions stimulates students to analyze information in a given complex context, and then thinking more broadly or deeply to articulate, justify, and reflect on their arguments (Ge & Land, 2003). In this study, the students with guided inquiry questions were well scaffolded to foster their critical thinking skills which involved processes of analysis, articulation, justification, and reflection.

Contrary to the second hypothesis, there was no difference between two groups in relation to levels of satisfaction. Students in both groups reported high general satisfaction and high satisfaction of learner-content interaction. There may not be one reason for their high level of overall satisfaction, because different learners have different perceptions or standards in relation to their learning. In the satisfaction survey, some of descriptive responses said that the argumentation activity motivated students in the online course. The online argumentation has been considered an alternative strategy to engage students more in online discussion (Golanics & Nussbaum, 2008). In addition, some students mentioned that they felt an authenticity from the invented case which presented a complex problem that was likely to happen in the real world.

In distance learning, improving students' critical thinking and increasing students' motivation are important issues. These findings provide empirical evidence for distance learning educators and instructional designers to use guided inquiry questions when they want to enhance students' critical thinking as students solve complex problems in online learning environments. Although this study did not support the effect of scaffolding on students' satisfaction with online learning, providing appropriate scaffolding may increase students' motivation in terms of confidence and satisfaction. This study indicates that providing guided inquiry questions may be a good strategy to improve students' critical thinking skills and suggests future research on the effects of scaffolding on students' satisfaction in online learning would be valuable.

### **Limitations and future suggestions**

The study had some limitations. First, we administered the post-test immediately after the one week online argumentation activity. Consequently the results do not indicate the effect of the guided inquiry question on retention of improved critical thinking skills. Second, the post-test provided a new case analysis problem which was very similar to the case provided in the online argumentation. As a result we cannot assume that students can transfer their critical thinking skills to new learning situations. Additional research is needed in which a long-term assessment with different cases analysis problems in the post-test is administered.

In future research, the attributes of participants could be treated as an independent variable in order to determine how the guided inquiry questions might affect learners who differ by gender, age, prior experience in either domain knowledge or an online course, and the level of self-regulation. Moreover, there are other types of scaffolding suggested by other researchers in the area of pedagogical approaches (Hmelo-Silver et al., 2007). In the satisfaction survey one student described the need for a step-by-step exercise in analyzing the given case which can be presented as a fill-in response by sequential questions. Building on this, future research could consider the different types of scaffolding such as the process work sheet and the worked example in evidence-based argumentation.

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# **Generational Differences at a Hispanic Serving Institution: An e-Learning study**

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## **Abstract**

Is there any generational difference among Hispanic learners in the arena of e-learning? This quantitative inquiry is intended to study students' technology ability, learning activity preference, attitude towards technology use, and instructional strategy orientation at a Hispanic serving institution of higher education in a university along the southern border with Mexico. The finding from a previous study used a straightforward t-test comparison of variance and determined that age was the dominant factor affecting learners' orientation toward instructional strategy. However, does this observation still hold true after controlling for the students' preferred course delivery mode and academic status? Limitations and recommendations are also be stated.

## **Introduction**

Past literature of generational differences seems to acknowledge the significance of attending to unique characteristics of each age generation (Aro, Rinne, Lahti, & Olkinuora, 2005; Borrero, McGinnis, McNeil, Frank, & Conigliaro, 2008; Hammill, 2005; Mishler & Rose, 2007; Waddell, 2004).

This quantitative inquiry was designed to investigate generational differences in the (a) learners' technology ability (TA), (b) learning (activity) preference (LP), (c) attitude toward use of technology (e.g., email) that are commonly used in learning online (ATT), and (d) instructional strategy orientation (IS) within a Hispanic-serving institution on the southern border with Mexico. More importantly, the investigation is intended to synthesize findings and extrapolate implications for practitioners and researchers interested in a similar study.

Besides the four latent factors previously mentioned, Hispanic learners' demographic information (e.g., age) is taken into account in this research. Generational differences in this quantitative study may refer to any cognitive, psycho-motor, affective, and interpersonal discrepancies of learning online due to age differences. These differences among generations (i.e., Baby Boomers, Generation X, and Net Gen) appear to raise an instructional design issue for professors who teach online and instructional developers who assist the faculty in developing online courses (Feiertag & Berge, 2008). The issue can be multi-faceted. Two of these issues which the authors hoped to address can be understood as follows.

1. Are there any differences between age groups in their respective perceptions or beliefs of online learning?



2. To what extent do these differences in the four factors affect the decision-making process of the course design and development?

The results of this survey study were expected to inform online course developers and cyber instructors of potential instructional strategies that may be taken into account in the design and development of a course with an online component integrated. It was also anticipated that their students will better enjoy their learning experience in an online environment in light of this study.

### Literature Review

Using language acquisition as an analogy, Prensky (2001) used two terms, “digital natives” and “digital immigrants” in an attempt to explain the contrast between those who grew up with the Internet and digital devices and those who were born before the Internet was created. Native speakers acquire their first language or mother tongue effortlessly compared to those who speak the language as a second or foreign language. In this context, digital natives are characterized as those who are relatively comfortable or proficient in terms of interacting with the computer and other technology devices. Such comfort or proficiency is so pronounced that it can be associated with speaking a native language. Digital immigrants are those who did not grow up with the Internet, so the way they interact with the computer or the Internet may not be similar, possibly not even as comfortable, as their generally younger counterparts. Furthermore, Prensky (2005) claimed that younger learners are now able to achieve learning through a mobile phone. Older learners would not normally consider such an activity or behavior to be a typical, common place behavior for learning in everyday life other than possibly calling “411” for information. Despite that fact that empirical findings seemed missing from Prensky’s arguments, this noticeable dichotomy has suggested that as more and more digital natives are going to college, a study on whether or not college courses ought to be redesigned in an attempt to address the dichotomy is not only timely, but has gained further traction (Carlson, 2005).

Are digital natives and digital immigrants so different? There seemed to be a generational difference in learning soft skills (a.k.a. people skills) across “Traditionals,” “Baby Boomers,” “Generation X,” and “Generation Y” (Tolbize, 2008). Tolbize (2008) found that younger workers prefer assessment and feedback whereas older generations favor classroom instruction. Even so, strategies such as “on the job training, discussion groups, peer interaction and feedback, and one-on-one coaching” are popular across the four generation groups. On the other hand, Tolbize contended that when it was concerned about hard or technical skills training these workers prefer a similar instructional design. This is one observation from the workforce. Another observation came from a report by Reeves (2008). Reeves stated, “Generational differences are evident in the workplace, but they are not salient enough to warrant the specification of different instructional designs or the use of different learning technologies” (p. 21).

What about higher education? According to Garcia and Qin’s (2007) findings, the Net Generation (i.e., digital natives) and non-Net Generation (i.e., digital immigrants) may differ from each other with regard to the ability to operate a technological device in favor of the natives. However, both groups showed no difference in their perception of an effective instructional activity; both desired more interaction with the instructor through class lectures and discussions. Stapleton, Wen, Starrett, and Kilburn (2007) found that Millennials (i.e., Net Gen) have a tendency to interact or collaborate with their peers through various technologies, but when it comes to their own perceptions of learning in online courses, there is not any difference than other age groups. The four researchers warned that the age differences should not be considered the only single factor that determines students’ successful learning or satisfaction with online learning. Billings, Skiba, and Connors (2005) compared the undergraduate nursing students’ (i.e., mostly Net Gen) perception of experiences in Web-based courses to their graduate nursing students (i.e., primarily Generation X). As a result, they discovered that Net Gen likes to take the responsibility for their own learning and develops a similar perception for the use of technology and a similar concept of professionalism, just like other generations, regardless of some differences in educational practices. Thus far, the research on generational differences has not clearly shown much significant difference between Net Gen and non-Net Gen with respect to a favored learning environment. This is one of the motivations behind this investigation. Since most of the studies mentioned earlier targeted primarily non-Hispanic student population, another motivation of this paper lies in a question, “How do the two age groups differ in the e-learning environment that predominantly services a Hispanic student body?”

This cursory review of the relevant literature suggested that, at present, there is a potential gap in the literature regarding the possible effect of ethnicity, possibly compounded by age in students’ effective participation in online learning. The present investigation was intended to explore this generational differences issue by targeting Hispanic learners, specifically Mexican American learners. One primary question investigated in this research effort

reads as follows, “Is there any significant difference between age groups in the four factors (i.e., TA, LP, ATT, and LS)?” Three follow-up questions were attempted to further the inquiry related to e-learning.

1. Is there any significant difference among three course delivery modes in the four factors?
2. Is there any significant difference between academic status groups (graduate vs. undergraduate) in the four factors?
3. Does the effect of age on the four factors remain significant when controlling for course delivery mode and academic status?

### Method

As aforementioned, this quantitative study was designed to study how age can affect TA, LP, ATT, and LS using a Hispanic student population. The setting of this quantitative study was located in the online learning environment, empowered by Blackboard Course Management System within a state university in South Texas, U.S.A. According to Santiago (2006), the university is a Hispanic-serving institution (HIS) with approximately 94 percent of total undergraduate Hispanic full-time equivalent student enrollment.

Target population was the entire student body, including both graduate and undergraduate, that is enrolled in any class that has an online Blackboard component in it. The accessible population consisted of those students whom investigators are given instructors' permission to survey. The surveyed students must be at least 18 years old and participate in this study on a voluntary and anonymous basis. As suggested by Hartman, Moskal, Dziuban (2005), participants are divided into three age groups: (a) those born before 1965 (aka Baby Boomers), (b) those born in 1965 through 1980 (aka Generation X), and (c) those born after 1980 (aka Net Gen).

This study was launched in the summer of 2008. As of September 2009, 177 students have successfully responded to the questionnaire. Of all, 140 are Hispanic learners, with 11 identified as baby boomers, 54 as of Generation X, and 75 of Net Gen. Additionally, two out of 140 cases were removed from the dataset because of missing data.

Data were collected using a password-protected computer server through an online questionnaire. The questionnaire was composed of six instruments, but for the purpose of this phase of investigation, Behavior Pattern Instrument was excluded. The five instruments are as follows:

1. Demographics Instrument (9 questions), measured on a nominal scale
2. Technology Ability Instrument (25 questions), measured on an interval scale
3. Learning Preference Instrument (27 questions), adapted from the work by Loo (2004), measured on an interval scale
4. Attitude Instrument (20 questions), adapted from the work by Ajzen and Fishbein (1980), measured on an interval scale
5. Instructional Strategy Instrument (8 questions), adopted from the work by Tapscott (1997), measured on an interval scale

Demographics Instrument dealt with variables, such as sex, birth year, and academic major. Technology Ability Instrument included questions that deal with respondents' perceived ability in technology use, such as “I can use Google Docs Spreadsheet” and “I can download photos from a digital camera.” The Learning Preference Instrument was concerned with respondents' preference in the classroom activity. Of all, two questions were, “I like in-class group projects as a class activity” and “I like writing reflection as a class activity.” The Attitude Instrument was composed of questions in regard to respondents' attitude toward technology use. Two of the questions/statements included were, “All things considered, my use of Blackboard is negative vs. positive” and “All things considered, my use of electronic devices is negative vs. positive.” Instructional Strategy Instrument encompassed questions with respect to respondents' preference of strategies commonly used in the instructional setting. Two sample questions/statements from that instrument were, “All things considered, my preference of instructional strategies below is teacher-centered vs. learner-centered” and “All things considered, my preference of instructional strategies below is school as torture vs. school as fun.”

Technology Ability and Learning Preference Instruments both were measured on a five-point Likert scale with “1” as strongly disagree, “5” as strongly agree, and “3” as neutral. The higher the composite scores are on each of the two instruments, the more agreeable the respondents are. On the other hand, Attitude and Instructional Strategy Instruments both adopted a five-point bipolar semantics scale. The higher the composite scores are Attitude Instrument, the more favorable or positive the responses are. For Instructional Strategy Instrument, the higher scores, the more learner-centered. The questionnaire was administered at one occasion in the beginning of the semester, which begins in the third week and end in the fifth week of the Fall and Spring semesters. In both Summer semesters in 2008 and 2009, the administration began in the second week and end in the fourth week. With instructors' prior

approval, investigators emailed the consent form through Blackboard email system. Data sets will be purged from all the computer hard drives in five years after the research begins (by the end of spring 2013) as regulated by the institutional review board that approved the project in May 2008.

Data sets were exported from the password-protected computer server to Microsoft Office Excel before entered to the SPSS program. Due to the number of the participants, the baby boomers group and the Generation X group were combined. The merged group was then named, Non Net Gen. Among others, statistical procedures, such as multivariate analysis of variance (MANOVA) and multivariate analysis of covariance (MANCOVA), were adopted for further data analysis.

## Results

A Cronbach's alpha reliability testing was conducted to test the reliability of the four instruments on the interval scale adopted or adapted from the literature. Alpha values were .92 for Technology Ability (TA) Instrument, .85 for Learning Preference (LP) Instrument, .93 for Attitude (ATT) Instrument, and .77 for Instructional Strategy (IS) Instrument. The results indicated that the four instruments were reliable and all were consistent with earlier studies with fewer participating students (e.g., Pan, Zhang, & Sullivan, 2009). In replicating the earlier phase of the investigation using a slightly larger sample and a different statistical procedure, MANOVA was used, Wilks's Lambda = .88,  $F(4, 125) = 4.46, p = .002$ . With ANOVA as a follow-up procedure and tested at the .0125 level, of all, the scores on ATT and IS were found significant,  $F(1, 128) = 11.66, p = .001$  and  $F(1, 128) = 9.67, p = .002$ .

To answer Research Question 1, "Is there any significant difference among three course delivery modes in the four factors?" MANOVA was used, Wilks's Lambda = .82,  $F(8, 222) = 4.46, p = .004$ . With ANOVA as a follow-up procedure and tested at the .0167 level, of all, the scores on IS were found significant,  $F(2, 114) = 6.65, p = .002$ .

To answer Research Question 2, "Is there any significant difference between academic status groups (graduate vs. undergraduate) in the four factors?" MANOVA was used, Wilks's Lambda = .79,  $F(4, 103) = 4.46, p < .001$ . With ANOVA as a follow-up procedure and tested at the .0125 level, of all, the scores on IS were found significant,  $F(1, 106) = 11.42, p = .001$ .

To answer Research Question 3, "Does the effect of age on the four factors remain significant when controlling for course delivery mode and academic status?" A MANCOVA result indicated that the effects of age on the four factors do not remain significant when controlling for course delivery mode and academic status, Wilks's Lambda = .94,  $F(4, 123) = 2.04, p = .093$ .

## Conclusions

The primary purpose of this phase of investigation with a larger sample ( $N=138$ ) was to study the effect of age on four dependent variables, scores on Technology Ability, Learning Preference, Attitude, and Instructional Strategy Instruments using Mexican American students. The MANOVA results indicated that age has a significant effect on these students' attitude toward technology use and their preference of strategies commonly used in the instructional setting. Both outcomes were in favor of non-Net Gen group, which is congruent with the earlier findings (see Pan, Zhang, & Sullivan, 2009). This suggested that non-Net Gen group has a more favorable attitude toward technologies such as Blackboard, email, and electronic devices (in general) than the Net Gen group. This also suggested that the non-Net Gen group prefers an instructional strategy that is more non-linear, discovery-type, and in line with the learner-centered approach, than the Net Gen group. This finding is not consistent with what Prensky (2005) described about the Net Gen group. To further investigate this inconsistency, the authors examined any possible effect of two variables, delivery mode and academic status, and their influence each on the four dependent variables.

An attempt to determine whether course delivery mode (i.e. fully Web-based, hybrid, and face-to-face) has an effect on the four dependent variables was made using MANOVA. Pos hoc analyses to the ANOVA test for the IS scores showed that Fully Web-based group significantly scored higher than the Face-to-face group. Another MANOVA result indicated that academic status (i.e., graduate and undergraduate) has a significant effect on instructional strategy, suggesting graduate students are more in favor of the learner-centered approach than undergraduate students.

However, when controlling for delivery mode and academic status, age does not seem to exert any influence on any of the four dependent variables, suggesting that statistically speaking, the Net Gen and non-Net

Gen groups do not differ from each other in Technology Ability, Learning Preference, Attitude, or Instructional Strategy Instruments even though the non-Net Gen group seem to outperform the Net Gen group across the four variables. This could have been the fact that generally speaking those who participated in this survey study were either younger undergraduate students who were taking non-fully Web-based courses or relatively older graduate students who were taking fully Web-based courses. Regardless, the findings of this paper echoed previous studies by Billings, Skiba, and Connors (2005), Garcia and Qin (2007), Stapleton, Wen, Starrett, and Kilburn (2007).

So, there may be nuances between the two age groups, but the differences are too subtle to warrant any redesign of the online course solely based on the findings of this paper.

Having said all that above, the findings of this quantitative investigation are by no means expected to apply to the entire Hispanic college student body around the country. This was due to its small sample size, the volunteered convenience sample, and the accessible population, Mexican American students. It is recommended that the sample be enlarged using stratified random sampling for further analysis.

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# **Understanding and Supporting the Teachers Involved in Adopting a Mixed-Reality Embodied K-12 Environment**

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## **Abstract**

Supporting the K-12 teachers involved in adopting a radical educational innovation requires that they be understood on a personal level. By capturing teacher concerns at multiple points during implementation, change facilitators can design personalized interventions that help educators proceed through the adoption process. A study was conducted to explore how the Stages of Concern (SoC) component of the Concerns-Based Adoption Model (CBAM) could be used to better understand educators undergoing change and to facilitate their adoption of a mixed-reality embodied environment. Eight educators participated over the course of one academic year, with two receiving a personalized training intervention. The progress and patterns of adoption amongst the educators were systematically tracked and compared to gain insights about teachers experiencing change and how to design support interventions to facilitate adoption. In the end, the Stages of Concern proved to be an effective system for tracking, understanding, and supporting high school teachers in adopting this technological innovation.

## **Introduction**

A personal understanding of each educator involved in the change process is critical to the successful implementation of innovative technologies. Change implementation is not an instant in time, but rather is a process whose success or failure is determined at the personal level (Hall & Hord, 2005). Understanding individuals is crucial when dealing with a radical educational innovation, such as the Situated Multimedia Arts Learning Lab (SMALLab).

SMALLab is a mixed-reality environment that emphasizes embodiment, multimodal feedback, and collaboration as vehicles for learning. Its architecture consists of a cube-shaped metal frame with open sides. An attached array of motion-capture cameras tracks objects within its boundaries, while a projector and speakers provide users with real-time audiovisual feedback (Hatton, Birchfield, & Megowan-Romanowicz, 2008). In this system, students simultaneously interact with each other and dynamic multimedia (text, graphics, sounds) through three-dimensional movements (Johnson-Glenberg, Birchfield, Megowan-Romanowicz, Tolentino, & Martinez, 2009). SMALLab has been studied in terms of student learning outcomes and has shown positive results in science (Birchfield & Megowan-Romanowicz, 2009, Johnson-Glenberg et al., 2009, Tolentino et al., 2009) and language arts (Hatton et al., 2008). The system is currently deployed in three U.S. high schools. In the Eastern United States, the SMALLab is part of an exploratory curriculum that focuses on game-based learning. In the southwestern United States, the newest SMALLab is being used in a student-driven design and development course. Also in the southwestern United States, the longest standing SMALLab installation has been used by multiple teachers in several subjects and has a history of professional learning communities and research partnerships. For these reasons, this study explored the experiences and perceptions of the teachers incorporating SMALLab into their practice at the latter high school.

The Concerns Based Adoption Model (CBAM) was developed to help facilitators to address individual adoption needs (Hall & Hord, 2005). One CBAM component, the Stages of Concern (SoC), describes the developmental pattern by which most innovation adopters follow (George, Hall, & Steigelbauer, 2008). Its accompanying measure, the Stages of Concern Questionnaire (SoCQ), was used to learn about SMALLab educators. Teachers' responses to the SoCQ addressed the following research questions.

1. How can SoC be used to better understand the adopters of a radical educational innovation?
2. How can SoC be used to design appropriate interventions for the adopters of a radical educational innovation?
3. How can SoC be used to assess the impact of designed interventions?

## Methods

### Participants

Eight teachers from a high school in the southwestern United States participated in this study ( $n = 8$ ). This location has a dedicated SMALLab installed on-site. The educators have incorporated SMALLab into their curriculum to varying degrees. They are diverse in terms of teaching experience and technical knowledge. Four are male and four are female. Of the eight teachers, four work in science, three work in English language development, and one works in special education. Although these educators received a stipend for participating in SMALLab professional learning communities, their decision to partake in this study was voluntary.

### Procedures

During the fall 2009 semester, between October 22 and November 16, each educator completed the SoCQ for the first time. On January 21, 2010, two teachers, who were to receive a training intervention during the spring semester, again completed the SoCQ. Near the end of the spring 2010 semester, between March 25 and April 12, each of the eight educators completed the final administration of the SoCQ.

### Intervention

Two teachers, one male and one female, who specialized in English language development, participated in a training intervention above and beyond that of the remaining study participants. The individualized training intervention was designed to assist the teachers in transforming their roles from primarily end-users of SMALLab modules to designers and developers of their own SMALLab content. Training activities consisted of operating the SMALLab hardware, generating multimedia and syncing it with the system, and using the SMALLab software to create and modify learning scenario templates. The development of these skills had not been previously fostered in teachers at the school. Both teachers participated in four two-hour sessions, for a total of eight hours of training. Three sessions involved two-on-one instruction (two teachers, one trainer), while the remaining session involved one-on-one instruction. The training intervention took place over a period of five weeks between January 21, 2010 and February 25, 2010.

### Instrument

The Stages of Concern Questionnaire (SoCQ) is a 35-item Likert-style survey that can be employed to understand the adopters of any innovation (Hall & Hord, 2005). The SoCQ is a well-known and validated instrument (Hall, George, & Rutherford, 1977) that has been used, from its inception to today, to understand the concerns of innovation adopters (LaRocco & Murdica, 2009, Chamblee, Slough, & Wunsch, 2008, Donovan, Hartley, & Strudler, 2007). It is designed to measure the concerns of individuals as they move through a developmental series of seven stages (Figure 1). Hall et al. (1977) described being concerned as "being in a mentally aroused state about something" (p. 5). Therefore, concerns can involve both negative and positive emotions and perceptions, as well as everything in-between. Following the 35 likert-scale items, the SoCQ can be appended with an additional page. In this study, open-ended questions regarding the educators' experiences, roles, and concerns in relation to SMALLab were included. These items were used to gather further insights about participants by allowing them to provide extended descriptions of their perceptions.

IMPACT	6	<b>Refocusing</b>	The individual focuses on exploring ways to reap more universal benefits from the innovation, including the possibility of making major changes to it or replacing it with a more powerful alternative.
	5	<b>Collaboration</b>	The individual focuses on coordinating and cooperating with others regarding use of the innovation.
	4	<b>Consequence</b>	The individual focuses on the innovation's impact on students in his or her immediate sphere of influence. Considerations include the relevance of the innovation for students; the evaluation of student outcomes, including performance and competencies; and the changes needed to improve student outcomes.
TASK	3	<b>Management</b>	The individual focuses on the processes and tasks of using the innovation and the best use of information and resources. Issues related to efficiency, organizing, managing, and scheduling dominate.
SELF	2	<b>Personal</b>	The individual is uncertain about the demands of the innovation, his or her adequacy to meet those demands, and/or his or her role with the innovation. The individual is analyzing his or her relationship to the reward structure of the organization, determining his or her part in decision making, and considering potential conflicts with existing structures or personal commitment. Concerns also might involve the financial or status implications of the program for the individual and his or her colleagues.
	1	<b>Informational</b>	The individual indicates a general awareness of the innovation and interest in learning more details about it. The individual does not seem to be worried about himself or herself in relation to the innovation. Any interest is in impersonal, substantive aspects of the innovation, such as its general characteristics, effects, and requirements for use.
	0	<b>Unconcerned</b>	The individual indicates little concern about or involvement with the innovation.

Figure 1. Stages of Concern About an Innovation. From George et al., 2008. Reprinted with permission.

#### Data Analysis

Educators' responses to the SoCQ were interpreted in adherence to the outlined protocols (George et al., 2008, Hall et al., 1977). Initially, each person's data were graphed on a diagnostic chart (Figure 2) called a "Stages of Concern profile" (George et al., 2008, p. 91). This profile represents the personal concerns of a given individual across the seven dimensions at a particular moment in time. A person's profile conveys the relative intensity of his or her concerns across all seven stages at that time. In accordance with the recommended interpretation methods (George et al., 2008, Hall et al., 1977), the educators' profiles were examined by looking at the overall shape, peaks and valleys, and relative position of the stages. Individual SoCQ item responses were also consulted.



## Results

For brevity, the results of the two teachers in the intervention group will be described here, along with comparisons to the profiles of the nonintervention group. It is hoped that these results will aid others in envisioning the information that is derived from SoC research.

### Intervention Group

Teacher A is a male, high school English language development teacher in his early fifties with several years of teaching experience, one year of SMALLab experience, and limited classroom technology integration experience. In October 2009, Teacher A's SoC profile (Figure 2) revealed high interest (low stage 0; for this one stage only, the scale is reversed) in learning (stage 1) about the SMALLab system and a notable concern for the system's impact on students (stage 4). By January 2010, nearly two months removed from SMALLab due to winter vacation, Teacher A showed lower interest in SMALLab (stage 0), but sustained a dominate concern in learning (stage 1) more about the system. In late March 2010, towards the end of the school year, Teacher A still showed a primary interest in exploring the SMALLab (stage 1) and had renewed collaboration concerns (stage 5). His overall interest in SMALLab (stage 0) returned to a more moderate level.

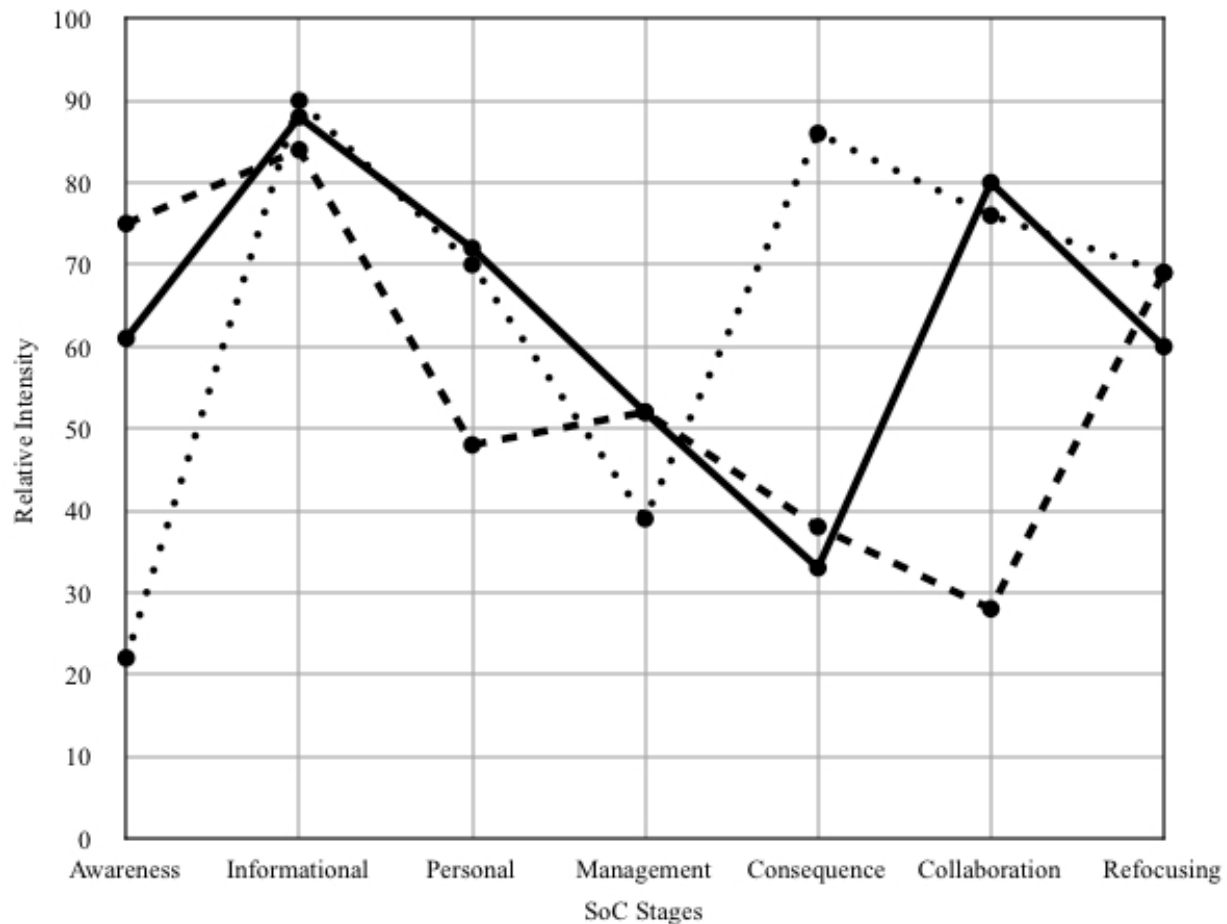


Figure 2. Teacher A's SoC profiles in October 2009 (dotted), January 2010 (dashed), and March 2010 (solid).

Teacher B is a female, high school English language development teacher in her early fifties with a few years of teaching experience, no SMALLab experience, and a zest for educational technology. In October 2009, her

profile (Figure 3) indicated intense interest in SMALLab (low stage 0) and concern about the impact that SMALLab would have on her students (stage 4). The remaining intensities in her profile were relatively moderate. By January 2010, Teacher B's profile was moderate across most stages (0, 2, 3, 4) and her dominant concern was learning more about SMALLab (stage 1). In late March 2010, Teacher B's profile exhibited a primary concern over the impact that SMALLab has on her students (stage 4). Meanwhile, she had lower early stage (1, 2, 3) and revision (stage 6) concerns.

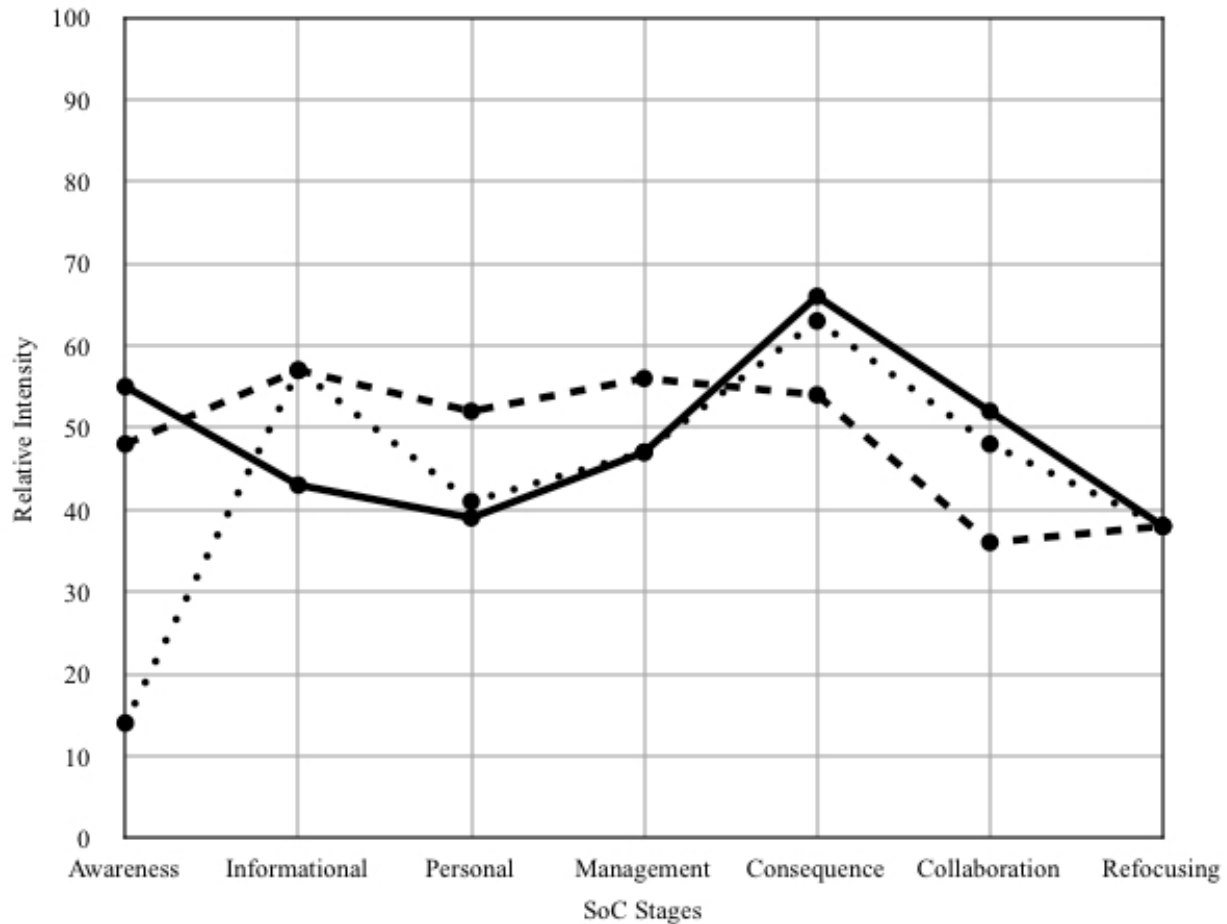


Figure 3. Teacher B's SoC profiles in October 2009 (dotted), January 2010 (dashed), and March 2010 (solid).

#### Nonintervention Group Comparison

The changes that took place in these two teachers over the course of the 2009-2010 school year can be further understood in the context of the teachers who did not experience the training intervention. In October/November 2009, the nonintervention group (Figure 4) showed moderate interest in SMALLab (stage 0) and was primarily concerned with learning more about the system (stage 1) and its collaborative aspects (stage 5). By March/April 2010, this group exhibited low interest in SMALLab (high stage 0), slightly increased collaboration concerns (stage 5), and moderate revision (stage 6) concerns. The group's remaining concerns remained largely unchanged.

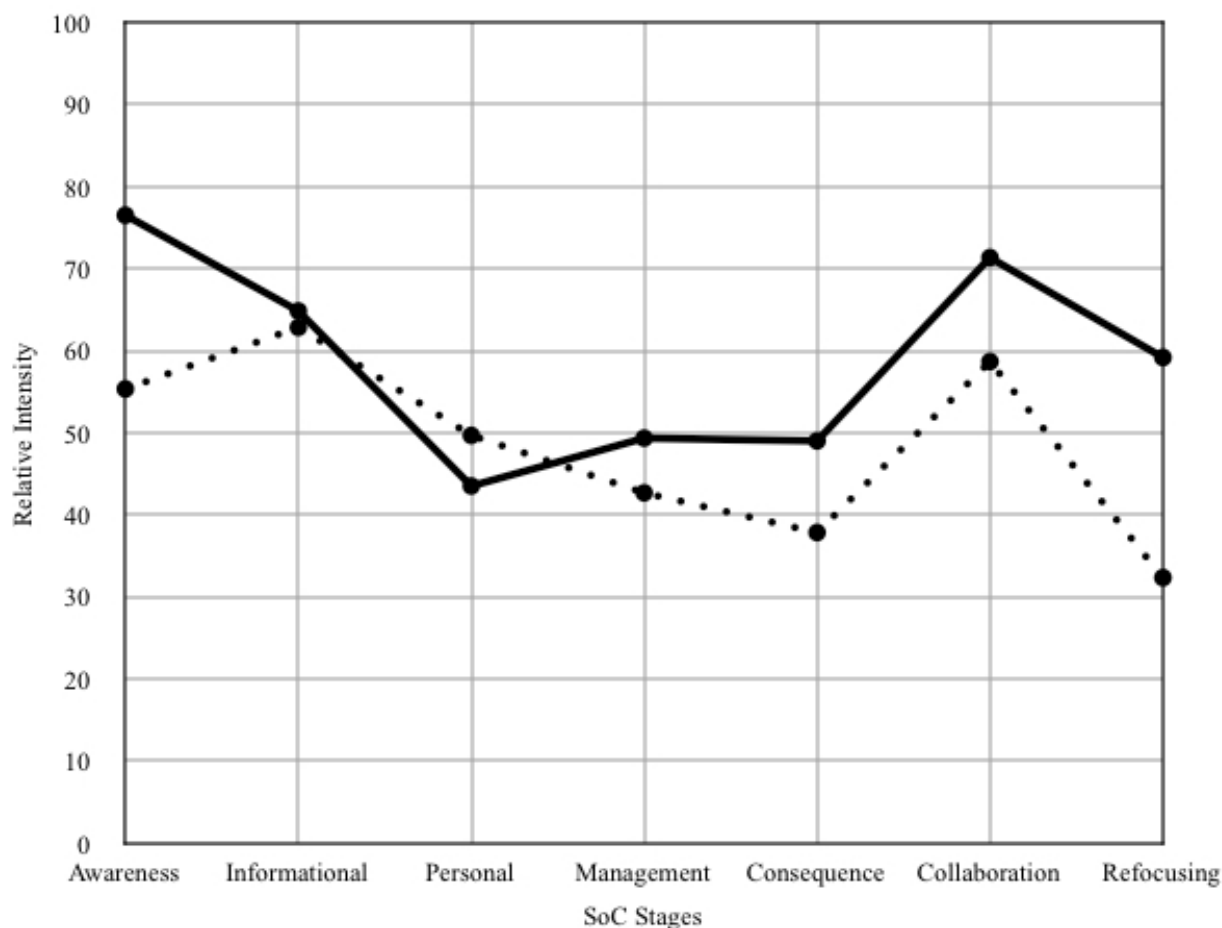


Figure 4. Nonintervention group SoC profiles in October/November 2009 (dotted) and March/April 2010 (solid).

## Discussion

### Understanding

The SoC can be used both to understand innovation adopters at instances in time and across the lifespan of the change process. When evaluating single time points, one should consider the sole SoC profile along with any open-ended responses. Doing so will help the researcher paint a picture of and comprehend the educator's role and position within the adoption process.

For instance, in October 2009, Teacher A was intensely interested in learning more about SMALLab and concerned about the impact that the system would have on his students. He also wrote of a need to incorporate more technology into his curriculum, as this was a part of his job function, but that he needed help doing so. At the same time, Teacher B was similarly interested in SMALLab and how it would impact her students. She saw herself as a liaison between university researchers and students.

To understand how innovation adopters change over time, one should consider how their concerns develop, shift, and alternate. This can be accomplished by considering an educator's SoC profile at multiple time points. For example, by January 2010, Teacher A had participated in an intensive collaboration effort to implement a unique socio-cultural language learning experience in his classroom (Martinez et al., 2010). His concerns about the impact of SMALLab diminished, likely because he felt that the new activity was beneficial to students. Simultaneously, his desire to explore SMALLab was sustained, logistics concerns increased, and revision concerns became notable. These indicate that he participated extensively within SMALLab during the fall semester and carried ideas for improvement through to the spring. Here, Teacher B's concerns and self-described role did not change significantly from the previous semester, which suggests that her place in the adoption process was stable over this period.

## Intervening

Educators' concerns can be used to design appropriate interventions that will meet their needs. The impact of an intervention can be assessed by considering an educator's profile directly before and after the intervention, as well as in comparison to those in a nonintervention group.

Case in point, by March 2010, Teacher A had completed the training intervention, which introduced him to the technical aspects of SMALLab. At this time, Teacher A's profile showcased a sustained interest in exploring SMALLab. His impact concerns remained low, suggesting that he was convinced that SMALLab was a positive influence on his students. His revision concerns were no longer in the forefront, suggesting that these concerns were addressed. Intriguingly, Teacher A described a significant role shift during this semester, citing the development of his own content, supervising the student creation of multimedia, and managing these assets in the SMALLab system. It is believed that his newfound focus on the technical aspects of SMALLab is a direct result of his participation in the training intervention. Teacher B, who also participated in the training intervention, experienced a noticeable drop in informational concerns, which suggests that she had learned much about SMALLab. Furthermore, her overall profile showed lower early stage (0, 1, 2, 3) and increased late stage (4, 5, 6) concerns. These shifts indicate increased experience and expertise in the use of SMALLab and are probably due to her participation in the training intervention.

Simultaneously, the nonintervention group profile in March/April 2010 was similar to the one in October/November 2009, with two major exceptions. First, the group's interest in SMALLab decreased sharply from a moderate level in October/November 2009 to a low level in March/April 2010. Second, the group's revision concerns increased sharply over the same period. These factors indicate that the educators in the nonintervention group were becoming less interested in the innovation and that certain concerns were not being addressed.

Meanwhile, the teachers in the intervention group maintained moderate levels of interest and decreased revision concerns, which suggest sustained participation in SMALLab and needs that were being addressed. These differences in progression through the adoption process are likely to be attributable to the intervention, as well as the extensive participation and collaboration efforts of the teachers in the training group. It appears that these experiences functioned to keep the intervention group teachers more interested and involved in SMALLab, while increasing their knowledge of and expertise in using the innovation.

## Conclusion

In summary, the Stages of Concern can be an effective tool for understanding the adopters of educational interventions, designing interventions to meet their needs, and assessing the impact of interventions. Educators' concerns can be gauged at moments in time and across the lifespan of the change process using the Stages of Concern Questionnaire and its related diagnostic profiles. These concerns can be used to design custom-tailored interventions that catalyze adoption. The effectiveness of interventions can be assessed through the examination of individuals across multiple time points, as well as in comparison to similar individuals in a nonintervention group. In total, these features make the Stages of Concern a systematic way to track, understand, and support the adopters of educational innovations.

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# Assessing the impact of online technologies on PBL use in US high schools

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## Abstract

This study examines online technologies that can support project based learning (PBL) and how much use of these technologies relates to time spent on this approach to instruction, perceived preparedness and ability to overcome challenges. It examines the responses of 331 teachers, from intentionally varied types of high schools, who used PBL or similar practices to teach math, science, social studies or English. Findings suggest that teachers report more use of PBL, fewer perceived challenges, and a greater sense of preparedness when they use online technologies to support their practice. While use of technologies differs across school type and subjects, the relationship of their use to PBL use is surprisingly consistent. Results help us understand the prevalence of technology uses for PBL and how these are related to PBL use and perceptions, with implications for how new technologies might help extend the reach of PBL-related instructional reforms to more schools.

## Introduction

In the last few decades there has been a concurrent growth in the availability of online technologies for educators and interest in supporting teacher use of constructivist-based instruction, such as project based learning (PBL) as a way to motivate students, engage them in "real-world" issues and learning of information age or 21<sup>st</sup> century knowledge and skills. In addition, hundreds of small "start-up" high schools have been designed to personalize instruction and meet students' needs. It is important to understand how these three areas of innovation -- online technologies, PBL and small schools -- overlap and to what extent teachers are taking advantage of new practices and technologies.

### Small schools and reform models

In districts across the country small start-up schools have been launched and large comprehensive high schools have been 'converted' into small learning communities (e.g., Bloom, et al., 2010). The purpose of small school efforts has been to remove the structural barriers that impede effective teaching and learning. These schools are testing the idea that students learn better when they experience a climate of trust and relationships (e.g., Cotton, 2001; National Association of Secondary School Principals, 2004; National High School Alliance, 2005).

Evaluations of small school initiatives suggest that instruction is still a key challenge to be addressed. While smaller schools have been effective at creating more personalized environments for teaching and learning, *instructional* reforms have lagged behind structural and cultural changes (American Institute for Research & SRI International, 2005). As noted by Kahne, Sporte, de la Torre & Easton (2006), "It appears that small schools are fostering more personal and supportive contexts for both teachers and students but they do not appear to be spurring increased instructional reform" (p. 2).

A few reform organizations have had some success pushing instructional boundaries. These organizations build on high-profile efforts to promote student readiness for the 21st century (President's Committee of Advisors on Science and Technology, 1997), to create "break the mold schools" (Bodily, 1996). Many received financial support from the Bill & Melinda Gates Foundation (American Institutes for Research & SRI International, 2005) or were the result of legislation and funding for comprehensive school reform (CSR) intended to change "all aspects of schooling" (Desimone, 2002).

The goals of many (not all) of these school reform models and the rhetoric for small schools in general, are "progressive" in the sense that they generally work against standardized, mechanical view of curriculum and lean

toward one that promotes critical engagement, interactive meaning-making, and self-realization (e.g., Feinberg, 1999; Clinchy, 2003; Van Ryzin & Newell, 2009). A few reform model approaches have emphasized changes in the culture of schooling while retaining a more traditional approach to instruction (e.g., Tough, 2006; Viadreo, 2009). By and large, however, small schools have common origins, inspiration and goals tracing back to earlier work by the New American Schools Design Competition (Bodily, 1996), Coalition of Essential Schools (Meier, 1995;Sizer, 1992) and others.

The four model high school reform networks that participated in this study --New Tech High, High Tech High, Edvisions, and Envision Schools – have helped set the pace by establishing dozens of start-up schools based on their models. These schools have organized themselves around a consistent school design model, affiliate with a central organization that supports the reform model’s philosophy and practices, and form at least a minimal professional learning community within and across schools.

To a large extent the reform models in our study embrace PBL as a central component of instruction (Pearlman, 2002; Newell, 2003). In addition, each of the models has a unique set of practices and technology infrastructures to help guide their work. New Tech High has a proprietary project management system and library, Envision Schools has a Project Exchange library and workspace for teachers, teachers in Edvisions schools have used Project Foundry™ software to help manage and assess student projects, while High Tech High has established a “digital commons” for sharing resources among teachers.

### Project based learning

Project Based Learning (PBL) is a constructivist-based instructional approach that is designed to support more engaged learning (Duffy & Jonassen, 1992; Brooks & Brooks, 1993). This approach uses “projects” as vehicles to encourage student motivation and to provide a means for demonstrating and explaining what they have learned. This approach has much in common with problem-based or inquiry-based instruction (Barron & Darling-Hammond, 2008; Savery, 2006). Evaluations of small school initiatives have highlighted the prevalence of this general approach:

“Among the schools in this initiative that reported efforts to implement a common pedagogy across all classes, project-based learning (PBL) is the most commonly cited instructional strategy . . . in practice, many educators will refer to the same activity interchangeably as ‘project-based’ or ‘problem-based’ learning, or simply ‘PBL’.” (Mitchell, et al., 2005, p. 40).

Evidence of growth of interest is provided by the growing number of teachers who have received PBL materials (our organizational database is almost 10 times larger today than when we undertook this study), the growth of web sites that emphasize PBL as a core instructional concept (e.g., Edutopia, 2001), inclusion of project-based learning in policy documents such as from the National Middle School Association (Yetkiner, Anderoglu, Capraro (2008) and the National High School Center (Harris, Cohen & Flaherty, 2008, p. 3), and even state-wide efforts, notably in West Virginia (Williamson, 2008) and Indiana (Indiana University, 2010).

No two teachers implement PBL in the exact same way, so this makes it difficult to define exactly what PBL is and then study its effectiveness. Over the years, research on PBL has expanded from a specific kind of problem-based learning in medical schools to a wider variety practices, subjects and grade levels (Walker & Leary, 2008). Taken as a whole, with the exception of memorization for short-term learning, PBL use has been shown to be as effective as traditional instructional approaches, and in many studies superior (Buck Institute for Education, 2010; Edutopia, 2001; Geier, et. al., 2008; Strobel & van Barneveld, 2009; Walker & Leary, 2009).

### Challenges to PBL

Implementing PBL and other inquiry-based instruction can be challenging, requiring changes in classroom management and forcing teachers to be ready with a vast array of resources and knowledge (Blumenfeld, Soloway, Marx, Krajcik, Guzdial, & Palincsar, 1991; Mergendoller, Markham, Ravitz & Larmer, 2006). Teachers can report difficulty or feel under-prepared when making the transition to this more student-centered approach (Ertmer & Simons, 2006; Marx, Blumenfeld, Krajcik, & Soloway, 1997). On the other hand, when PBL is well designed and well supported, it is possible for teachers to be surprised by what their students can accomplish (e.g., Johnson, Smith, Smythe & Varon, 2008).

It does not seem reasonable to expect teachers to learn about and use this approach entirely on their own,

although some certainly do. Effective use of PBL requires extensive planning and professional development for teachers, a supportive environment, and tools and strategies for both teachers and students (Hmelo-Silver, Ravit & Chinn, 2007). If instructional reforms have had limited success in small high schools, this is likely due to challenges associated with how much preparation is needed to design and implement PBL effectively.

### The Role of Technology - Untangling a Tangled Relationship

It is important to understand how much online technologies might be helping provide valuable PBL resources for teachers who are exploring PBL use. Teachers who want to use PBL and must confront the above challenges can start by gathering additional ideas and resources by going online. They can locate models or examples in their subject area or find tools that can be useful for coming up with ideas and planning projects. Examples of online features considered in this study include tools for linking to outside experts, mentors, or other schools, collections of projects, tools for managing or assessing student work, for planning and designing projects, and more general features such as blogs, WIKI, and others.

If teachers are already familiar with PBL, online technologies can help scaffold instruction and provide the kinds of supports that teachers and students need to be successful with PBL (e.g., tools for collaboration, feedback, managing work, etc.). Research suggests that both of these elements -- teachers' development of PBL-related knowledge and the availability of implementation scaffolds -- are critical to the implementation and effective use of PBL (Boss & Krauss, 2007; Cognition and Technology Group at Vanderbilt, 1992; Ertmer & Simons, 2006; Hmelo-Silver, 2006).

As a result of the Internet explosion many simply assume new technologies will play an important role supporting PBL (more than in the past, when connections were slow, resources were not widely available, etc.). As one reviewer of an earlier version of this paper noted "It seems implausible to suggest that PBL should be implemented without the use of online resources."

In some ways, it does seem implausible to not use new technologies. A convergence of interest in PBL use and new technologies has led to many interventions that intentionally incorporate technology as a key component of PBL use (e.g., Saye & Thomas, 2005). Many technology-related barriers have come down and opportunities for teachers to conduct projects in a technology-rich environment have never been greater. However, there is still a lot to be learned about how and in what ways teachers incorporate technology and PBL use in their practice. Importantly, because our definition of PBL does not require online technologies, we can see how PBL use varies with and without their use.

### Research Questions

This study explores the relationship between PBL-related teaching practices and use of online features to support these practices. It addresses the following questions:

For teachers across different high school contexts and academic subjects...

What is the prevalence of PBL use, preparedness and challenges?

What is the prevalence of online feature use to support PBL?

To what extent is online feature use related to preparedness, challenges, and use of PBL?

As noted for Becker & Lovitts, (2003), the only way we can hope to see how new technologies contribute to teaching and learning is to explore their use independent of pedagogy. Once we accept that some PBL-using teachers and projects do not require online technologies (e.g., for projects that involve designing a golf course for the moon, staging a debate about the death penalty, observing changes in bird populations, presenting a land use policy), it becomes possible to explore how use of technologies is related to differences in PBL use and to examine the apparent convergence of PBL and use of new technologies more closely.

### Methods

#### Population and Sample

In the fall of 2007, over 400 PBL-using teachers completed an online survey -- a 35% response rate based on a sample of approximately 1200 teachers. This included teachers in the current analyses -- 331 teachers who



taught academic subjects (math, science, social studies or English) in public high schools and confirmed that they used PBL in these subjects. These teachers came from diverse school types that we categorized as large comprehensive high schools (n=61), small schools and small learning communities (n=104), or one of the four reform networks New Tech High, High Tech High, Edvisions, and Envision Schools (n=166). To avoid biasing the results, we analyzed data separately for each of these school types.

The sample is considered to be fairly representative of PBL-using teachers, clearly representing a variety of schools, academic areas and geographic locations. Mid-west and rural states were under-represented as were a few key states in the south. In addition, a couple east coast organizations were not included whose participation could have boosted the number of PBL using teachers substantially, notably Big Picture Schools (Littky & Grabelle, 2004; McDonald, Klein, Riordan & Broun, 2003) and Expeditionary Learning Outward Bound (1999).

The sample of probable PBL users was based on information about sales of PBL materials and attendance at workshops. In addition to querying our own organizational database and searching for teacher lists on the web, this study received support from reform model staff who provided lists of teachers or schools receiving PBL professional development or materials, and professional development staff from the Center for Effective School Practices (with workshops held in NJ and OH), the San Diego Renewal High Schools initiative, and the North Carolina New Schools Project (see Ravitz, 2008 for full sample details). Each teacher received multiple contacts and both a social and economic incentive, with communications closely following strategies outlined by Dillman (2000).

## Measures

The survey instrument was constructed after reviewing existing surveys and piloting different version of questions in 2006. Development of the instrument used methods similar to “cognitive interviews” (Desimone & LeFloch, 2004) and revising questions until they appeared to generate reasonable responses from teachers in vastly different kinds of schools.

*Project based learning (PBL)* was defined for participants minimally as an approach to instruction that a) features in-depth inquiry b) occurs over an extended period of time like a week or more, c) is student/self-directed to some extent, and d) requires a formal presentation of results. While there are other characteristics of PBL we might have included, these criteria represent a minimal definition that allows variation in other aspects like group work or technology use. Participants were invited to substitute a preferred term for PBL, as long as it included the above characteristics. Approximately 17% said they preferred problem-based, inquiry-based, or some other term.

In addition to be provided with the above definition, teachers saw a list of example types of projects (e.g., researching a community issue and creating an action plan, making observations and collecting data, creating a museum-like exhibit, etc.) so they would know what kinds of practices were being referenced. They were then instructed to pick the academic course in which they used the most PBL and report on their teaching of that course.

*Time spent using PBL* was based on teachers’ response to the following item: “For a typical student in this course, how much of their overall TIME was spent on project based learning?” scored on a 6-point scale (1 = none or almost none, 2 = less than ¼, 3 = about ¼, 4 = about ½, 5 = about ¾, 6 = all or almost all).

*Online feature use* was based on a count of the number of features that were used at least “a little”, because not many responded that they used any feature “a lot”. The online features we asked about are listed below, with the accompanying prompt “For each of the following Internet-based features of capabilities, indicate whether you have seen or used this kind of online resource or tool for conducting PBL.”

- Online collaboration tools (e.g., blog, Wiki, listserv, social networking)
- An online collection of high quality projects
- An online collection of PBL resources (e.g., rubrics, templates, examples, descriptions, suggestions, video)
- Tools created to help you or your students design and manage projects online
- A way for your STUDENTS to post work to get feedback or be assessed by you or others
- A way for YOU to get feedback from other teachers or adults on your projects or student work
- Tools for linking you or your students to outside experts, mentors, or other schools

Instead of focusing on specific web sites or software platforms, we described more general features of online use (e.g., for planning, giving feedback, collaborating, etc.) as might be provided by a variety of web sites or tools. We limited the features we examined to ones that teachers in our pilot study said they used in planning PBL or that helped them with PBL implementation. These online features (available using multiple software or web site

configurations) provide the capacity to conduct projects or support them. They allow teachers to learn about PBL and manage projects more effectively, to share PBL examples, experiences and advice. They also may make it easier for communication and feedback to occur between teachers and students, or across different schools. In each of these ways, the features can be expected to play a role in supporting PBL use. These online uses are probably related to use of more general online features (like search engines, email, or file sharing) and other computer uses that were not asked about because we wanted to focus on specifically PBL-related tools and practices.

*Perceived challenges for PBL* use was assessed using five items that were determined through conversations with teachers to be critical for the effective use of PBL (e.g., “I lacked models or examples for using PBL in my subject area with my students”). Items were scored on a 4-point scale (ranging from 1 = not a challenge to 4 = a major challenge).

*Preparedness for PBL* was assessed using nine items that asked teachers how prepared they felt to carry out tasks related to effective PBL use (e.g., “To what extent do you feel prepared to assess individual student’s content learning using PBL”). Items were scored on a 4-point scale (ranging from 1 = not at all prepared to 4 = very well prepared). An index based on the mean of all nine preparedness items had strong reliability (standardized alpha = .91), while the index for challenges was reliable enough for our purposes (standardized alpha = .80).

Finally, the *kind of school* was considered in our analyses and controlled for accordingly. Small schools and learning communities were defined as having less than 500 students and identified as being part of a reform model network or not.

### Analysis Plan

Descriptive data helps us understand the prevalence of responses across a wide range of schools. Differences in mean scores used standardized z-scores, and ANOVA statistical tests, while percent differences used cross-tabulations and chi-square tests. The research questions use correlations between online feature use, perceived challenges, perceived preparedness and time spent on PBL with data presented using cross-tabulations and mean comparisons controlling for school type or subject taught.

### Results

Although school context and subject limit use of PBL and online features, online feature use is clearly most prevalent among the most frequent PBL users. We see this in all three types of schools we studied. The more teachers used online features the more prepared they felt and the better they were able to handle PBL-related challenges. Some key descriptive findings provide an indication of differences across school types. The descriptive findings are not particularly surprising, but they provide interesting contrasts regarding teachers in small schools that were and were not affiliated with a reform model. Overall, the most PBL use and the greatest amount of technology use were seen in the reform model schools, where teachers reported fewer challenges and greater PBL preparedness.

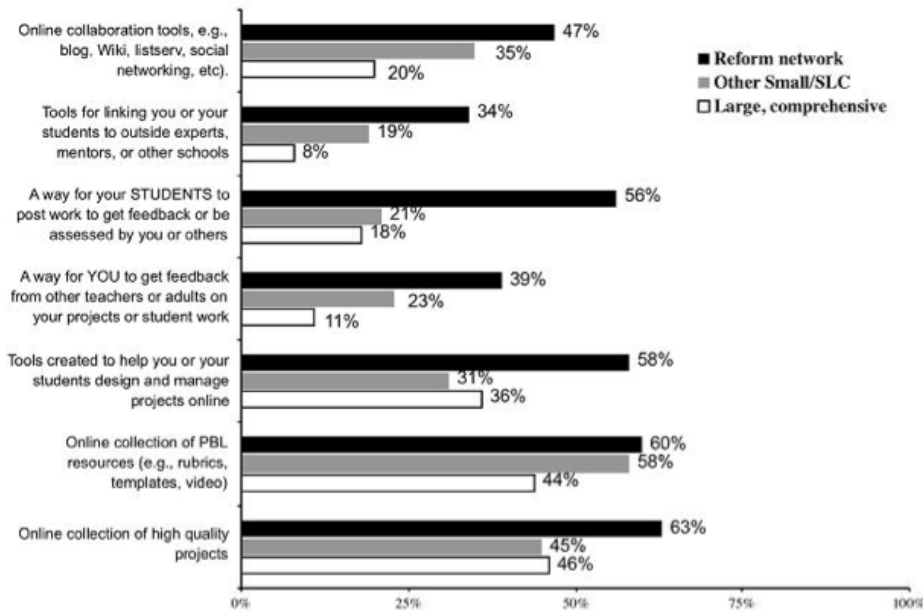
- 83% of reform network teachers reported spending more than “about ¼” of their time conducting PBL, compared to 48% of teachers in other small schools and 34% in the larger schools.
- The percentage of reform network teachers who reported feeling “well prepared” for PBL was higher than in other schools -- with statistically significant differences in preparedness for meeting state or district standards, assessing content learning and planning or designing new projects.
- Professional development for PBL was rarely a challenge in reform model schools and other small schools (reported by 17% in both), but was frequently a challenge in larger, comprehensive schools (reported by 40%).

Some key differences in features used (as shown in Figure 1) include the following:

- More than half (56%) of the teachers in reform model schools had students post their project work and receive feedback, compared to 21% and 18% of teachers in the other two types of schools
- More than half (58%) of the teachers in reform model schools had designed and managed projects online compared to 36% and 31% of teachers in the other school types.
- Online collections of PBL resources were prevalent in reform model and unaffiliated small schools (reported by about 60% of each group), but online tools to plan and manage projects were only prevalent in the reform model

schools (58% vs. 31% of other small schools)

**Figure 1. Use of online technology features for PBL, by school type**



These descriptive findings reinforce the idea that the most extensive use of PBL and supporting technologies are in the reform model schools, followed by the other small schools. This would indicate that overall, across school types, technology use is associated with PBL use. In fact, the overall correlation is 0.37 ( $p < .05$ ). The next section examines a more significant question, whether this pattern exists even within school types.

#### Relating PBL use to online feature use

Findings clearly indicate that the more teachers used online features the more they used PBL, the more prepared they felt and the better they were able to handle PBL-related challenges (Table 1). The largest correlation with preparedness was in small schools outside the reform model networks ( $r=.46$ ) but the correlation was positive for all three types of schools. The correlation between PBL use and online features was .33 for teachers in reform model schools, and .23 for teachers in other small schools (both  $p < .05$ ). For larger schools, the correlation to time on PBL was not significant, but feature use was significantly correlated to both preparedness and fewer challenges.

**Table 1. Correlation of features used to time on PBL, preparedness and challenges, by school type.**

Correlations for...	Correlation of number of features to...		
	Time on PBL	Preparedness	Challenge
All schools combined (n=330)	.37*	.35*	-.18*
Reform Model (n=161)	.33*	.25*	-.06
Small Schools (n=103)	.23*	.46*	-.13
Large comprehensives (n=61)	.10	.28*	-.25*

\*  $p < .05$

Table 2, below, presents significant differences in the percentage of teachers who reporting that they felt “well prepared” to handle common PBL-related instructional tasks by use of online features, analyzed separately for each

school type. The comparison is between teachers who reported that they used the online feature “at least a little” versus those who reported that they did not use that feature within a particular school type.

Table 2. Significant differences in teachers reporting that they felt WELL PREPARED for PBL tasks by use of online features, within each type of school

PBL-related Task	(% of those who used the feature who felt “well prepared” for the task, % of those who did not use the feature)						
	Tools for linking you or your students to experts, mentors, or other schools	A way for your STUDENTS to post work to get feedback or be assessed	A way for YOU to get feedback from other teachers or adults on projects or student work	Tools to help you or your students design and manage projects online	An online collection of high quality projects	An online collection of PBL resources (e.g., rubrics, templates, suggestions)	Online collaboration tools (e.g., blog, Wiki, listserv, social networks)
Assess students working in groups	R (86%, 55%) S (85%, 52%)			S (79%, 50%)			
Teach and assess skills beyond academic content	R (91%, 66%) S (85%, 45%)	R (82%, 63%) S (86%, 58%)	R (83%, 69%) S (88%, 56%) L (100%, 59%)	S (82%, 56%)	S (77%, 53%)	S (75%, 48%)	S (78%, 57%)
Structure student presentations so the whole class learns	R (76%, 49%) S (85%, 45%)	S (73%, 48%) L (82%, 40%)	S (75%, 46%)	S (76%, 43%)	S (68%, 41%)	S (64%, 39%)	
Facilitate and manage students' work in groups	R (89%, 65%) S (85%, 62%)		L (100%, 61%)	S (85%, 58%)		S (75%, 55%)	
Promote depth or quality in student work during projects	R (86%, 63%)		S (92%, 54%) L (100%, 61%)	S (82%, 53%) L (82%, 56%)		S (71%, 50%)	
Assess individual students' content learning using PBL	R (86%, 69%) S (90%, 50%)	R (81%, 67%)	S (79%, 53%)	S (76%, 50%)			S (72%, 52%)
Meet state or district standards using PBL	R (88%, 73%) S (90%, 53%)		S (88%, 53%) L (100%, 56%)	S (79%, 51%)		S (72%, 43%) L (74%, 50%)	S (75%, 53%)
Plan and design new projects	S (85%, 61%)	S (96%, 58%)	S (92%, 59%) L (100%, 52%)	S (82%, 58%)	L (71%, 46%)	S (75%, 52%) L (74%, 44%)	L (88%, 51%)
Find existing projects that are high quality	S (80%, 51%)	S (82%, 50%)	S (79%, 51%)	S (82%, 45%)	R (71%, 56%) S (70%, 46%) L (68%, 34%)	S (69%, 49%)	R (76%, 58%)

R=Reform network (N=164); S =Small school / small learning community (N=105); L=Large, comprehensive school (N=61)

All comparisons are statistically significant, chi-square  $p < .05$  Features are slightly abbreviated from the actual items as shown in the methods section above.

## Preparedness and Feature Use

All significant differences in were in the expected direction with feature use relating to a higher percentage of teachers who felt “well prepared” and a lower percentage reporting major/moderate challenges (Table 2).

- In larger, comprehensive schools, use of a feature “to get feedback from other teachers or adults” was related to statistically significant differences five of the nine PBL preparedness tasks
- Use of tools created “to help you or your students design and manage projects online” was related to teachers’ sense of preparedness in unaffiliated small schools across *all nine* tasks.
  - For example 82% who used this tool felt well prepared to “promote depth or quality” in PBL, compared to 53% of those who did not use this kind of tool.
- Use of tools for “linking you or your students to outside experts” related to significant differences in preparedness across *all nine* tasks for at least one of the type of school.
  - For example, 90% of teachers in unaffiliated small schools who used this feature felt well prepared to assess student content learning in PBL, compared to 50% who did not use that feature
- In large schools, use of a tool for “feedback from other teachers or adults on your projects/student work” was related to preparedness for five of the nine preparedness tasks.
  - For example, 71% of the larger school teachers who used “an online collection of high quality projects” felt “well prepared” to plan and design new projects, compared to 46% of teachers in those schools who had not used this feature.

## Challenges and Feature Use

We see a similar pattern, although less extensive, regarding challenges for PBL. The challenge that was most substantially reduced with use of online features concerned “lack of professional development or coaching in PBL”. Some key differences within school type include the following:

- In reform model schools, 8% who used online tools to manage student projects cited lack of professional development as a challenge, compared to 30% who did not.
- In reform model schools, 8% of those who had a way to get online feedback said professional development was a challenge, compared to 24% who did not use this feature.
- Only 7% teachers who used tools for linking to outside experts felt lack of professional development posed a major or moderate challenge, compared to 22% of the teachers who did not use these tools.
- Less than one-fifth (18%) of teachers in large comprehensive schools who used online tools to design or manage projects said professional development was a challenge, compared to more than half (53%) that did not use such tools.

The online feature that related to differences in perceived challenge across all five issues was “tools created to help you or your students design and manage projects online”, although the type of school for which the significant difference occurred varied.

## Across Subjects Taught

A final set of analyses concerns the correlation of the number of online features to the measure of PBL use measure and the challenges and preparedness indices, by subject taught. For these analyses we used correlations or compared mean z-scores on indices. Statistically significant ( $p < .05$ ) differences by subject taught included:

- Among science teachers online feature use is associated with more PBL use ( $r=.36$ ), a decrease in mean challenges ( $r=-.34$ ) and increase in mean preparedness ( $r=.51$ ).
- Among social studies teachers there was a strong relationship between the amount of PBL use and the number of online technologies used among social studies teachers ( $r=.57$ ,  $p < .001$ )
- English teachers who used more online features felt better prepared for PBL use ( $r=.33$ ,  $p < .01$ ).
- Math teachers reported the least PBL use overall (mean z score =  $-.35$ ) and felt least prepared for PBL use (mean z score =  $-.31$ ), but there was a strong correlation between online feature use and PBL use ( $r=.60$ ,  $p < .001$ ).

Although these subject-specific relationships may be largely spurious – due to the fact that we did not have enough cases to control for school differences at the same time – it is useful to see similar patterns data across subject, indicating that the relationship is widespread, not limited to certain disciplines.

## Discussion

This study is important because it concerns efforts to improve instruction by using online technologies and PBL. Regardless of school type, effective design and use of PBL requires ongoing professional development and support. Even in the best of circumstances, even in schools that have fully embraced PBL, the professional development and resources needed for effective use of PBL are unlikely to be fully met by most schools (Ravitz, 2010). Results suggest that online tools may provide an important way for teachers and schools to help address the challenges of PBL use.

It is helpful to know which technologies and practices have proliferated and which are only seen in reform model schools. For example, it appears far more teachers have used online libraries of projects and resources than have used tools to help with designing and managing projects. The latter feature is seen more frequently in reform model schools and is closely associated with PBL use and preparedness.

Sometimes teachers in non-network small schools (i.e., unaffiliated with reform models) reported similar practices or perceptions as reform model teachers, but not always. For example, in both types of small schools there appeared to have been ample professional development for PBL (with this being a challenge for only 17% in both school types). However, teachers in unaffiliated small schools reported that time in the curriculum for PBL use was much more frequently a challenge. This suggests that PBL is emphasized to a large extent even in unaffiliated small schools, but conditions and practices in the reform models are different.

Across school types, the technology feature that was most closely associated with PBL preparedness varied. This suggests certain technology applications are useful in different kinds of schools. For example, in larger comprehensive high schools the feature that best predicted preparedness was a way for teachers to get feedback from other adults, perhaps indicating a lack of effective feedback mechanisms in larger schools. In the reform model schools, the most predictive feature was access to outside experts to support projects, perhaps reflecting efforts to make PBL more authentic for students. In unaffiliated small schools access to outside expertise was also a predictor of preparedness, but so was using online tools for designing and managing projects. Perhaps without a reform model to help guide them, teachers in small schools may have to rely more on tools they find on the Internet to help them design and manage PBL.

To conclude, there is a robust relationship between use of online technologies and greater amounts of PBL use and preparedness. The correlation between online features and PBL preparedness was significant for numerous study strata, not just the three kinds of schools. However, the study data cannot answer questions about the causes of this relationship. The direction of causality that seems most important is how online technology use increases or improves PBL use. However, there is almost certainly a

mutually reinforcing relationship wherein technology helps teacher implement PBL but PBL also helps teachers integrate technology by providing reasons for its use.

It would be interesting to see more studies looking at how technology use differs when PBL is used, as well as how PBL differs when technologies are used, including perhaps technologies that we did not include—general online search features, or productivity software. However, the goal of promoting technology use seems less important than the goal of promoting effective PBL use. Educators are not in the business of coming up with uses for technology. As Ely famously asked “Technology is the answer, but what was the question?” In this case, how to improve preparedness for PBL use seems to be a question worth asking, and online technologies seem to provide part of the answer.

Although the experiences of individual teachers and schools may differ, the overall pattern suggests that technologies are probably helping teachers increase their PBL use and preparedness. Future research might focus on how reform model teachers are using online tools to support their PBL use and on finding ways to share these lessons and tools with other small schools to see if more teachers can be prepared to use PBL effectively. Clearly technology supports are only part of the answer to effective PBL use, but increased use of online technologies may be one way that instructional reforms like PBL can be disseminated from reform model schools to others.

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## **Federally funded study provides evidence of PBL effectiveness in high school economics: Could PBL be a hot topic in K-12, again?**

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Note. This paper draws heavily from the final study report provided by Finkelstein, et al., (2010).

### **Abstract**

Over the years, supporters of project- or problem-based learning (PBL) in K-12 have generally had to rely on limited research, weak research methods, and sometimes mixed results. Results from a federally funded, randomized controlled experiment in high school economics provide evidence for the efficacy of PBL and should fuel growing interest in this approach to instruction. The study examined the impact of a one-week summer professional development institute and use of five PBL curriculum modules on the economic knowledge of approximately 7,000 12th grade students, taught by 76 teachers in 66 schools. Student outcomes that were studied included scores on the standardized Test of Economic Literacy (TEL), and scores on performance assessments of student conceptual understanding. Teacher outcomes included confidence in teaching economics and satisfaction with teaching materials. The findings, prepared by the Regional Educational Laboratory West (REL West) at WestEd, indicates there were significant positive impact for students of teachers who received the curriculum compared to their peers and teachers scored higher in satisfaction with teaching materials and methods than those in the control group.

### **Purpose**

This study was undertaken to provide strong experimental evidence concerning the effectiveness of PBL use in high school economics. The study was designed to assess student-level impacts of a problem-based instructional approach using a randomized controlled trial. It tested the effectiveness of a series of five curriculum units developed by the Buck Institute for Education ([www.bie.org](http://www.bie.org)) on student learning of economics content and problem-solving skills. This study targeted high schools in urban, suburban and rural areas and engaged teachers who committed to teach economics for two semesters during the 2007/08 academic year.

Student achievement outcomes were the study's primary focus. Specifically, it examined whether the Buck Institute's curriculum improved grade 12 students' content knowledge as measured by the Test of Economic Literacy (TEL), a widely accepted, standards-aligned test used across the United States, along with students' problem-solving skills in economics as measured by a performance-task assessment. In addition to these student outcomes, the study examined changes in teachers' content knowledge in economics, their pedagogical practices, and satisfaction with the curriculum.

### **Why study economics instruction?**

For decades, economists, prominent educators, and business and government leaders have advocated for developing economic literacy as an essential component in school curricula. Their arguments have ranged from the need for improving the ability to manage personal finances to the value of economic education for critical thinking and an informed citizenry. "The case for economic literacy is obvious. High school graduates will be making economic choices all their lives, as breadwinners and consumers, and as citizens and voters. A wide range of people will be bombarded with economic information and misinformation for their entire lives." (Tobin, 1986).

At the federal and state levels, economics has received increasing attention as a critical content area for K–12 education. Forty-eight states now include content standards in economics, with 40 requiring their implementation, and 17 requiring a course in the subject for graduation. (National Council on

Economic Education 2007). Economics is a required course for high school graduation in California and Arizona, the two states where the study takes place, and is usually taught to seniors for one semester.

While there is growing agreement on the need for some economics content in K–12 education, there is less consensus about where it fits into the curriculum, how to teach it effectively, and how much subject area background should be required of classroom instructors. Additionally, there is concern that many students do not understand economics and their teachers may lack content knowledge, access to relevant teaching materials and adequate professional development (Walstad, 2001, Watts, 2006).

Why study PBL use?

PBL is an approach to instructional design that can help organize the curriculum and deliver instruction. It provides a mechanism to gain student attention, to motivate and anchor learning. It provides opportunities for authentic assessment of content and skills, and use of new technologies. Research suggests that for the most important outcomes (other than short-term recall or recognition), such as long term retention and assessments involving elaboration of understandings, PBL has been as effective as traditional instructional approaches, and there are many studies that show PBL to be superior (Strobel & van Barneveld, 2008; Walker & Leary, 2008). Of these studies, relatively few have been well-designed K–12 experiments, however a few studies do suggest PBL can be effective in diverse K–12 settings (Barron & Darling-Hammond, 2008; Boaler, 1992; Edutopia, 2001; Marx, et al., 2004).

There has been an evolution of thinking about what PBL is. PBL can no longer be equated with “minimally-guided or “discovery learning” (Hmelo-Silver, Duncan & Chinn, 2007; Mayer, 2004; Kirschner, Sweller & Clark, 2006). Gradual consensus appears to be building that not all PBL is created equal. Considerable effort has to go into problem or project design, scaffolding and management of learning activities, and the requisite professional development for teachers in order for PBL to be effective. As Dewey noted, “The belief that all genuine education comes about through experience does not mean that all experiences are genuinely or equally educative.” (1938, p. 25). Today’s projects, such as those conceived at High Tech High School (<http://www.hightechhigh.org/projects/>), Envision Schools (<http://www.envisionprojects.org>), Expeditionary Learning schools (<http://elschools.org/>), or New Tech Network schools (<http://www.newtechnetwork.org/>) look nothing like the “child-centered” progressive education ideas of William H. Kilpatrick (1918), who popularized the ‘Project Method’ in the early part of the 20<sup>th</sup> century.

Contemporary PBL is standards-focused, and can incorporate a wide variety of instructional strategies—even more “traditional” lectures, skill-building activities, library and Internet research, and various forms of writing. Students can be assessed by both performance-based and traditional means. PBL differs from a traditional curriculum approach, however, by creating a reason to learn or “need to know” (besides getting a good grade on the test) prior to using any of these other techniques. PBL also provides opportunities for students to develop (and be assessed on) their ability to work together, manage complex work, explain themselves to an external audience, etc. Well-conceived projects or problems provide questions and challenges that can serve to organize the curriculum as a whole. These characteristics of PBL are reflected in the definition of PBL as “a systematic teaching method that engages students in learning essential knowledge and life-enhancing skills through an extended, student-influenced inquiry process that is structured around complex, authentic questions and carefully designed products and tasks” (Mergendoller, et al., p. 587).

Evaluations of small school initiatives have highlighted the prevalence of PBL:

“Among the schools in this initiative that reported efforts to implement a common pedagogy across all classes, project-based learning (PBL) is the most commonly cited instructional strategy . . . in practice, many educators will refer to the same activity interchangeably as ‘project-based’ or ‘problem-based’ learning, or simply ‘PBL’.” (Mitchell, et al., 2005, p. 40).

Additional evidence of growth of interest in PBL includes the number of schools and districts using PBL as a key component of school wide reform (Ravitz, 2010), state-wide initiatives (Williamson, 2008; Indiana University School of Education, 2010), web sites that emphasize PBL (e.g., Edutopia, 2001), and policy documents such as from the National Middle School Association (Yetkiner, Anderoglu, Capraro (2008) and the National High School Center (Harris, Cohen & Flaherty, 2008, p. 3).

## A PBL approach to economics

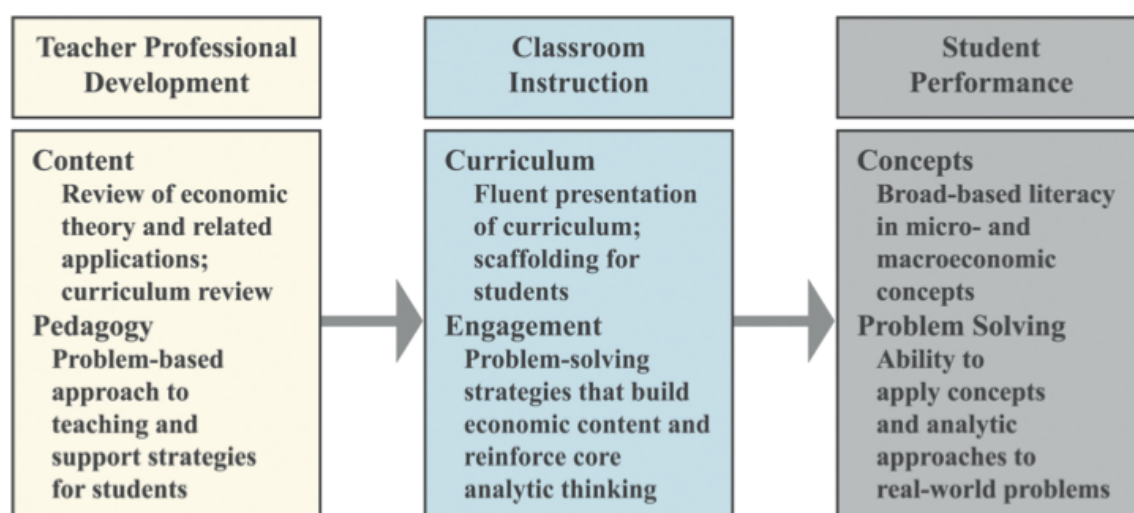
The approach to PBL in this study represents a modification of the problem-based approach originally developed for use in medical schools (Mergendoller, Maxwell, and Bellisimo 2000). The modifications were made for use in US high school settings, although the resulting curriculum has been found to be effective in college courses (Smith & Ravitz, 2008) and when translated for use overseas (Mo & Choi, 2003). In contrast with the more typical textbook and lecture-driven approach that is commonly seen, teachers initiate inquiry based on examination of real-world economic problems that require a set of disciplined, analytic steps. The intent is that students learn to contextualize, understand, reason, and solve problems using analytic skills that are taught as part of the curriculum.

Each of the five curriculum modules used in this study is set up around a fictitious (simulated) case study that is well suited to student-driven problem solving. Each unit is organized around four major phases:

1. Project launch
2. Framing the inquiry
3. Problem-solving and learning activities
4. Presentation, assessment and debrief

The step-by-step teaching guide that is provided is the cornerstone of each module. It lays out for teachers the problem statement, introduction, placement in curriculum, concepts taught, objectives, content standards, time required, lesson description, resource materials, sequence of the unit, procedures, and do's and don'ts. For the PBL group teachers, the curriculum is introduced during a five-day professional development workshop led by expert teachers who have used the materials extensively in classrooms.

The logic for the intervention and its intended effects are outlined in the below. Student achievement outcomes are of primary importance. These are hypothesized to be mediated by changes in teacher knowledge and pedagogical practice.



The intervention for this study included a combination of materials and professional development. The professional development consisted of a 40-hour economics course for teachers, held over five days in the summer of 2007. This workshop introduced five curriculum modules that contained fundamental components of the curriculum standards in economics in the states where the study was implemented (Arizona and California) and covered approximately 50–70 percent of the curriculum content of economics classrooms. Teachers left the session with an understanding of how to sequence the material for each curriculum unit into consistently applied teaching steps. During the course of the semester, periodic videoconferences were offered to support teachers during the implementation of the units, although these were sparsely attended.

## Research Questions

The research questions for the study reflect the expected changes in teacher knowledge and practice, attitudes toward teaching economics and student outcomes. They were as follows:

1. Does PBE change students' content knowledge in economics?
2. Does PBE change students' problem-solving skills in economics?
3. Does PBE change teachers' content knowledge of economics?
4. Does use of PBE change economics teachers' instructional practices?
5. Does the use of PBE change teachers' satisfaction with teaching materials and methods use?

## Methods

### The study population and sample

Implemented from summer 2007 to spring 2008, the study targeted high schools in rural, suburban, and urban areas of both California and Arizona, two states where economics is a required course for graduation. Study participants included economics teachers who were randomly assigned to an intervention or control group.

Every school in Arizona and California with enrollment of more than 1,500 students (approximately 1,000 schools) was contacted to discuss the study. The recruiter had some discussion with administrative staff or teachers in nearly all of them. The resulting pool of schools in the study sample was 106. Only after a teacher was found willing and eligible to participate in the study were the school and district asked to permit study participation. Thus, the recruited sample was composed of teachers who volunteered to participate in a randomized controlled trial and who committed to participate in the professional development and to implement the curriculum if randomly assigned to the intervention group. The study team was not able to collect information about teachers who declined to participate in the study, and as a result, it is unable to make any inference about the differences between teachers who did and did not agree to participate.

After random assignment, and accounting for attrition and missing data, the intervention group for Spring 2008 included 35 teachers and their 2,502 students, while the control group included 29 teachers and their 1,848 students. There was attrition of 12 control teachers and 7 intervention teachers who did not return data for this study. In addition, two teachers in the treatment group did not provide outcome measures on the performance tasks. The number of missing students for each measure ranged from 11% to 15%, except for the performance tasks which were missing for 19% of the control group and 23% for the treatment group students. Students were excluded from the impact analyses if they were missing associated outcome measures.

Teachers in control schools participated in their regular annual professional development activities and continued their usual instructional practices in economics classrooms. (As an incentive for their participation they received the curriculum and professional development in the year following the study).

### Measures

The experimental study was designed to test whether problem-based instruction in high school economics can result in gains in students' content knowledge. The primary outcome measure for this study is content knowledge gains for students in economics measured by the Council for Economic Education's Test of Economic Literacy (TEL), a 40-item closed-response economics exam (Walstad and Rebeck, 2001). This is a widely accepted, standards-aligned test used across the United States to measure economic literacy among high school students.

The research team augmented this outcome measure with an opportunity to test students' abilities to reason and solve problems with the concepts they had learned. Student problem-solving skills are measured with open-response performance assessments of applied economics concepts (performance task assessments) developed by the Center for Research on Evaluation, Standards, and Student Testing at the University of California, Los Angeles (UCLA CRESST). These written tasks gave students the ability to demonstrate problem-solving skills as they answered open-ended essay question, as outlined by Baker, Aschbacher, Niemi & Sato (1992) and Niemi (1996).

The assessment tasks were created and piloted by CRESST with more than 300 students in spring 2005, prior to this study. These feature paper-and-pen thinking and writing responses based on contextual prompts that focused on monetary policy/federal funds, monetary policy/employment, fiscal policy, consumer demand, and opportunity costs. These tasks were chosen because of their focus on fundamental economics concepts and their alignment with state standards in the course. These economics performance assessments do not explicitly reference the Buck Institute's curriculum and were piloted both with teachers who used the relevant curriculum units and with teachers who did not. The assessment tasks and their common rubric were revised based on several rounds of student responses. Based on this initial work, CRESST indicated that the tasks provide good evidence of the quality of student conceptual understanding in economics. The performance tasks were administered at the end of each semester as a measure of student learning. (These assessments did not have a pretest component.) Each task required 15–20 minutes to complete (75–100 minutes for all five tasks).

Pedagogical practices were measured using teacher self-reports on 9 items using items similar to those used by Ravitz, Becker & Wong (2000) to indicate the frequency different practices were used. "During the past semester, how often did you give assignments in economics that required students to do the following?" [1 = Never, 2 = A few times, 3 = Once or twice a month, 4 = Once or twice a week, 5 = Almost every day]: Work on projects that take a week or more; Work together in small groups; Use a rubric to help assess and guide their work; Organize and analyze information or data; Come up with solutions to economic problems, like those found in the real world; Consider alternative solutions to an economic problem; Orally present their work or ideas to others; Use the Internet to get information; and Use computers—besides word processing—to analyze or present data (such as Excel). The index measure based on these items was reliable, coefficient alpha=.85.

Teacher satisfaction with the curriculum was addressed by asking how satisfied on a scale from 1-5 (from "very unsatisfied" to "very satisfied") teachers were with the curriculum materials you have for teaching economics, and the methods you use to teach economics, with the mean on the two measures being reliable, coefficient alpha=.80.

#### Data Analysis

The analysis for this study compared the outcomes for students and teachers in the intervention group with their counterparts in the control group after the students' economics course had been completed in spring 2008. All outcome variables were treated as continuous variables in the impact analyses (estimated using multilevel or single-level linear regression models). To increase the precision of the estimates, a set of baseline characteristics of students and teachers was included in the models as covariates. These included student gender, race/ethnicity and pretest measures, as well as teacher background indicators (years teaching, number of college courses in economics and confidence teaching economic concepts) and aggregated student pretest measures. Additional information about dummy variables and randomization procedures are available in the full report, along with HLM models and treatment of fixed and random effects (Finkelstein, et al., 2010). Statistical power estimates for Type 1 error = .05 indicate a minimum detectable effect size of .18-.21 at the student level and .55 at the teacher level (based on 83 teachers and 40 students per teacher)

#### Findings

This REL West study was designed as an in-school, randomized controlled trial that tested the effectiveness of a Problem Based Economics (PBE) curriculum developed by the Buck Institute for Education on student learning and problem-solving skills. The study found that students benefited from the combination of the curriculum, the associated professional development program, and the support that was provided as part of the study's implementation. The students whose teachers used the problem based curriculum in their classrooms scored significantly higher on both content assessments (TEL and performance tasks) compared to students who were not exposed to the curriculum in their economics classes. In addition, teachers who used the curriculum were more satisfied with the materials than those who used standard teaching materials.

## Student benefits

Results indicate that students whose teachers had received professional development and support for use of the PBL economics curriculum outscored their control group peers on the Test of Economic Literacy by 2.60 items (effect size = 0.32). Student academic performance was also assessed using open-ended performance tasks that tested problem-solving abilities in short essays. On a composite score of these tasks, students in the intervention group outperformed those in the control group (effect size = 0.27,  $p < .05$ ).

One way to interpret the magnitude of these effects is to compare them with the overall progress that students make during an academic or calendar year. Hill et al. (2008) reported that 10th graders' scores on norm-referenced tests in reading increase by 0.19 standard deviation units and in math by 0.14 standard deviation units over a calendar year. Comparable growth information is not available for high school economics. One might imagine that not having taken any economics previously the growth of knowledge in economics would be greater than in these other subjects. However if growth in economics achievement is similar, the impact estimates are equivalent to at least one year of growth.

## Benefit to Teachers

There were also statistically significant differences in favor of intervention group teachers on a measure of teacher satisfaction with the teaching methods and materials used to teach economics. The economics teachers who used the PBL approach were significantly more satisfied with the materials and methods than their peers who did not use the curriculum. The effect size was quite substantial (effect size=1.09,  $p < .01$ ).

No statistically significant difference was found between the intervention and control groups on teachers' knowledge of economics, possibly due to a ceiling effect. Teachers averaged more than 90% correct on the pretest, which was the same as the student version of the test that was used.

Finally, no significant difference was found in teachers' pedagogical style with the survey measures used, based on a cut-off point using  $p$  value  $< .05$ . However, there was an effect size of .55,  $p < .07$ , even after multiple controls were in place, indicating a strong likelihood that PBE teachers were in fact more constructivist in their teaching practices as a result of using the curriculum.

## Conclusion

The positive outcomes from this study are ground breaking in many ways. We are not aware of any other federally funded studies of this kind that examined PBL in a high school subject, or any K-12 for that matter. These findings add to the research base on use of PBL in economics, which had indicated promising impacts on student gains and teacher satisfaction. However, unlike previous studies, the design of this study allows for a causal interpretation of the students' gains and greater generalizability. Educators may be looking for ways to strengthen their economics education programs; this study may provide useful information to curriculum specialists and teachers interested in alternative approaches for providing instruction in a required component of the high school curriculum in their state.

However, in other respects this study only scratches the surface of our understanding of the impact of a PBL approach to teaching economics. A study like this only looks at "bottom line" differences attributable to the intervention. It does not address variations in the outcomes due to the quality of implementation or differences within teachers (e.g., who was more successful teaching economics than others using the curriculum and with which students, or how their practices in general and implementation of the curriculum differed).

Observations of classrooms indicate that implementation the PBE units varied enormously depending on the individual teacher. It was not clear that professional development session impacted teachers' use of the PBL materials compared to how they might have used the materials without professional development.

Observations of control group teachers also indicated a wide range of practices, including some very effective and clever use of methods that resembled PBL at times, use of Socratic discussions and other seemingly useful approaches. At the end of the day, it is very hard to get an impact in a study like this. There were a lot of teachers in both groups who were extremely engaging and had a certain "spark" for economics that was conveyed to students, while in both groups there were teachers who lacked this spark.



(Personal communication with Neal Finkelstein, September 24, 2010)

The differences in teaching practices were not statistically significant, suggesting the difficulty of capturing pedagogical differences. (Although self-reported practices almost showed a statistically significant difference (Effect size = .55.  $p < .07$ ), there may be better ways to document differences in teaching quality both within treatment and control conditions. One such approach has been developed in large scales studies such as reported by the TeachScape project (Pea, et al., AERA 2010), which analyzes pedagogical practices using audio and video. It would be interesting to see a study of this curriculum that more carefully addressed pedagogical differences and how these impact learners.

A great deal can still be learned by understanding how the supports offered to teachers, which included online supports, were used and can be used in the future to scale use of PBL. The intervention included some technology supports via video conferences, but these were not studied and evaluated. A key question to be addressed is how to support more effective use of PBL and it is likely that new technologies can play an important role (e.g., see Ravitz, 2010b). Perhaps there are ways to offer online professional development for teachers who obtain the curriculum or even ways to put the curriculum itself into an online format for use by teachers and students. (Note. Social Studies School Services is now publishing this curriculum without a professional development offering under the name of Project Based Economics. <http://www.socialstudies.com/c/product.html?record@TF43284>).

While the PBE curriculum appeared to be beneficial as compared to the approaches used by teachers in the control group, according data in the TEL handbook (Walstad & Rebeck, 2001) , both the treatment and contrast group in our study below the norm scores for country. This means that although the PBE group appears to have benefitted, there is still a long way to go in delivering high quality economics instruction in the participating states. It is possible that the characteristics of schools where the study took place are different from the schools in which TEL was normed. For example, California and Arizona may have larger than average number of language minorities and low SES students. We still have a lot to learn about how PBL works with diverse students, including language learners. It is unclear how much the intensity of language required for PBL or the assessments that were used may have influenced the study results, and whether the curriculum may have measurably helped students with some backgrounds more than others. Future analyses of the data will examine which types of students did well with the PBL economics curriculum, and how implementation can best support different kinds of learners.

There is an inherent inability for this study, as it was designed, to untangle curriculum and pedagogy. The treatment group received not just a PBL approach to curriculum but a series of information session and materials designed to support their content knowledge and teaching during the curriculum. This makes drawing conclusions about the effectiveness of the PBL approach problematic; the difference in outcomes could be attributable to teacher learning and access to higher quality content, not just a new approach to teaching that content. We are not sure how you could separate these things, but perhaps the control group in future studies could receive resources designed at improving teacher content knowledge and ability to present that content, independent of the framing of this content by a PBL unit.

There are only so many economics teachers per school, so it is important to consider how the lessons from the economics study might apply to other grades and subjects. This curriculum was developed over the course of several years and involved experts in instructional design and content areas. This development effort is clearly more substantial than most teachers would be able to undertake. However, in recent years, thousands of teachers have received professional development to design their own PBL units (tailored to their subjects and grade levels and students), and large libraries of projects have been developed using templates designed to scaffold planning, management and assessment of PBL (e.g., Buck Institute for Education, 2010; Williamson, 2008). The growth in the number of teachers who are trying to create well-designed PBL in an important development and there is very little research being conducted that might help people better understand how to effectively support their efforts.

One area of research to investigate in the future includes better understanding the conditions required for effective use of PBL. The intervention for this study was quite extensive. It will be important to figure out what is required if more people are to teach this way in economics and other subjects. People who have developed “small ID” reforms (lessons, curriculum) have often suffered from lack of “big ID” contexts (systemic change) for their work. The blossoming of large-scale PBL initiatives brings forth a plethora of opportunities for graduate students, researchers and developers (e.g., to study performance assessments, group work, student-as-researcher, specific technology scaffolds, etc.). Many challenges still face PBL users and researchers, but there has been progress in designing schools to support PBL (e.g., Author, 2010; Expeditionary Learning Outward Bound, 1999; Pearlman, 2002), creating online scaffolds

for PBL use (e.g., Hmelo-Silver, Duncan & Chinn, 2007), administering large scale performance assessments (e.g., Silva, 2008), measuring youth development outcomes (Newell & Van Ryzin, 2009). Now we have the first randomized controlled study to support PBL's effectiveness.

After answering the question "does it work" in this large study, it is still critical to learn how PBL can work better and be made more accessible across schools and subjects. There are unprecedented opportunities for research and it is important for the field to be aware of these. With the release of this new study, interest in using PBL to support effective teaching and learning should grow.

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# How could we use fantasy for learning in educational games: the first attempt

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**Abstract:** The purpose of this study was to explore fantasy meaning in learning technologies, especially an educational game setting. According to the literature and prior research base, fantasy has 2 main factors in the innate meaning. As a result of this research, the scope and depth of fantasy aroused from media imply what functions of fantasy in educational games are, how to use fantasy as a learning facilitator in learning technologies and design fantasy for learning on tailor-made purposes. For purpose of this study, the effects of fantasy in educational games on student academic achievements are explored. As a learning technology environment, the MMORPG (Massively Multiplayer Online Role Playing Game) Nori-school was used by the participants, consisting of third graders in elementary school. The operational definition of fantasy in educational games was set as an independent variable. Interest, intrinsic motivation, and storytelling as a narrative test were set as mediating variables, and academic achievements were chosen as a dependent variable. Interest, intrinsic motivation, and storytelling as a narrative test which are the mediating variables, affect the academic achievements. Results imply that learning technologies in conjunction with fantasy can be an effective way to increase students' cognition toward academic achievements.

**Keywords:** fantasy, fantasy and learning, communication in learning technology

## 1. Introduction

The self in post-traditional societies has been proposed as individual practice and narrating their identity (Hartley, 2005; Beck and Beck-Gernsheim, 2002). Personal media in post-traditional societies suggest a reflexive relation forming identity in social networks (Beck and Beck-Gernsheim, 2002).

Human's cognition as an agent of information processing can't equal to the reality as phenomena. Shared cognition is not objective real since it connotes prejudice, distortion, or stereotype of their culture. Thus, some culture areas might call our collective cognitions as a fiction, their fantasy. However, we have shared our cognitions and that is able to communicate through inter-subjectivity, thus we are grounded on collective fantasy, culture code.

Briefly, fantasy means a personal world in consciousness. According to research about memory (Eichenbaum, 2002), forming identity is the prerequisite of building their constructs. Personal media could give people potentials or chances for constructing and identifying their identities by freely expressing and realizing in social networks or personal settings with using the features of media. For instance, Web 2.0 as a learning technology which can suggest learner participation and creativity and online identity formation is come into the spotlight.

Fantasy as a concept of personal information processing might be meaningful for improving memory which can link academic achievements. Based on shared fantasy as cultural level, how can we use the individual memory which is formation of complexity between cognition and emotion for improving achievements?

## 2. Background

Educational or serious games might suggest the most fantastic media features as a learning technology. Most experimental research on the adoption of educational games on fantasy and learning has shown that digital games as a learning environment are presented in a fantasy context that is of interest from fantastic features and leads to increases in both student's interest and learning (Parker and Lepper, 1992; Cordova, 1993; Cordova & Lepper, 1996). High levels of interest arouse and maintain an intrinsic motivation for learning (Hidi, 2000). Interest is associated with deeper narrative of education and it may be the primary affective component in engagement (Consedine et al., 2004). Narrative is a way of resolving some fundamental antagonism by rearranging into a temporal succession (Zizek, 1997). Thus, fantasy contents which are based on need have been analyzed by using narrative structure (Scott, 2001).

Learning is associated with play benefits related to factors such as increased motivation (Rieber, 2001), and computer games are reported to increase motivation of learning as well (Asagari & Kaufman, 2004). The fantastic features may increase intrinsic motivation in individuals through satisfying their needs in its field (Asagari & Kaufman, 2004). In addition, narrative is a potentially effective tool for exploring the structure and process of "meaning making," as evidenced by psychologists adopting techniques from narrative analysis (Bruner, 1990). Narrative learning could offer more motivational and cognitive benefits than traditional learning experiences.

### 2.1. Fantasy

Malone and Lepper (1987) define fantasy as an environment that “evokes mental images of physical or social situations not actually present.” Psychiatric researchers define fantasy as a “defense mechanism” for the fulfillment of wishes and the resolution of conflict (Caughey, 1984; Hook, 1979). According to Hume (1984), fantasy is any departure from consensus reality, an impulse native to literature and manifested in innumerable variations, from monster to metaphor.

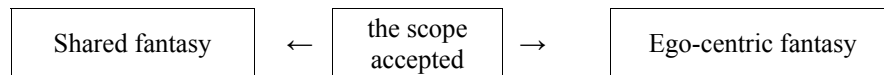
As indicated by Tolkien (1961), the reason we use “fantasy” is that it combines with its older and higher use as an equivalent of imagination the derived notions of unreality, of freedom from the domination of observed “fact”, in short of the fantastic.

To synthesize the above information, the operational definition of fantasy is as follows. Fantasy is an imaginative personal mental process or operation for substitute behavior that intends to fulfill the needs of people (Table 1).

Imaginative personal mental process	Imagination
Substitute behavior	Memory intervention

**Table 1:** Components separated by concept of fantasy

In the sense of Philosophy and Sociology, fantasy patterns are separated like Figure 1. According to this stereotype, the concept of fantasy’s degree in educational games can be applied as below.



**Figure 1:** Fantasy patterns in contents

#### 2.1.1. Shared fantasy

Games with no fantasies involve only abstract symbols (Malone, 1980). This pattern of fantasy is to experience mental operation or process based on the real. The real is represented by some specific culture of the related people on the game. The real of gamer and designer is made up of their culture and cognition formed by socialization. Not only do objects or storyline biased in game, by means of the absolutism perspective, but also they are containing elements of the culture system so called common illusion as an agent of sharing fantasy like ego, moral laws, religion, economy, science, and arts. Common illusion can be separated by a scope such as the world, a country, or a group. The wider accepted scope is the more stuck reality. Representations reflected by designer's view and interactions of massive multiplayer game, which are a fusion of their common illusion as a subculture. Objects, storyline, and interactions which we have felt authentic or realistic are cultural results. As the inherent properties of community through interactions, personal mental operation and process might be controlled by fantasy of reality as common illusion.

Thus, a game which has attributes of social grouping tends to arouse collective fantasy which lacks features of egocentric or autistic qualities that Freud and Piaget discuss as characteristic of fantasy states (Fine, 2002). Since human's needs to fulfill are focused on communication to achieve goals in massive multiplayer, objects or storyline could be coated just as materials. That is, a mechanism of fantasy as reality turns up more frequently than personal role-playing game does.

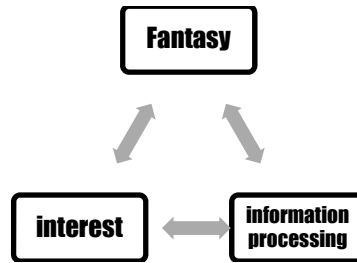
#### 2.2.2 Ego-centric fantasy

This pattern is to experience imaginative mental operation or process so called defense mechanism for the fulfillment of individual unconscious wishes and the resolution of conflict (Caughey, 1984). Wishes and needs take one's mental ground from experiences distinguished. A feeling of satisfaction could begin to escape the present states. It can provide opportunities to undergo achievements couldn't be gained in actual land. Human meet their needs through internal dialogues, and then they feel catharsis. This is the reason why a game could induce engrossment and promote identification with the figures.

### 2.2. Fantasy in learning, especially educational games

Children have a unique opportunity to explore their own emotional arousal (Fein, 1987), and an opportunity to experiment with possible interactions and relationships among humans (Leslie, 1987) through pretense or fantasy play. Fantasy play fosters children's cognitive and language skills (Cassell & Ryokai, 2001). In fantasy play, children practice their ability to represent objects and feelings with something that stands for them (Cassell &

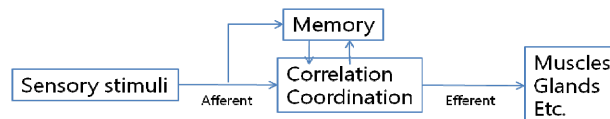
Ryokai, 2001). Peer's stories and imaginary creations serve as new suggestions for children to enact and tell their story creatively and freely (Baker-Sennett & Rogoff, 1992). In sum, fantasy might function to fun and information processing mechanism (Table 2).



**Fig 2:** Fantasy loop in learning

As mentioned by Tolkien (1961), fantasy is the mental complexity as an equivalent of personal imagination and reality ranged by a person's life scope. As a unique mental complexity adopting personal imagination, fantasy has a differentiating feature from usual information processing. Thus, fantasy can be separated in a similar way to mental information processes and, may also follow perception through sensory functioning, representation and action by motor functioning of brain. These stages are the conjunctive points of processing adjustment between inner consistency and new stimuli from learners' outside as well. Therefore, fantasy in an educational game might be observed in a view of pathway of sensory stimuli in physiology (Fig 3): response, narrative, and creation, and it is reflected to Table 2.

First, in the moment learners see or interact with fantastic features, they can experience their fantasy as response. It is triggered by fantastic features made by media characteristics, which are so called "bells and whistles". Sometimes it is used as a feedback loop to gamers for supplying rewards, when a gamer accomplishes the mission, such as sounds and messages of congratulations, shining images, or three-dimensional (3D) actions. Second, when they start to follow the scenario of the game, gamers' narratives, however, are different. Gamers concentrate on game environments first, and build their own meaning by inner consistency against new stimuli second. That is, the spacing between the lines of concepts is fulfilled by personal narrative built by gamers' own constructs. Third, if they change or create something in a game, they can participate in the game scenario as a creator. In Second Life, making an HUD (Hheads up Display), transforming objects, and generating and shifting appearance are adaptive instances. Avatars, fantastic features, and many functions for controlling their actions in a game environment facilitate learner's fantasy, and learners can experience their fantasy by interacting with their past or prior experience or constructs. Table 2 shows a summary of this concept.



**Fig 3:** Pathway of sensory stimuli in physiology

Information processing	Fantasy type	Fantastic features in games
Sensory functioning	response	Bells and whistles such as a fantastic sounds, images, or actions
Representation	narrative	Inner construction through interaction user's inner construct with symbols
Motor functioning	creative	Freely expressing using game control functions their thoughts or themselves

**Table 2:** Comparison of fantasy type based on information processing

For expediting fantasy, there are some environmental conditions. The first condition is a permissive atmosphere of free thought in which their narratives are respected and their storyline of mind can be reflected. This has a role of activating chances of memory intervention. The second is stimulating environment for imagination such as sensory richness or suggesting refreshing images. The more various and new sensory channels experienced by people, the deeper and wider their imagination scope becomes. The third is an advantageous environment for having projective identity. If humans' needs can be fulfilled in some situations, their immersion is deeper. Immersion is the necessary condition for evoking fantasy, and the relationship of projective identity and immersion is clinical. Projective

identity is formed by mirror neuron mechanisms of the brain. According to Meltzoff and Prinz's research (2002), mirror neurons might facilitate preliminary motor neuron simulation, priming, programming, and rehearsing, and this process enhances their ability to read the minds of others. Seeing characters in a game activates mirror neurons of gamers' brain, and it is possible to auto shape projective identity about their seized character or as a member of a virtual community.

Games suggest narrative structure by a pre-determined storyline and give chances for reflecting gamers' narrative. For example, some games do not include an ending scenario. Instead, gamers make their own world, and this becomes the result of the game. The characteristics of the game, such as 3D effects and virtual adventures, supply the fantastic features to gamers' group as a community, thus they can feel the pleasure of triumph from this world, added to the winning experience for each stage and can share it with other game members. They could realize their needs and be immersed in the game situation and then, their world is added to their constructs as virtual experiences. Virtual experiences act on their cognition as a mental complexity between the real and the imaginary.

### **3. Relationships among variables**

Interest has been defined as the most basic and ubiquitous of universal motivating emotions for humans (Bye et al., 2007; Izard, 1997, 1993). The proximal motivator for persistence and subsequent engagement, especially for activities that take place over the long term, is the degree to which one experiences interest and enjoyment in a particular task (Sansone & Smith, 2000). Particularly, intrinsic motivation has been described as the source of strength from individual interest (Alexander et al., 1997).

Csikszentmihalyi (1997) has described the auto telic or intrinsically motivated person as one who pays attention to things for their own sake without expecting an immediate return, is capable of sustained interest without recognition or with little support, and becomes caught up in the feedback loop between learning, interest, and enjoyment. An individual can enter the flow state by new skills, challenges, or new cognitive layers to existing interests built on the foundation of prior experience (Bye et al., 2007).

Tuner (1981) suggests that narrative is an experiential knowledge. The pattern of individual narrative can be easily observed by storytelling (Cassell & Ryokai, 2001). Narrative effects are included more or less unconsciously in most everyday storytelling; tellers explore and convey knowledge and experience. At the cultural level, personal narrative gives cohesion to shared beliefs and acknowledged values, so they are even more powerful when we tell the stories ourselves (Cassell & Ryokai, 2001). Especially, sociolinguistic discussions about narrative start with Labov and Waletzky (1967). The theory of natural narrative that emerged, focused on oral narratives of personal experience, describes a linguistic phenomenon that is both structured and detailed. Labovian Narrative Theory (LNT) makes clear that its discussion of narrative describes a very specific type of single-person narratives of personal experience. It notes that such narratives overwhelmingly tend to favor a very specific structure and organization, starting with the speaker signaling intent to begin a narrative, then a brief outline signaling the "point" of the story (Abstract) followed by context and setting (Orientation) within which the personal experience is embedded (Complication). The actions or events in the narrative then lead to some climax or effect (Resolution), which the narrator interprets or presents in some manner (Evaluation) reflecting her memories and stance toward the experience. Finally there is a conclusion or concluding statement (Coda), marking the end of the story.

Fantasy is, in accordance with learning principle viewpoint, the concept of respecting the maximization of students' constructs as a mental process which is aroused by interaction with gamers and context. After that, although learners have a real physical existence with their own identity of thinking because they have the experience as a main knowledge agent of thoughts, they can be interested in the suggested context. That is, the rich sensory and motor environment and elements of games can facilitate learners' free and infinite thinking, which leads to increased intrinsic motivation. According to accepted Carnival pedagogy (McCarthy & Dimitriadis, 2004; Rabkin & Redmond, 2006) which emphasis on daily life of learning, voluntary and active participation and enjoying oneself, however, positive effects about learning context such as fun, interest, and expectation can link to achieve academic grades through opportunities to experience ordering and withdrawing their world which is fantasy. For academic achievement, learners' private fantasy needs to order based on common fantasy in their culture like using a method of storytelling for expressing their narrative. Especially, storytelling has a role of communication in their community, thus, that would be used in a representative way for consultation of their narrative with others.

In summary, the current study aims to address the following research questions:

1. Are there direct significant effects of fantasy in educational games on achievements in learning?
2. Are there indirect significant effects of fantasy in educational games via interest, intrinsic motivation, and storytelling on achievements in learning?

In answering these research questions, the appropriate methodological tools are those of path analysis.



## 4. Research Method

### 4.1. Participants

The subjects used for this experiment were drawn from an elementary school located in Daejeon, South Korea. The participants were composed of 120 third grade students who had never played the game Nori-school. Their ages ranged from 9 to 10 years.

### 4.2. Instruments

Measuring the variables is composed of fantasy in educational games, interest, intrinsic motivation, and storytelling. **The on-line game.** There are many genres of computer games including action games, adventure games, strategy games, and role playing games. In this study we used a commercially available MMORPG known as Nori-school. Nori-school is a popular MMORPG in Korea that is set in the English learning context of a wizard town. Players receive a variety of quests from Non-Player Characters (NPCs) and have to solve these quests to become a powerful avatar. In the English learning scenario, Nori-school allows players to interact with objects in hospitals, houses, and factories. The learning goal of Nori-school is to memorize, understand, and apply expressions of English. **Fantasy in educational games.** This is a questionnaire of 18 items (Likert scale) modified appropriately based on concepts of imagination, memory intervention, and identification for educational game setting and elementary school students to be based on the creative experiences questionnaire (CEQ) developed by Herald Merckelbach et al. (2001). Cronbach's Alpha value of the inventory was .83. **Interest.** This consists of 15 items based on Schiefele's (1991) theory of interest. In addition, five items of The Differential Emotions Scale □-A (DES; Izard, Libero, Putnam, & Haynes, 1993) are used for measuring more persistent interest. Cronbach's Alpha value of the inventory was .73. **Intrinsic motivation.** The intrinsic motivation inventory (WPI: Work Preference Inventory) developed by Amabile, et al. (1994) was selected and adapted by the author. The scale consists of 10 items. Cronbach's Alpha value of the inventory was .78. **Storytelling (narrative test).** When learners finish the game Nori-school, they wrote reflective diaries focused on frequently used expressions as learning contents in Nori-school. It was graded by a 3-point scale how much they wrote expressions used in Nori-school depending on their own words. **Academic achievements test.** An achievement test developed by the author was administered to participants. The achievement test was used to measure student's achievement about memory or understanding of words. The test consists of words of 50 questions suggested by the second stage of Nori-school. Cronbach's Alpha value of the inventory was .82.

### 4.3. Procedure

First, the teacher explained how to play the game. Then, the participants played Nori-school until they all reached the first level. This was done to ensure that players have the same gaming ability. They played the online game, Nori-school, about 80 minutes per day (sum of classroom and homework), three times a week, for four weeks. Then, interest, intrinsic motivation, narrative, fantasy proneness, and the academic achievement were administered. As we intended to examine students' academic achievement by fantasy, game scores were excluded in this experiment.

## 5. Data analysis

Quantitative data were collected and analyzed using SPSS 15.0 for Windows and AMOS 7.0. The dependent variable is academic achievements. The independent variable in this study is fantasy in educational game. The mediating variables are interest, intrinsic motivation, and storytelling. Path analysis was conducted to examine the correlations and causal relations between the independent and dependent variables. Developed by Sewell Wright in the 1930s, path analysis is usually used to understand the relationships among variables. In path analysis, covariance or correlation coefficient is used to do causal analysis. It can be used to understand direct and indirect effects as well as quasi-effects that are hard to observe in multiple regression analysis. This means of analysis is used to find the regression coefficient of the linear structure formula among the variables set by the investigator.

In addition, narrative analysis was conducted to find fantasy contents from reflective dairies, based on the scope accepted. The tendency between shared fantasy and ego-centric fantasy was counted.

## 6. Results (1)

### 6.1. Analysis of correlations between variables

A correlation analysis was performed to determine the relationship among all the variables. Table 3 shows the correlation coefficient among variables. Fantasy in educational games appears to be significantly related to the interest, intrinsic motivation, narrative, and academic achievements. Narrative and intrinsic motivation are

significantly related to the achievements in learning. Interest, intrinsic motivation, and narrative have a statistically significant relation to the achievements in learning (Table 3).

**Table 3:**  
\*\* Correlation the 0.01 level

	Fantasy	Interest	Intrinsic motivation	Storytelling	Academic achievements
Fantasy	1				
Interest	.50**	1			
Intrinsic motivation	.60**	.51**	1		
Storytelling	.67**	.50**	.76**	1	
Academic achievements	.53**	.48**	.87**	.74**	1

Correlations, is significant at (2-tailed)  
analysis

## 6.2. Path

between the variables

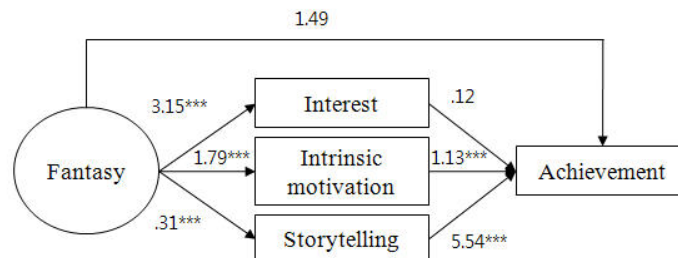
The research model was established based on the idea that fantasy in educational games has an effect on interest, intrinsic motivation, and narrative, and that interest, intrinsic motivation, and narrative have an effect on the achievements in learning. The path model is presented in Figure 4. In assessing the model, the author relied on several standard fit indices to examine the overall model fit: GFI, CFI was calculated as in Table 4. The chi-square was 27.216,  $p$  (probability level) = .004, the chi-square/degrees of freedom ratio ( $Q$ ) was 2.474, the GFI = .920, the CFI was .964 indicating that our structural model was a satisfactory fit for the data.

Fitness index	$\chi^2$	Q	GFI	CFI	NFI	TLI
Research model	27.216	2.474	.920	.964	.942	.932

**Table 4:** Summary of fit indices for measurement models

Paths	Estimate	S.E.	C.R.	P	Label
Intrinsic motivation $\leftarrow$ fantasy	1.793	.304	5.895	***	accepted
Interest $\leftarrow$ fantasy	3.151	.589	5.351	***	accepted
Storytelling $\leftarrow$ fantasy	.306	.052	5.894	***	accepted
Achievement $\leftarrow$ Interest	.118	.064	1.831	.067	dismissed
Achievement $\leftarrow$ Intrinsic motivation	1.126	.290	3.875	***	accepted
Achievement $\leftarrow$ Storytelling	5.539	1.694	3.269	.001	accepted
Achievement $\leftarrow$ fantasy	-1.486	1.213	-1.225	.221	dismissed

**Table 5:** Estimate of path coefficient, \* $p < 0.05$  \*\* $p < 0.01$  \*\*\* $p < 0.001$



**Figure 4:** The path analysis model

Results of the path analysis are shown in Table 5 and Figure 4. The fantasy in educational games does not have a significant effect on the achievement in learning and is therefore dismissed. The fantasy in educational games has a significant effect on the interest, intrinsic motivation, and narrative ( $\beta = 3.15, 1.79, 0.31, p < .001$ ). The intrinsic motivation and narrative have a positive and significant effect on the achievement ( $\beta = 1.13, p < .001, \beta = 5.54, p < .001$ ). But interest does not have a significant effect on the achievement and is therefore dismissed. The fantasy in educational games partly has a significant effect on the achievement in learning via the interest, intrinsic motivation, and narrative. As predicted in research problem 2, the fantasy in educational games had positive effects on the achievements in learning (Fig. 4), when it has mediate variables that are the interest, intrinsic motivation, and narrative.

## 7. Results (2)

The purpose is to see how respondents in interviews impose order on the flow of experience to make sense of events and actions in lives. The importance of narrative analysis is how narrative is organized. Grounded the concept of fantasy contents, narrative analysis was conducted to select between shared fantasy and ego-centric fantasy. Shared fantasy has a tendency of the community values which seek to external needs desiring to be recognized. Ego-centric fantasy, however, is focused on internal needs relatively. Used game, Nori-school is Massively Multiplayer Online Role Playing Game. This game environment is able to communicate or establish some strategies to achieving game goals, at the same time individual playing is not unnaturally. Fantasy contents were investigated, with grouping to massively multiplayer (64) or individual player (56). Conducting narrative analysis, Table 6 is the result of counting two groups.

Needs type	Needs content	Massively multiplayer	Individual player
External needs	Predominance	47(73%)	24(43%)
	Control others	57(89%)	16(25%)
	Game goal oriented	59(92%)	32(50%)
*Real community rule based		62(97%)	25(39%)
Internal needs	Individual representation	46(71%)	51(91%)
	Self goal oriented	28(44%)	50(89%)
	Out of rules in real	11(17%)	45(80%)

**Table 6:** Results of narrative analysis

As a result of narrative analysis, in case of massively multiplayer had a tendency of distinctly seeking to game goal. Since they participated in the game for breaking game missions, they communicated by common language adopted in real community. Their social activities with cognizing other people might be conducted in the game environment. Massively multiplayer felt a sense of belongings in community more densely because of group goals. They could share their fantasy which is converted collective fantasy, and it might rearrange game goals fitted in their world.

In contrast, players participated in the game individually were defined to their inner worlds relatively, because they didn't need to communicate other players. They just achieved personal game goals until wanting to quit the game. Thus, the game might act as an environment concentrating on their projective presence.

## 8. Conclusion and implications

This study sought to investigate the effects of fantasy in educational games on academic achievements. Games facilitate learner's fantasy through their media characteristics, given chances in virtual communities and game structures, and then educational games could act as a trigger to form learner's narrative toward learning. Research problem 1 suggested, however, is dismissed, because fantasy questionnaires is examined to focus ego-centric. Since each character of a MMORPG has its own role and skills, and players gamed in groups are about half in participants, the possibilities of forming personal narrative structure could be restricted as well.

Considering the path analysis model, fantasy has the strongest significance on interest. Following Hume's interpretation (1984), "Tolkien meant the refreshing effect of defamiliarization, the newness available to us only after we have freed ourselves from our sense of possessing the familiar (p.16)." In contents of fantasy, refreshing effect functions as ventilation of stimuli in intelligence and affect. Fantasy is a very strong factor for arousing fun and interest, thus, many students may show symptoms of game addiction. The second strongest variable affected by fantasy is intrinsic motivation. One of the distinguishing characteristics of intrinsic motivation from those of other motivations is "interest" about something endogenous. Interest is the strongest factor of fantasy in educational games, but it did not show a significant effect on academic achievements. Intrinsic motivation about learning contents, however, had a significant effect on academic achievements, thus, we could identify the importance of transitioning from interest to intrinsic motivation. That is, interest can just serve as a trigger to rely on media characteristics.

According to a result of path analysis, narrative is the strongest variable affecting achievements in learning. If learners begin to own their narrative about learning context regardless of the format supplied, they can achieve the goal of learning more effectively. Thus, it is needed to develop how to design the fantastic features for forming more efficiently and effectively personal narrative as information processing about learning contents and how to suggest

the chance for withdrawing from their narrative for academic achievements.

Conclusions which can be drawn from this study are as follows. First, fantasy in educational games needs conjunction strategies such as intrinsic motivation and using narrative for increasing students' academic achievements. Therefore, it is desirable for designers to find factors of fantasy in educational aspects, map them (the fantastic features) to their curriculum objectives, and apply benefits of fantasy for players in order to secure learning effectiveness. Second, designers of educational games need to focus on adopting strategies for forming and eliciting learner's narrative about learning from their fantasy such as storytelling or creative activities. Fantasy has a property of narrative, but the complexity of fantasy can interfere in withdrawing their narrative for achieving learning goals. Personal stories are not merely a way of telling someone (or oneself) about one's life; they are the means by which identities may be fashioned (Rosenwald & Ochberg, 1992, p.1). Narrative has a strong significant effect on academic achievements, thus, designers of educational games have to consider strategies for systemically ordering learner's thought from their fantasy to common fantasy. Storytelling elicits their experience or constructs including present learner's situations and the eliciting could serve as another experience through ordering narrative as a complexity of fantasy. In this research, in that massively multiplayer, they had a chance of sharing their world through their common real rule and language, they experienced storytelling in a group. However, their storytelling is just their collective fantasy in their group, thus it needs to be differentiated from the meaning of ordering gamers' narrative. Divergent thinking can be extended in educational games as sensory richness environments, but it is meaningful on academic achievements when it is linked to opportunities for learner's expression, which can gain experiences of reconstruction. This study suggests that designers of educational games need to set strategies which facilitate the building and extracting of learner's narrative as a mental complexity, since fantasy in educational games has no connection with learning context directly, but fantasy can be used with mediating variables for academic achievements. If this is done, then educational games might be more accepted as an effective teaching and learning tool in formal educational settings.

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## **Online Learning is NOT FLAT: An Analysis of Online Learning That Promotes Interactivity**

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## Abstract

The application and analysis of instruction in an online environment is critical to the success of distance learning. Whether a web page, blog, or content delivered by a learning management system, the instructional design is key to increasing the level of interactivity among participants. Using an Action Research model, the Interactive Learning Taxonomy (ILT) has been integrated throughout an online course for K-12 teachers. This study shows examples of the taxonomy, of interactive learning elements, and of the continuous improvement of learning outcomes in an online course.

## Review

Online learning in K-12 schools, in community colleges, and in higher education is the choice method of delivery. As traditional K-12 educators move to the role of instructional designers of online curriculum, it is important to recognize that what works in a face-to-face classroom filled with text and textbooks does not always work in a web environment. Online learning is not flat, is not text heavy, or a replication of the textbook. Good online content invites, motivates, and engages the learner to interact with the online content. The term engaged is used here to emphasize that the participants interact with each other around substantive issues (Xin, & Feenberg, 2006). In addition, Mitsuhashi, Kanenishi, & Yano (2006) coined the phrase multiperspective thinking in reference to learners needs to think about online content from many perspectives beyond their individual interests.

The term, “interactive learning” is described as the decisive measure of engagement in an online or in an on-ground class. As a dynamic relationship between teacher and students, between students and resources, and among students, interactive learning encompasses all content areas and all dimensions of learning. Steinaker and Leavitt (2008) designed the Interactive Learning Taxonomy (ILT) as one of 17 taxonomies educators could employ while engaged in the act of teaching and learning.

The role and function of computer enhanced learning as well as the level of interactivity for the teacher and learner has long been studied in the literature. “Computer based instruction provides greater potential for truly interactive instruction than any mediated teaching device...excluding the human tutor (Jonassen, 1988:97, in Sims 2003). To frame how digital content becomes “interactive” the ILT and its inquiry needs to include many of the contemporary digital construction tools such as blogs, wikis, learning and content management systems and other Web 2.0 tools that allow for the easy construction of digital, multimedia enhanced instruction.

The purpose of this paper is to report ongoing action research conducted with K-12 educators in a Masters degree program, which specializes in educational technology with a focus on teaching online. Action Research is defined as the process of “any systematic inquiry conducted by teachers in a teaching learning environment, to gather information about the ways in which their particular school operates, the teachers teach, and the students learn” (Gay, Mills & Airasian, 2006, p. 595). An Action Research model has been applied to examine if the ILT could be effectively utilized in an online environment. This study also seeks to exemplify the ways in which each step in the taxonomy is made intrinsic to the online learning process. Following Davis and Dunhill’s (2008) model of Learning Study, lesson preparation is preceded by an attempt to identify variation in ways of understanding a phenomenon that is the focus of the lesson. The intention of this activity is to help students to revise their professional knowledge, their theories of learning and teaching, in the light of their experience of practice.

Through this ongoing research, we continue to collect data on the application of the ILT as a practical tool for the construction and analysis of online content and online instruction. Although this research reports the role of a student constructed lesson using a blog tool, there are other learning and content management systems that will be studied in future research.

## Theoretical Construct of Interactive Learning

The ILT was first published in Steinaker & Leavitt (2008). The five categories of the ILT are: invitation, involvement, investigation, insight, and implementation. At the first stage of the taxonomy, activities in the invitation category are designed to engage students. Students need to become engaged in terms of content and process and then become aware of the short-term content as well as long-term goals and outcomes. Activities in this

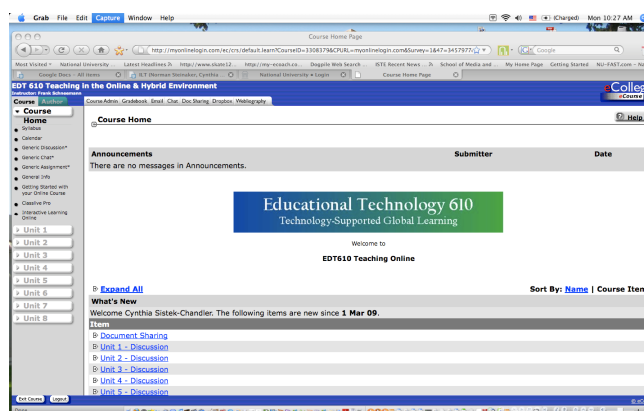


category involve interactive dialogue as well as developing a sense of readiness to learn. Involvement with the content follows as a second category where it is essential for students (as navigators through the content) to develop new levels of interaction. Involvement is the step when connections are more firmly established with the content. At this phase, the student explores ideas, issues, and materials.

As relationships grow, so does the next category of investigation. Here the learner begins to work at the application and analysis levels of cognition (Bloom, 1956). In this category, discourse and discussion are central to investigation. Group interaction among peers online is critically important. As a key component of the ILT, interrogative interaction with the teacher is pivotal in this investigative stage. It is hypothesized that insight develops when ideas and concepts come together and the process is internalized. Students demonstrate that they have achieved insight through analysis of goals and through expected outcomes. The process of developing insight from an interactive lesson can be both a culmination and a challenge for the student. The challenge becomes how to use what they have learned within the real world of their classroom or at their workplace. Implementation is the fifth and final category. Implementation is the dissemination and sharing of the changes that have taken place during this process of thinking, learning, and teaching. In this category of the ILT, students assume responsibility for what they have learned. They demonstrate their roles as influencer and disseminator. These are the categories of the ILT and the proposed process through which students will experience when they go through the taxonomy.

## Background of Study

EDT 610 Teaching Online is the second class in obtaining a Masters of Arts (MA) degree with a specialization in Educational Technology. The specialization consists of four focused technology integration classes as a supplement to the (MAT) offered by the School of Education at National University. This specialization is designed to assist practicing teachers to enhance their teaching skills and to develop knowledge and skills for using technology in an educational setting. EDT 610 is a comprehensive course that covers principles and strategies for conducting online instruction in a variety of online teaching environments including hybrid and blended instruction. In this class, students survey theories and explore the application of online learning and teaching for youth and adults. During this class, students are engaged in both asynchronous and synchronous discussion groups.



As the culminating project for this class, students were asked to create an interactive, online lesson using a blog format. A blog is "web log", an online lesson designed by the teacher to teach a concept or concepts in a specific subject and grade level. Blogs are widely used in K-12 education as a format for posting content and for communicating thoughts and ideas. Much of the "blogosphere" outside of education is used for logging personal comments and opinions. For the purpose of this class, students created a blog in EduBlog.

## Demographics and Description

In March 2009, the Interactive Learning Taxonomy (ILT) was integrated and applied in the EDT 610 class as a focused assignment for the analysis of an online lesson. Formerly, the class did not contain a model for building and assessing an online lesson. This pilot class included 13 students who were enrolled in the course: 7 males and 6 females. For this initial study, 12 students completed the application and analysis of the ILT. Since March 2009, 2 additional classes were added to the study, March 2010 (n=19) and July 2010 (n=21).

## Process for Analysis and Application of the Taxonomy

Students in EDT610 were asked to review a blog created by a former student, C. Lee (2009). An ILT template describing each stage was to evaluate the lesson/blog. Responses had to be three or more sentences in length. In addition, students were asked to rate the lesson according to criteria to determine the extent the blog followed the ILT criteria for interactivity and to rate at which level the National Educational Technology Standards (NETS) were mastered. These standards were developed by the International Society for Technology in Education (ISTE): Standard #1 – Facilitates and Inspires Student Learning and Creativity (NETS, 2008). The overall evaluation of the lesson/blog was rated using a 4-point Likert scale.

Evaluation of Online Lesson/Blog with Application of the ILT (Sistek-Chandler, Amber, Steinaker, & Tolbert, 2008)

1. Invitation - How has the instructor motivated and invited the learner?
2. Involvement - How does the lesson involve the learner with the content?
3. Investigation - Does the content of the lesson use an investigative strategy for learning the content?
4. Insight - What insight does the student gain from being involved in the lesson?
5. Implementation - How does the lesson and learning encourage the learner to implement or apply the content?

Does this lesson address the ISTE/NETS Standard #1?

1-Doesn't Address    2-Somewhat    3-Mostly Addresses    4- Completely Addresses

## Study Results

In the initial pilot study, twelve students completed the review of the lesson/blog and provided feedback that enabled the researchers to gauge their understanding of the taxonomy and consider it for future analysis.

## Analysis Questions:

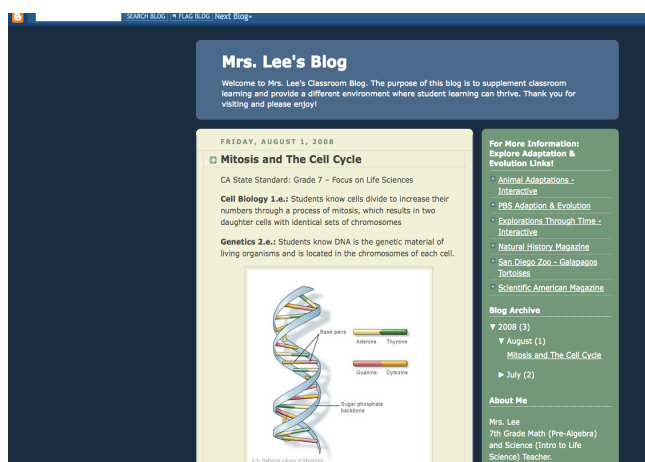
1. How has the instructor motivated and invited the learner?

Responses to the Invitation stage indicate the students perceive the site as meeting this stage of the taxonomy. Students mentioned such elements as “eye-catching and topic appropriate graphics; simple, attractive, well-organized format; page is easy to follow; and material is introduced with examples.”

2. How does the lesson involve the learner with the content?

Responses to the Involvement stage note that learners using the blog are required to interact with the content. Comments “builds on previous knowledge; good use of a variety of websites; provided California standard; rich print environment; allows students to interact with technology; and requires students to create a flow map and answer questions.”

3. Does the content of the lesson use an investigative strategy for learning the content?



The action words used by respondents indicate their view that students are involved in investigative activities such as “students explore their surroundings and relate material to previous knowledge; students list adaptation of living organism; applying concepts; responding to posts; choosing an environment; and visually expressing results.” This indicates students are challenged to use higher order thinking skills.

#### 4. What insight does the student gain from being involved in the lesson?

The Insight stage was seen as a strong element of the class blog. Comments from this area detailed activities that would encourage students to apply the knowledge in practical ways: “Students respond to posts and use critical thinking in their descriptions; students choose an environment and adaptations; students learn to visually express what they’ve learned; reinforcement occurs through use of external websites and activities; learning by reading other posts; encouraged to apply content; website encouraged real-life application; lesson draws comparisons to stages students will go through; students create a flowchart, and use knowledge to solve crimes; students provide their own examples through blog postings.

#### 5. How does this lesson and learning encourage the learner to implement or apply the content?

Students documented activities that lead to implementation of the content: “respond to blog postings; answer questions based on observations; students choose an environment and remark on adaptations; students use knowledge to solve crimes; websites encourage interaction and real life application.” Each of these elements encourages learner interaction with the content.

The EDT610 students were also asked to rate how well the instructional blog addressed ISTE/NETS Standard #1: Facilitates and Inspires Student Learning and Creativity (NETS for Teachers, 2008). A 4-point, Likert scale was used by the students to evaluate the level at which the lesson complied with or met the ISTE standard: 1 – Doesn’t Address; 2 – Somewhat Addresses; 3 – Mostly Addresses; and 4 – Completely Addresses.

In the July 2009 study, the mean of the 12 responses was 3.83. Seventy-five percent of respondents (n=9) rated the blog as 4; 17% (n=2) rated the blog 3.5. For the March 2010 section the mean score was 3.66 (n=19) and for the July 2010 section, 3.7 (n=20).

In July 2010, many students readily adopted this analysis of an online lesson and have also applied reflection and analysis to the overall process. In the dissertation research conducted by Ma, Lai, Williams, Prejean & Ford (2008) teachers who engaged in online journals often lacked articulate and reflective attributes of meaningful learning. Reingold, Rimor, & Kalay, (2008) emphasize that learning does not take place without reflection and engagement of metacognitive processes. One student in particular has applied this metacognitive statement in his work, suggesting we add another category to the taxonomy as an aid for his personal construction of the lesson.

Dear Professor, Given the form [template] that I received...I am hesitant to suggest adding another "I" to the list without first consulting you. Given the research that is stamped all over...the course's textbooks, might there be a place for an "Interactivity" category in the taxonomy? Overall, I believe the model [ILT] is a useful checklist, but will include the interactivity in my own evaluations to insure that I create the most powerful learning tools that I can (Student, EDT 610, July 2010).

Through continuous observation and analysis, we have noticed another theme. Students have also engaged in the reflective process of comparing the model (C. Lee’s blog) to their own blogs.

Overall it is a great blog. I see many weaknesses in my own [blog that I have created] that I am not sure I will be able to easily fix. A well-thought out lesson will take hours to complete, refine and edit, but once the final product has been produced, it can be replicated year after year with ease (Student, EDT 610, July 2010).

#### Overall Findings

The ILT, its structure and categories were generally easy to apply, initiating thoughtful responses to the prompts. All of the five categories were responded to in detail. The Insight stage was seen as a strong element of the

class blog. The principles of the ILT can be used to increase interaction and involvement in an online course. The ILT can assist the teachers in guiding the construction of content to be more interactive. As a tool for analysis and evaluation of an online, interactive lesson, the ILT proved to be extremely positive and useful; students easily embraced the taxonomy. Often students engage in the practice of restating factual information however in this case, the ILT fosters higher order thinking through application and analysis. Overall, the results indicate the ILT is a valid tool for analysis of interactivity for practicing teachers.

The July 2009 study is the first application that actively applied and assessed the five elements of the ILT (Sistek-Chandler, et al, 2009). Students responded to using the ILT without prompting or hesitation. Although the population for the initial study was small (n=12), the pilot proved to be the resounding utility of the ILT and the need to include this application and analysis in future EDT 610 classes. Since the initial pilot, an additional 40 students have been asked to participate in the study of the ILT to analyze a sample blog and reflect upon their understanding of the ILT stages.

#### Application of the Interactive Learning Taxonomy in Future Studies

In applying the interactive learning process, we believe this approach has the potential to produce a high-quality online learning environment that actively and purposefully engages learners (Baldwin & Sabry, 2003). According to Steinaker & Leavitt (2008), the strength of interactive learning is that it encapsulates the overall process of learning and helps to provide a concrete representation of knowledge for the student. Implementation of the ILT theory becomes the springboard to new areas of learning and assists the learner to move toward the replication of the process in a new context. The taxonomy of interactive learning can be utilized for online teaching while the designer applies each step of the ILT to a planned and purposeful pathway for learning.

Online learning environments (OLE) and online content is typically designed for one-way dissemination of information (Hughes, Terveen, Ernst, & Ooms, 2009). Hughes et al posit that the OLE delivers the instructor's content and structure, without the consideration of students' needs, perspective, or interests. We refer to this as flat, passive content with a minimum level of interactivity. Our research extends beyond the issue of learning style and emphasizes the need to apply 5 guiding principles from the ILT to engage the learner with interactive content; content that promotes interactivity between teacher and students, between students and resources, and among students. The Web interface is a bridge between instruction and learning (Cassarino, 2003). It is clear that while presentation of content is clearly one important aspect of any learning encounter, without effective interactivity manifested through communication, involvement, control and adaptation, the effectiveness of online and flexible learning will be minimized (Sims, 2003).

The next step in the investigation of the use of this taxonomy is to solicit suggestions to refine the ILT categories. As we move forward with new classes of EDT610, we plan to have the students use this taxonomy (ILT) to further analyze not only the work of a peer which serves as a model online lesson/blog but also to apply this same analysis as a reflection on their own instructional, online content (blog).

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# **Effectiveness of Mediated Communication Formats for Learning and Student Interaction in a Distance Learning Course**

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As computer use and the internet have become more mainstream so has the acceptance of utilizing the internet as an alternative platform to perform many tasks that have traditionally been in physical environments. Considering how the world has embraced the internet, it is no surprise educational institutions have found the web to be a good home for the next evolution in distance learning. While technology has been the driving force behind most of the evolutions in distance education, it is also the force behind the generally recommended good practices of online pedagogy (Moore & Kearsley, 2005; Belderrain, 2006). It is now considered status quo for an online learning course to have a computer-mediated communication medium in which students collaborate, interact, and engage in discussions. Most commonly, this mediated communication takes place asynchronously inside the learning management systems by means of an electronic bulletin board, also commonly known as discussion boards (Hew & Chung, 2008). Through this mediated communication students are afforded the opportunity to establish connections with their peers through communicative exchanges. These dialogues may be socially driven or they may be driven by the content of the instruction.

As discussion boards become the de facto standard medium for peer communication in online learning (Dennen, 2005), the next generations of web tools has come of age. Web 2.0 is a term used to describe a new variety of online tools that are geared toward enabling and promoting user participation in the creation of the web content (O'Reilly, 2005). The key to Web 2.0 is a sense of participatory media and increased collaboration and online community. With Web 2.0 and good practice for online learning sharing similar theoretical frameworks it seems as though this next generation of applications would be a good match with online education. Would a Web 2.0 utility, such as an online blog, provide the same learning opportunities as electronic discussion boards? According to Christenson, Anakwe, and Kessler (2001) providing a computer-mediated online learning environment is not sufficient for a technology to be seen as inherently viable. A technology must be considered by students' to be useful, in general, and specifically useful to online learning efforts (Christenson, Anakwe, & Kessler, 2001). The potential usefulness of a specific type of Web 2.0 application, blogs, can be found in the structure. Blogs are simply an evolution of the traditional web page; comprised of individual posts, rather than presenting information as web pages. A blog post may only be a single commentary no more than a couple sentences or a paragraph or it may be much more lengthy and detailed, some may even incorporate audio and video segments. The opportunities for each student to post substantive comments to other students' blog entries add an additional tier of interactivity and social engagement (Glogoff, 2005). In online learning communities enhanced opportunity to promote collaboration and interaction is highly beneficial to learners.

Although asynchronous discussion boards have become standard parts of online learning courses, online learners are becoming more accustomed to Web 2.0 technologies. Would student interaction and collaboration be different if online students used blogs instead of the standard message boards? Does the format of the interaction

make a difference in the level of learning that takes place for students? Jung, Choi, Lim and Leem (2002) found that increased collaboration activities among students did not lead to an increase in learning among the students. Similarly, Godwin, Thorpe and Richardson (2008) report adoption of interactive computer-mediated learning within online learning environments may not be enough to lead to positive learning outcomes.

The very process of writing encourages reflection, which helps promote higher level learning so computer-mediated collaboration should enhance student learning (Hew & Chung, 2008). Results from other studies found that students have a preference for more collaborative learning environments (Christenson, et al. 2001). While some research suggests that learners can benefit from simply reading the substantive postings of other students and taking an active role in collaborating may not be necessary for all students in distance learning courses (Gulati, 2008). Results reported by Hara, Bonk and Angeli (2000) found mediated communication platforms in online learning courses lead to increased substantive collaboration among students as well as higher cognitive processing of instructional materials, as based on posting analysis. Dennen (2005) similarly found online courses with mediated communication forums where students had a higher level of participation and less socialization focus also had a higher quality of cognitive learning expressed via message postings. While Fernandez (2007), concluded that social presence in the online community can aid in collaboration and learning.

This paper examines the results of an experimental research study aimed at answering the following question: What effect does the format of computer-mediated communication have on students' learning and substantive interaction in online asynchronous distance learning courses? The dependent variables of the study included student interaction, as indicated through qualitative analysis of the message posting by utilizing the definition of meaningful interaction posed by Seo (2007). The second dependent variable was learning, as indicated through analysis of the message postings qualitatively assessed by means of according to Krathwohl's (2002) revised version of Bloom's (1977) taxonomic framework and through posttest measures of learning objectives.

## **Methods**

### **Participants**

The participants for this study are twenty graduate-level education students from an educational technology course at a large public university in the southwestern region of the United States. The course focused on the integration of technology in education. The ages of the participants range from approximately 23 to 52 years old. Sixty percent of the participants were female and forty percent of the participants were male. All students had previously completed at least one online course. All students had the minimum baseline level of technical competency required for participation in an online distance-learning course. Examples of these technical competencies include: accessing and receiving facilitation through an online learning management system, communicating with other students and their instructors using emails and discussion boards, and participating in distance learning assessments, such as quizzes and exams, in the online modality.

### **Materials**

#### Instructional module

A module on designing online instruction was presented in the Blackboard LMS. Module objectives included 1) Discuss the types of Websites that can be used in educational settings, 2) Explain what planning is necessary prior to establishing Web-based instruction, 3) Understand how HTML editing software is used to create Web pages, 4) List strategies for organizing the documents of a Website, 5) Explain why regular maintenance is vital to a quality Website. Several reading assignments, a learning activity, and a discussion prompt were provided as a means for students to engage in the module's conceptual information.

#### Discussion Board

All students received the same prompt and repeated instructions about the number of required posts; one original posting and two responses to other postings were the typical expectations for computer-mediated discussion in the course. The posting expectations were to write one or two paragraphs about the educational tool and how the tool could be most effective in teaching/training and learning. Students were directed to suggest a technology tool related to the chapter reading for the week, which would be effective in teaching/training and learning. They were also prompted to provide a link to the tool's website and a link to at least one demonstration or tutorial available online for the selected tool.

A discussion board rubric designed to assess cognitive performance was adapted from a similar rubric created by Christopher, Thomas, and Tallent-Runnels (2004). This rubric assigned point values to the cognitive performance demonstrated in the students' postings as delineated by categorization into low, mid, and higher order thinking skills as displayed in Table 1. The basis of the rubric was formed using Krathwahl's (2002) revised version of Bloom's taxonomy cognitive process dimensions

Table 1  
**Cognitive Performance Rubric**

Score	Dimension	Explanation	Related Thought Processes
1	Remember Understand	Learner must be able to recall information such as dates, events, places, ideas, definitions, formulas, theories, etc. The learners must be able to grasp the meaning of the information, express it in their own words, and/or cite examples.	Recognizing, Recalling, Identifying, Retrieving, Clarifying, Paraphrasing, Representing, Translating, Exemplifying, Illustrating, Instantiating, Classifying, Categorizing, Subsuming, Summarizing, Abstracting, Generalizing, Inferring, Concluding, Extrapolating, Interpolating, Predicting, Comparing, Contrasting, Mapping, Matching, Explaining
2	Apply Analyze	The learner must be able to use or apply knowledge or skills to new situations. The learner must be able to use information and knowledge to solve a problem, answer a question, or perform another task. The learner must be able to break down knowledge into parts, and show and explain the relationships among the parts.	Executing, Carrying out, Implementing, Using, Differentiating, Discriminating, Distinguishing, Focusing, Selecting, Organizing, Finding coherence, Integrating, Interpreting, Outlining, Parsing, Structuring, Attributing, Deconstructing
3	Evaluate Create	The learner must be able to judge or assess the value of material and methods for a given purpose. The learner must be able to pull together parts of knowledge to form a new whole and build relationships for new situations.	Checking, Coordinating, Detecting, Monitoring, Testing, Critiquing, Judging, Generating, Hypothesizing, Planning, Designing, Producing, Constructing, Constructing models

The definition of meaningful interaction in CMC for educational exchanges introduced by Seo (2007) was utilized to classify interaction among participants in the two types of CMC. Postings that (a) pertained to a discussion topic, (b) responded to a question or an idea expressed in a previous statement or invites a comment, and (c) enriched the conversation by adding substance to the discussion, were coded as fully interactive. A rubric was created using this scale to code the students' postings and is illustrated in Table 2.

Table 2  
**Substantive Interaction Rubric**

Score	Criteria
1	Pertained to a discussion topic
2	Responded to a question or an idea expressed in a previous statement or invites a comment
3	Enriched the conversation by adding substance to the discussion



### Assessment

Demonstration of student comprehension of content presented in the learning module was assessed via a ten-question multiple-choice quiz delivered through the course LMS. The questions for the quiz aligned with the learning objectives for the module, the module learning activities and the weekly assigned readings. All questions in the quiz related to the learning module topic of designing online instruction.

Students were also presented with an attitudinal survey to gauge technology preference, receptivity to technology, confidence with technology, and frequency of technology use. The attitudinal survey was adapted from a previously validated instrument created by Christensen, Anakwe, & Kessler (2001). The adaptations in the survey represent evolutions in technology and distance learning advancements.

### **Procedures**

This was a two-part, quasi-experimental study. The study was conducted using participants from a graduate level, education course. All students had previously participated in a learning module on Web 2.0 technologies and had at least one previous experience interaction with blog technology. All students in the course were expected to participate in group “discussion activities” via the discussion board in the Blackboard LMS each week of the semester. The instructions for participation in the discussion activities were presented in the syllabus and reiterated by the instructor via postings in the Blackboard LMS.

The first part of the study was conducted as a formative evaluation of materials. In this first part of the study, fifteen students from a graduate level education course were randomly assigned to one of the two treatments groups, discussion board or blog. Students completed the discussion activities, the module quiz and the attitudinal survey. Adjustments to the study instruments and methodologies were made after observing participants and reviewing feedback from the formative evaluation phase.

In the second phase of the study, twenty students from a graduate level education course were randomly assigned to one of the treatment groups, discussion board or blog. All students had previous experience with online learning, discussion boards and blogs. The study took place during the seventh week of the semester. All students in the course were introduced to Web 2.0 technologies as a regular part of the course instruction during the fifth week of the course. One instructor facilitated the learning for the course in which all the participants were enrolled. That instructor served as the study liaison and answered any question from the students that arose including providing directions to find the link to the blog and the attitude survey. The instructor did not provide any feedback on the requirements or expectations for postings in either of the mediated formats during the tenure of the study. The students who were randomly selected to participate in the blog groups received an email invitation to the blog location sent via the Blackboard LMS. The link to the blog was also placed in the learning module materials along with the link for the discussion board for the week, the online quiz and the attitudinal survey.

### **Measures**

This research study uses both quantitative and qualitative approaches to describe and analyze patterns of participation, interaction, and meaning construction in CMC postings. Following measures validated by Christensen, Anakwe and Kessler (2001) the distance learning questionnaire was used to assess student preferences toward distance learning, preference for various types of CMC and frequency of use of CMC tools. The questionnaire includes a collection of demographic data and a survey about the receptivity toward and preference for the method of CMC they used during the study. The questionnaire was adapted to include current technology references as well as questions related to the learning module.

The content was analyzed to consider the level of cognitive performance and substantive interaction displayed within CMC postings. The rubrics developed follow the work initially introduced by Henri (1990) who utilized levels of Blooms taxonomy to categorize deepness of cognition. The rubric created in this study was adapted from Christopher, Thomas and Tallent-Runnels (2004) using a three level system to assess cognitive performance via the cognitive process domains as indicated in Krathwohl’s (2002) revision of Bloom’s Taxonomy.

The definition of meaningful interaction in CMC for educational exchanges introduced by Seo (2007) was utilized to classify substantive interaction among participants in the two types of CMC. Messages that (a) pertained to a discussion topic, (b) responded to a question or an idea expressed in a previous statement or invites a comment, and (c) enriched the conversation by adding substance to the discussion, was coded as fully interactive. The lead researcher twice scored each of the postings according to the substantive interaction rubric.

The posttest measured students’ understanding of the learning module content. The quiz questions were adopted from the instructor textbook companion website provided by the textbook publisher and aligned with the module

objectives. The ten questions were all in multiple-choice format and students all received the same set of questions on the quiz.

## Research Design

This study is a one-by-two posttest only design. The independent variable was computer-mediated communication format (blog or discussion board). The dependent variables were student interaction in postings and learning, as measured by cognitive performance in postings and quiz performance, as well as student attitudes.

## Results

This section summarizes the differences between treatment groups related to student cognitive performance and substantive interaction in discussion board postings and performance on posttest measures.

### *Cognitive performance*

The means and standard deviations for cognitive performance by mediated format (discussion board or blog) are presented in Table 3. The mean score for students in the blog prompt treatment was 1.91 (SD =.944) compared to the mean score of 1.00 (SD =.866) for students in the discussion board treatment group. The overall mean score for student cognitive performance was 1.50 (SD=1.00).

Table 3  
*Means and Standard Deviations for Cognitive Performance by Mediated Format Condition*

	Blog	Discussion Board	Total
Mean	1.91	.944	<b>1.50</b>
Standard Deviation	1.00	.866	<b>1.00</b>
N	11	9	<b>20</b>

*Note.* The maximum possible score for the cognitive performance was 3.

An ANOVA was conducted to assess the effect of computer-mediated format on the dependent variable, learning, as demonstrated through cognitive performance in discussion postings. The results are presented in Table 4. The main effect was found to be statistically significant,  $F(1, 18) = 4.939$ ,  $p = .039$ , partial  $\eta^2 = .215$ . These results indicate students in the blog group received significantly higher scores for cognitive performance when their postings were assessed as a measure of learning.

Table 4  
*ANOVA Summary Table Cognitive Performance by Treatment*

Source	df	F	Partial $\eta^2$	p
Contrast	1	4.939	.215	.039
Error	18			

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

### *Posttest performance*

The means and standard deviations for posttest performance by mediated format (discussion board or blog) are presented in Table 5. The mean score for students in the blog prompt treatment was 2.82 (SD =3.027) compared to the mean score of 2.44 (SD =3.005) for students in the discussion board treatment group. The overall mean score for student posttest performance was 2.65 (SD =2.943).

Table 5  
*Means and Standard Deviations for Posttest Score by Mediated Format Condition*

	Blog	Discussion Board	Total
Mean	2.82	2.44	<b>2.65</b>
Standard Deviation	3.027	3.005	<b>2.943</b>
<i>n</i>	11	9	<b>20</b>

An ANOVA was conducted to assess the effect of computer-mediated format on the dependent variable, learning, as demonstrated through posttest score. The main effect was not found to be statistically significant,  $F(1, 18) = 0.076$ ,  $p = .786$ , partial  $\eta^2 = .004$ .

#### *Substantive interaction*

The means and standard deviations for substantive interaction by mediated format (discussion board or blog) are presented in Table 6. The mean score for students in the blog prompt treatment was 0.91 (SD =1.044) compared to the mean score of 1.67 (SD =1.323) for students in the discussion board treatment group. The overall mean score for student substantive interaction performance was 1.25 (SD =1.209).

Table 6  
*Means and Standard Deviations for Substantive Interaction by Mediated Format Condition*

	Blog	Discussion Board	Total
Mean	.91	1.67	<b>1.25</b>
Standard Deviation	1.044	1.323	<b>1.209</b>
<i>n</i>	11	9	<b>20</b>

*Note.* The maximum possible score for the cognitive performance was 3.

An ANOVA was conducted to assess the effect of computer-mediated communication format on the dependent variable substantive interaction. The main effect was not found to be statistically significant,  $F(1, 18) = 2.053$ ,  $p = .169$ , partial  $\eta^2 = .102$ .

#### *Survey Results*

Students were given an attitude survey that contained forty-seven Likert scale style questions and three open-ended questions. The survey was grouped into categories including perceived technology usefulness, technology usage and technology preference. Technology usefulness and technology preferences were scored on a one to five scale and technology usage was scored on a one to six scale. The survey also included demographic criteria. The means and standard deviations by mediated format (discussion board or blog) are presented in Table 7.

The items that received the most positive responses referenced frequency of use of the World Wide Web and email. Students had the most positive attitude on items number thirty-six and thirty-seven, which inquired about frequency of technology use for the World Wide Web ( $M = 5.80$ ,  $SD = 0.632$ ) and frequency of e-mail usage ( $M = 5.80$ ,  $SD = 0.422$ ) indicating that all respondents used each of the technologies everyday. The item that received the next most positive response was item number twenty-three, which asked students how many times every day they used the world wide web ( $M = 5.30$ ,  $SD = 1.059$ ) indicating that all respondents used the web several times everyday.

The three items that received the most negative responses each referenced frequency of technology usage. Students had the most negative attitude on item number twenty-nine pertaining the amount of time spent on a daily

basis using chat rooms ( $M = 1.00$ ,  $SD = 0.00$ ) indicating that all students almost never use chat technology. The item that received the second most negative response was item number thirty pertaining the amount of time spent on a daily basis using blogs ( $M = 1.40$ ,  $SD = .699$ ) indicating that students on average use blogs for less than thirty minutes each day.

Table 7  
*Means and Standard Deviations for Survey Items*

Item			Mean	SD	Total	
					Mean	SD
1	I prefer to use blogs.	Blog	2.50	.837	2.50	.707
		Discussion Board	2.50	.577		
2	I prefer to use discussion boards.	Blog	3.67	1.033	3.70	8.23
		Discussion Board	3.75	.500		
3	Using a blog in a class helps me learn	Blog	3.33	.816	3.30	.675
		Discussion Board	3.25	.500		
4	Using a discussion board in a class helps me learn	Blog	4.33	.816	4.20	.632
		Discussion Board	4.00	.000		
5	This module was valuable	Blog	4.33	.516	4.20	.422
		Discussion Board	4.00	.000		
6	I liked this module	Blog	4.17	.408	4.00	.471
		Discussion Board	3.75	.500		
7	I would consider distance learning for a core course	Blog	4.33	.816	4.10	.994
		Discussion Board	3.75	1.258		
8	I would consider distance learning for an elective course	Blog	4.17	.753	4.30	.675
		Discussion Board	4.50	.577		
9	How useful do you feel the world wide web would be for distance learning	Blog	2.00	.632	2.30	.823
		Discussion Board	2.75	.957		
10	How useful do you feel e-mail would be for distance learning	Blog	3.50	1.049	3.70	.949
		Discussion Board	4.00	.816		
11	How useful do you feel video conferencing would be for distance learning	Blog	3.83	.753	3.80	.632
		Discussion Board	3.75	.500		
12	How useful do you feel chat rooms would be for distance learning	Blog	3.83	.753	3.60	.843
		Discussion Board	3.25	.957		
13	How useful do you feel audio tape would be for distance learning	Blog	2.33	1.366	2.50	1.179
		Discussion Board	2.75	.957		
14	How useful do you feel video tape would be for distance learning	Blog	2.67	1.211	3.10	1.101
		Discussion Board	3.75	.500		
15	How useful do you feel US mail would be for distance learning	Blog	1.50	.837	2.10	1.197
		Discussion Board	3.00	1.155		
16	How useful do you feel discussion boards would be for distance learning	Blog	4.17	.753	4.30	.675
		Discussion Board	4.50	.577		

17	How useful do you feel blogs would be for distance learning	Blog	3.83	.753	3.60	.843
		Discussion Board	3.25	.957		
18	How useful do you feel wikis would be for distance learning	Blog	4.00	.632	4.00	.667
		Discussion Board	4.00	.816		
19	How useful do you feel podcasts would be for distance learning	Blog	3.67	1.033	3.60	1.075
		Discussion Board	3.50	1.291		
20	How useful do you feel file sharing communities (such as YouTube) would be for distance learning	Blog	3.67	1.033	3.60	.966
		Discussion Board	3.50	1.000		
21	How useful do you feel Virtual Worlds (such as Second Life) would be for distance learning	Blog	2.67	1.506	2.70	1.160
		Discussion Board	2.75	.500		
22	How useful do you feel Social Networks (such as Facebook & MySpace) would be for distance learning	Blog	2.83	1.602	3.00	1.414
		Discussion Board	3.25	1.258		
23	How much time you spend on a daily basis using the world wide web	Blog	5.17	1.329	5.30	1.059
		Discussion Board	5.50	.577		
24	How much time you spend on a daily basis using e-mail	Blog	4.33	1.633	4.40	1.430
		Discussion Board	4.50	1.291		
25	How much time you spend on a daily basis transferring files with a computer	Blog	3.00	.894	3.30	1.059
		Discussion Board	3.75	1.258		
26	How much time you spend on a daily basis using video conferencing	Blog	4.17	3.125	2.90	2.846
		Discussion Board	1.00	.000		
27	How much time you spend on a daily basis using discussion boards (academic)	Blog	3.00	1.673	3.10	1.370
		Discussion Board	3.25	.957		
28	How much time you spend on a daily basis using discussion boards (non-academic)	Blog	2.00	1.673	2.10	1.524
		Discussion Board	2.25	1.500		
29	How much time you spend on a daily basis using chat rooms	Blog	1.00	.000	1.00	.000
		Discussion Board	1.00	.000		
30	How much time you spend on a daily basis using blogs	Blog	1.50	.837	1.40	.699
		Discussion Board	1.25	.500		
31	How much time you spend on a daily basis using wikis	Blog	1.50	.548	2.40	1.838
		Discussion Board	3.75	2.363		
32	How much time you spend on a daily basis using podcasts	Blog	2.83	2.401	2.10	2.025
		Discussion Board	1.00	.000		
33	How much time you spend on a daily basis using file sharing communities (such as YouTube)	Blog	1.83	.983	2.50	1.780
		Discussion Board	3.50	2.380		
34	How much time you spend on a daily basis using virtual worlds (such as Second Life)	Blog	3.33	2.944	3.50	2.877
		Discussion Board	3.75	3.202		
35	How much time you spend on a daily basis using social networks (such as Facebook & MySpace)	Blog	2.17	1.472	2.30	1.767
		Discussion Board	2.50	2.380		
36	How frequently do you use the world wide web	Blog	5.67	.816	5.80	.632
		Discussion Board	6.00	.000		

37	How frequently do you use e-mail	Blog	5.67	.516	5.80	.422
		Discussion Board	6.00	.000		
38	How frequently do you transfer files with a computer	Blog	4.33	1.506	4.40	1.776
		Discussion Board	4.50	2.380		
39	How frequently do you use video conferencing	Blog	4.50	2.950	3.70	2.983
		Discussion Board	2.50	3.000		
40	How frequently do you use discussion boards (academic)	Blog	2.67	2.422	2.90	2.378
		Discussion Board	3.25	2.630		
41	How frequently do you use discussion boards (non academic)	Blog	3.83	1.602	4.20	1.398
		Discussion Board	4.75	.957		
42	How frequently do you use chat rooms	Blog	2.17	2.401	2.30	2.497
		Discussion Board	2.50	3.000		
41	How frequently do you use blogs	Blog	3.33	2.582	3.20	2.530
		Discussion Board	3.00	2.828		
43	How frequently do you use wikis	Blog	4.17	2.041	4.40	1.955
		Discussion Board	4.75	2.062		
44	How frequently do you use podcasts	Blog	4.00	2.757	3.40	2.797
		Discussion Board	2.50	3.000		
45	How frequently do you use file sharing communities (such as YouTube)	Blog	3.33	1.862	4.10	1.912
		Discussion Board	5.25	1.500		
46	How frequently do you use virtual worlds (such as Second Life)	Blog	3.33	2.944	3.40	2.797
		Discussion Board	3.50	3.000		
47	How frequently do you use social networks (such as Facebook & MySpace)	Blog	3.17	2.483	3.90	2.183
		Discussion Board	5.00	1.155		
		Discussion Board				

*Note.* The maximum possible score for preference section was 5 with higher scores indicating stronger agreeance. The maximum possible score for usefulness section was 5 with higher scores indicating more perceived usefulness. The maximum possible score for usage and frequency was 6 with higher scores indicating more frequent usage.

A multivariate analysis of variance (MANOVA) was conducted on student attitude levels toward technology preference. The effect was not found to be statistically significant, Wilk's Lambda = .461  $F(1, 8) = .146$ ,  $p = .969$ , partial  $\eta^2 = .539$ .

Data was collected from a set of open-ended questions in both phases of the research. One of the questions related to technology preference regarding blogs and discussion boards. The other open-ended questions related to satisfaction with the learning module. The responses from the technology preference section are displayed in Table 8.

Table 8

*Open-ended responses to the prompt, "Please explain your answers [regarding technology preference] in more detail"*

The blog was new to me, so it was a little harder to use. I have used blogs before, but don't like them. They don't seem as "organized" as discussion boards with post titles, response trees, etc.

We used a blog ... and I found it unwieldy and unorganized. With a discussion board there is a thread with a clear topic and it is organized and easy to follow a blog is too all over the place for me. A blog also feels more social

than educational to me. Perez Hilton has a blog, he doesn't have a discussion board. A discussion board by nature seems more educational to me.
I have no experience with blogs yet. I like the discussion board because I learn from the other students and enjoy reading their posts, but I think that the instructors should have to respond to each of our posts if you're going to assign one every week. They are a lot of work. At this stage I am more comfortable using the discussion board, but with a little time I feel sure I would be just as comfortable with using a blog.
I have never used blogs in an online class, but I don't think they would be all that effective. Discussion boards just seem so tedious. I sometimes feel like I just do them to get them done.
Discussion boards lead to more interaction. They mimic a conversation more than a blog. Blogs are more like the long ramblings of the student who can't make their point. They can be interesting and informative but not interactive.
I have noticed that discussion boards are shorter than blogs. But I just created my own blog and I just love it.
I think both are useful tools in discussing, I just prefer the blog format
I think a blog is more interactive rather than the discussion board which seems very choppy and less like a discussion,
I do not really see a difference between using a blog and/or the discussion board. I will add, however, that blogs are more aesthetically pleasing.
I feel that discussion boards foster more natural conversation, as opposed to blogs, which are primarily one-sided.
Discussion boards for me are not necessarily learning opportunities as much as they are a chance to just see how other people think. The one exception was my BIO class ... where we used it to answer questions for the upcoming test. Going through that and answering other students' questions helped ME learn the material and was really gratifying. :)
I have been in learning situations where the usefulness of either of the above tools is determined by how the instructor sets them up.

## Discussion

The results of this study did not indicate a significant difference in learning as measured by the posttest. However, the qualitative assessment of postings indicated a significant difference in learning, as measured by cognitive performance using a scale based on Blooms revised taxonomy (Krathwohl, 2002; Christopher, Thomas, & Tallent-Runnels, 2004). Results showed that participants assigned to the blog group composed posts that were rated at a higher cognitive level than students who created postings in discussion board format. There was no significant difference in the level of substantive interaction between the students in either of the computer-mediated formats. Although the participants assigned to the discussion board group posted more responses than the students in the blog group, the postings were not qualified as substantive by measures of this study (Seo, 2007). This indicates that the form of communication in which students were assigned to post in this study did not make a difference in how thoroughly they interacted with their peers in the posting assignment.

The posttest results did not yield any significant difference between the mediated format groupings. The mean score for the posttest did not yield significant results when used as a measure of learning.

Feedback gathered from the open-ended questions indicates that some students may see posting assignments as tedious in any format. Students who were less familiar with the blog technology appear to indicate a lack of comfortableness with the medium and indicated that it could be found to be less organized and more one-sided than blogs. However, other students mentioned the aesthetically pleasing nature of blogs and indicated a growing fondness for the technology. Open-ended feedback also indicated students may find regular posting assignments to be tedious, in general. Respondents referred to instructor interaction and feedback as a criterion in satisfaction with the technology used to facilitate interaction.

Responses on the survey, not surprisingly, show regular use of the internet and e-mail among the student

participants. Mean preference scores also indicated that blog use was rated as one of the lowest among types of daily technology usage, while academic discussion boards showed a higher reported daily usage among the subjects of the study. This would support the notion that discussion boards are the most typical type of technology used in distance learning courses to simulate classroom interaction (Dennen, 2005; Hew & Chung, 2008).

### **Limitations of study**

The small sample size was one of the biggest limitations of this study limiting the power and generalizability of the findings. The length of the attitudinal survey may have also limited the results, as some of the participants did not complete all of the responses.

The blog was external to the Blackboard LMS and it is possible that the additional effort required to access the blog was demotivating to some of the participants. Disproportionate exposure to the computer-mediated technologies used in this study may confound the performance and feedback from the participants.

The study was conducted in an Educational technology course. This could also have an impact on the results, as these students may be more generally accepting of technology, especially for the purposes of learning, than the general student population in other educational disciplines.

The study participants reviewed the overall satisfaction with the learning module favorably but the performance on the posttest was low for all the students. The assigned prompts used in this study were loosely associated with educational technology tools in general, rather than the specific technology addressed in the learning module. It is possible that performance on posttest measures may have been different if the content were more tightly associated with the content of the discussion prompt and the assigned readings.

### **Implications**

Usage of technologies, such as blogs, for peer interaction in distance learning may lead to higher cognitive performance on learning objectives. Varying the design of a distance learning course beyond the typical usage of discussion board for regular posting assignments and student interaction may yield a gain in learning for students who compose more thoughtful postings in an alternate medium.

Distance learning facilitators and designers may want to consider integrating instructor feedback and more structured cognitive challenges for student posting assignments. Generalized prompts that are aimed to lead toward regular student interaction may not be found to be academically stimulating for students in distance learning courses. Participants in this study indicated an interest in interacting with the facilitator as well as other students during weekly computer-mediated interactions.

### **Future Research**

Future research to build upon the results of this study may consider the addition of instructor feedback as a variable. Further, future studies would gain insight by having a larger sample of participants from which to collect data. Many graduate level courses have a smaller enrollment size than do undergraduate level courses. Although graduate students do tend to be more intrinsically motivated to complete assignments, an undergraduate level course with high enrollment may serve as a better population from which to draw a sample. Research with students who are not in the education field would also provide insight into the interaction of students in other disciplines. The prevailing pedagogy and design of the distance learning courses in other disciplines may differ significantly from that of a graduate level education course. It may also be valuable to further dissect the information about students' postings and interaction in the mediated formats by categorizing initial postings and response postings separately. It is possible the level of interaction and cognitive performance differs depending on whether a student is composing an initial post or responding to others. It may also be of interest to examine demographic difference between subjects for familiarity with and preference for specific learning technologies. It is possible that gender and age may bias learners toward certain types of computer mediated communication technologies, which could be useful when designing distance-learning coursework. Another criteria for consideration of inclusion in an attitudinal survey may be the concept of passive learning gained from reading the postings of other students even if the reader does not respond or interact with the postings. The passive cognitive gains from studying these interactions may provide insight into the collective learning communities that form in distance learning courses.



## **Conclusion**

Communication in distance learning courses is an important part of team building and collaboration that helps simulate the natural community of the traditional classroom. Discussion boards contained within the learning managements system that facilitate the distance learning course quite often default to built-in discussion boards for the purposes of peer interaction and collaboration. Other mediated communication options, such as blogs, may prove to provide a higher level of cognitive performance and could lead to more substantive interaction amongst participants. The results of this study indicate that students who used a blog for a weekly posting demonstrated higher levels of cognitive performance in their postings.

Higher levels of cognitive performance are often associated with gains in learning. It is possible that deviating from the typical computer mediated format may stimulate students thinking about discussion prompt. It is also possible that once communication is out of the learning management system and instead out on the internet for others to see mundane assignments may be taken more seriously. Consideration should be given to designing a distance-learning course with the audience in minds. Technology novices and those who are not adept at learning new technologies may not find a new communication format engaging. They instead, may find the extraneous cognitive load to be detrimental toward the cognitive performance and substantive interaction that is beneficial for student learning in computer mediated communication assignments.

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# Adolescent Awareness of Security and Etiquette on Facebook

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**Abstract:** The number of Facebook users has dramatically increased in several countries. The highest number of users are in the United States, followed by the United Kingdom, Turkey, and Indonesia (GreyReview, 2010). Issues involving its use have increased as the number of users reach the 500 million mark (Facebook Press Room Statistics, 2010). As a social network, Facebook provides an exciting interactive online environment. Users collect “friends” as a manifestation of their increasing popularity, share their lives through photographs, reconnect with old friends, and maintain friendships. However, users are also open to online attacks, diminished real-life social skills, and identity theft. This paper attempts to initiate a critical discussion and establish relevant research methodology for studying adolescent awareness of ethical and security issues in Indonesia. The authors, users of Facebook as well as parents and teachers of Facebook users, offer their personal experiences to anchor the discussion.

## Introduction

Facebook (FB), considered the most popular social networking website today, has raised many concerns regarding its use by 18 - 24 year-old young adults and 13 - 17 year-old adolescents (Webster, 2008). Most youth, excited by its features and applications, constantly check their FB pages and have difficulty staying away for long periods of time (Mori, 2009). The integration of FB on smart phones, like the iPhone, has exacerbated the situation by giving users instant access from any location (Watkins, 2009). However, FB’s popularity among youth has drawn concern and criticism from parents and educators (Goodman, Maggio, & Lyman, 2008). The publishing and sharing of personal information on FB make malicious attacks possible, real-life socializing less common, and increase the risk of identity theft by strangers (Wang, 2009).

In the United States, online behavior and security are critical issues due to a proliferation of malicious behavior and cyber-crime. Online insults create conflicts between adolescents, adolescents and parents, and adolescents and teachers. Identity theft, cyber-bullying, and sexual harassment add to the negative consequences of FB misuse in the U.S. With the rise in popularity of FB in Indonesia, there is great potential for similar problems among Indonesia’s youth.

The number of FB users in Indonesia is increasing dramatically, similar to what is seen in the United States, United Kingdom, and Turkey. Based on The Facebook.com survey from March 1, 2010 (GreyReview, 2010), Indonesia was ranked 4th of the highest FB users in the world. The number of FB users in Indonesia now has reached near 19 million. From that number, the largest group of users are young adults (18-24) at 40.55% and adolescents (13-17) at 27.25%.

Research shows social networking sites, such as FB shape an adolescent's identity by facilitating the ability to network and access information (Bonk, 2009; Tapscott, 2009, Watkins, 2009). Most FB users post photos and videos, send messages, and chat. Many adolescents post everything on FB and include feelings, thoughts, and personal information, although Watkins (2009) found that not all the posted information was true.

Adolescent FB users are generally less aware of the risks of FB use (Goodman, Maggio, & Lyman, 2008). Teachers and parents try to protect their children and students by banning the use of FB. However, this does not solve the problem. According to James, et al. (2009), it would be more important for adolescents to have knowledge about the ethical uses, effects, and risks of this media. Raising adolescents' awareness regarding ethical online behavior and the importance of securing personal information will help adolescents make good decisions while using FB.

Although FB has improved its security system, the responsibility remains with the user to adapt and set up the new security system. Unfortunately, not all users are aware of FB's improvements and personal information continues to be shared freely on the Internet.

This paper examines information from Indonesian student FB users, parents and teachers in Hawai'i, and includes a review of the literature. With a focus on ethical and security issues, the authors seek to use this discussion to study adolescent FB use in Indonesia.

### Purpose

The purpose of this paper is to: 1) Review the literature on FB security; 2) describe reasons for focusing on adolescents in Indonesia; 3) develop a critical body of information on the topic; 4) plan a study of FB use among Indonesian adolescents.

### Methodology

Information was collected from a pilot project on Indonesian students use of FB, teacher and parent written perspectives of FB use by young people in Hawai'i and the United States, and a review of the literature. The overview describes the reasons for focusing research on adolescent FB users in Indonesia and presents data from a brief pilot study completed previously. A description of three categories of adolescent FB users in Indonesia follows. Hawai'i and U.S. perspectives, in the form of personal essays, are also included. A literature review includes case studies, articles, newspapers, and publications. The authors met face-to-face and online through Google Docs to discuss ideas, focus the topic, and collaborate on the writing of this paper.

### Review of the Literature

There are both negative and positive aspects to FB (Dwyer, Hiltz, & Passerini, 2007; Ellison, Steinfield, & Lampe, 2007; Boyd, 2008; Boyd & Ellison, 2008). Adolescents have fun interacting with friends and keeping in touch with friends or relatives who live far away. On the other hand, adolescents receive inappropriate photos or comments and suspicious calls and messages. There is also the potential of misuse if the user forgets to log out when using FB in an Internet café.

FB does provide users information about their rights and responsibilities as well as terms of service (Walters, 2009; Shih, 2009; Vander Veer, 2008; Vander Veer, 2009). This information is put on a page that is easily accessed by clicking the icon link at the bottom of a FB account page. In addition, when FB launched its new application, an email was posted to the user's account and information was posted in a blog online (O'Neil 2009). When FB launched its application for users to set up their profile security, the developers post an email and publish information on the Internet to let users know about it. Adolescents who ignored the message and/or did not look at the announcement email from FB showed a "lack of awareness." This "lack of awareness" about the security system was the dominant factor creating hacked or stolen FB accounts (Softmaster, 2001). Users did not secure their privacy and claimed that they did not know about privacy and security issues (Debatin, Lovejoy, Horn, & Hughes, 2009).

Security awareness means that adolescents can implement preventative actions (i.e., avoiding a friend

request from strangers, using the FB security system, or deleting important personal information on their accounts). Corrective action can include deleting the account, changing the account password, deleting the inappropriate posting, or making a complaint (Facebook Principles, 2007). It is important that adolescents learn and understand the security system and all security system updates to minimize the risks to their personal account and information. Brown (2005) stated that peers influenced the way adolescents think and learn about social [networking] relationships. It would be interesting to examine if adolescents would learn more about FB risks and etiquette if it came from their peers' experiences.

What role do parents, relatives and teachers play? Collin & Laursen (2005) tout the importance of parents in developing adolescent awareness. The Board of Children, Youth, and Families (2004) also reports the importance of teachers and school engagement. Parents, teachers and other adults have the responsibility to help adolescents use FB and other Internet sites safely. Adults, however, are facing difficulties with the new technology (Watkins, 2009; Bonk, 2009, Tapscott, 2009). A possible solution is for adults and adolescents to openly discuss Internet security issues together.

## Overview

Indonesia is the world's largest archipelago country. It covers an area of 1,919,440 square kilometers and contains a population of about 234 million people (Population Projections, 2010). Of the 234 million people, about 42 million are adolescents and young adults (17.95%). Recently, 19 million people in Indonesia have started using FB, which is approximately 8% of the total population. Of these users, the percentage of young adult and adolescent FB users in Indonesia is 67.8% (GreyReview, 2010) and approximately 13 million or 5.5% of the total population. Based on these statistics and the first author's experience with the geography and culture of Indonesia, there are 3 main reasons to research adolescent use of FB in Indonesia.

Indonesian adolescent identity is shaped by ethnic and religious factors. Conformity to ethnic traditions and religious rules are highly valued by most Indonesians which are reinforced by families and society. Indonesian adolescents are raised to conform to ethnic traditions and religious rules. Since ethnic tradition and religious rules are the guidelines for adolescents, it will affect what they will do on FB or their actions will conflict with core beliefs.

Indonesian adolescent identity is also shaped by family. Most adolescents live with family. Parents are more likely to have their children live with relatives or older siblings than in a dorm. In addition, family gatherings are one of the most important events in one's life. Therefore, it is not unusual to include family members in FB accounts. These family members may shelter their adolescents from harmful behaviors in FB.

In this study, adolescents were placed into three categories based upon access to digital technology and FB. The first category represents adolescents who have no access to digital technology because they are either in poverty or live in a remote area. This category will be excluded from this analysis because those in remote areas are most likely unfamiliar with FB. The second category represents adolescents with limited access to digital technology. This group consists of adolescents who might not have a computer and Internet access at home, but can access the Internet through Internet cafes. The third category represents adolescents who can easily access the Internet through a personal computer/laptop or a personal mobile-device (iPhone, Smartphone, etc.). While both categories share basic knowledge, experience, and Internet literacy, they vary in understanding and application; affecting their awareness of security and the ethical applications of FB use.

The following figure shows personal perspectives about adolescent FB use (see Appendix for full essays) with an analysis of the resulting information that follows.

Themes	A	B	C	D	E
Blurring Relationships	X	X			X
Maintain Social Ties (Personal & Family)	X	X		X	X
Distraction	X		X	X	
Games		X			
Decrease in F2F Social Skills			X		
Addiction	X		X		
School/Work Policies	X			X	

Figure 1. Common themes from the essays.

There were 7 themes that emerged, with 5 of the themes repeated in more than one essay. The theme of “Blurring Relationships” developed as FB is used in multiple environments - personal, work, and home. In her essay, B discussed the potential blurring between friends and family, as well as friend and teacher. She wrote, “I wondered if her friend shared that page with her mom and who else would see it that was not a “friend.” Later I learned that my daughter’s high school teachers were “friending” their current and former students” (para. 2). E also echoed the blurring between friend and family as he shared that his son is not his friend on FB (para. 2). He also argued that the term “friend” is too general in FB and suggested that “acquaintance” should be a “friend” alternative (para. 1). Similarly A wrote about the blurring between friend and work by sharing an example about a friend’s experience (para. 3). Through these examples, the theme of “Blurring Relationships” occurs in multiple ways.

Two of the themes, “Distraction” and “Addiction” are connected to the frequency in which users check their FB page. C wrote, “At my school, Facebook is unblocked and students can, and constantly do, access Facebook at all times of the day” (para. 2). D’s experiences with her daughter are also similar. She shared, “Every waking moment my child would find some way of getting on to the site, chat with classmates who were sometimes sitting across, and Facebook had become the evil of every dinner conversation...” (para. 2). A expanded on this, sharing how FB can be a “Distraction” and an “Addiction” to working adults as well.

Related to the frequency at which users check FB, are the policies that schools and work environment impose. Evidence of the “School/Work Policies” in D’s essay is shown in, “There was no monitoring system on student use and it became an issue of treating students like adults and having them decipher how to manage their time better” (para. 3). A wrote, “At work, while some networks blocked Facebook to keep their workers on track, there are some that don’t and I know of many who constantly check” (para. 3). Without clearly establish policies regarding social networking, “The temptation is there and [users are] expected to have the discipline enough to just say no” (D, para. 3).

Despite the concerns that several of the authors shared, a theme that nearly all of their essays shared was “Maintain Social Ties (Personal and Family). This theme is actually a positive feature of FB as many users share information with friends to stay up to date on their relationships. D wrote, “it has kept us updated with birthdays, family photos, and gossip” (para. 3). B stated, “It was a way for people to keep in touch and find out what’s going on in the lives of friends and family” (para. 2). Although there are concerns about the safety of FB, it can be beneficial. FB can be a wonderful tool when users exercise restraint regarding the amount and type of information posted.

### Conclusion: Future Research

In a previously completed pilot study, adolescents were placed into three categories based upon access to digital technology and FB. The first category represents adolescents who have no access to digital technology because they are either in poverty or live in a remote area. This category will be excluded from this analysis because they probably do not know about FB. The second category represents adolescents with limited access to digital technology. This group consists of adolescents who might not have a computer and Internet access at home, but can access the Internet through Internet cafes. The third category represents adolescents who can easily access the Internet through a personal computer/laptop or a personal mobile-device (iPhone, Smartphone, etc.). While both categories share basic knowledge, experience, and Internet literacy, they vary in understanding and application; affecting their awareness of security and the ethical applications of FB use. Future research would study categories two and three.

Four data collection techniques can be implemented in a study of adolescent FB use. These four techniques include an online survey, online interview and text-chat, FB account analyzing, and participatory observation and an in-depth interview, which can be used to collect and analyze data.

An online Survey is the easiest technique for collecting data with the use of survey applications like Survey Monkey, Lime Surveys, and Google Forms. The survey will be implemented by sending the link to adolescents’ FB or Gmail accounts. Potential respondents will be identified through their school affiliation. To expand the number of respondents, teachers and others who reside in Indonesia will be asked to also send the survey link. It is projected that a minimum of 3 months is needed to get the data representing a valid sample. It is hoped that both the data from adolescents who have higher access to FB and adolescents who have less access to FB can be gathered. The biggest challenge of the online survey will be to verify that the respondent meets the required criteria for the study, primarily since respondents will be anonymous. Other challenges are designing a questionnaire with the right amount of questions and translating it into Indonesian.

Interview and text-chat are two additional techniques. Skype, IM Conference Call, and Yahoo Conference Call can be used to facilitate a small number of follow up interviews. If the adolescents feel uncomfortable with talking, data can also be gathered through text-chat with FB, IM, and Yahoo chat room. More time will be needed to collect data with these techniques if a large number of respondents are involved. Data can also be collected from a small number of respondents and research can be focused on case studies. The biggest challenge in implementing these techniques is the language difference between most of researchers and the respondents. Other challenges for implementing these techniques are the process of organizing and presenting a large amount of qualitative data and the possibility of respondents deciding not to continue to participate in research. In case studies, the results cannot be generalized.

Analyzing Indonesian adolescents FB accounts is another potential way to collect data. After gaining user permission, research can be started by analyzing the FB accounts accessed through the researcher's account. To obtain a different access authorization, the researcher can create a new account as a non-friend. Researchers can collect information listed by adolescents to see what kinds of information are readily available for viewing by a friend and a non-friend. Comparing the different information relative to the level of friendship can give a birds-eye view of the number of adolescents that have implemented the security system to their accounts.

Participatory observation and in-depth interview are the best way to collect data. Through participatory observation, researchers can carefully observe and record the activity of Indonesian adolescents when using FB. In-depth interviews will obtain more information needed for analysis. Respondents' activities can also be recorded in a video. The greatest obstacle would be the long distance and the high cost needed for research. To collect the data, researchers need to stay in Indonesia and become involved in the adolescent's daily life.

A large-scale research study would add to the literature available on the topic and benefit adolescents, parents, and teachers by dealing with the implications of FB as a social networking site. The data would answer questions regarding adolescent general knowledge and responses on FB, including adolescent online activities, and present examples or non-examples of risky online behavior and development of social skills and ethical online behavior.

## Appendix

**A Student's View of Facebook (A):** Facebook began making waves while I was completing my undergraduate degree. I had a friend from another university who's school was just invited, and she was so excited to show me. I was impressed, and couldn't wait until my school was added. Once it hit my school, it was huge.

Profile pages were scrutinized, photos added, friends requests sent, and more. While my profile was always somewhat bare, looking at everything was just so much fun. One of my roommates at the time, was still holding out, and with her permission I created her account. Without one, people constantly asked her to join so that she could be added. It was almost as if she "had" to join.

Post graduation, things began to change. I started to go through the photos that I had been tagged in, and untagging myself from anything that could be potentially harmful. Facebook had become open to so many schools, that there was now potential of anyone discovering your profile, including your future boss. Some were so concerned that they completely deactivated their account.

At work, while some networks blocked Facebook to keep their workers on track, there are some that don't and I know of many who constantly check. This is seen with the speed at which people update their status and comment on one another. When Facebook completed incorporating all schools into their network, that is when the mixing of personal life and public life truly happened. Without the requirement of a [.edu](#) email address, anyone could join Facebook, and anyone could friend you and read your profile. While working, a client that a friend of mine was working with, friended her on Facebook. Schools were also impacted by this as well. Schools had to regulate teacher's use of Facebook since student could find their profiles. An entire school district's restrictions were so tough that no teacher was allowed to maintain a profile. At the college level, becoming "friends" with a professor is also questionable.

Aside from concerns about mixing one's personal and professional/academic life, is the concerns of mixing personal life with family life. For example, aside from having people of my generation online in Facebook, I also saw individuals older than me. Since I consider Facebook to be highly social, I don't necessarily want the older generation of my family being privy to everything that I post or was posted about.

Lastly, I tend to be a more private person, and don't want the whole world to see my life moment by moment.

**A Parent and Elementary School Teacher's View of Facebook (B):** I knew almost nothing about Facebook the day my daughter said that her college roommate was setting up a page for her. An online social network sounded pretty cool.

It was a way for people to keep in touch and find out what's going on in the lives of friends and family. It sounded good to me. She shared her first semester and her new friends via Facebook. I loved it! As time passed, there were lots of photos of performances, her study abroad program, and hiking trips. The photos were tagged with the names of people I came to recognize. Her friends added and tagged photos that she didn't have. Then one day Facebook took on a different meaning. My daughter was looking at a friend's page. As I looked on, I saw lots of pictures of parties and drinking. Hmm ... college life? I wondered if her friend shared that page with her mom and who else would see it that was not a "friend." Later I learned that my daughter's high school teachers were "friending" their current and former students, and a college professor sent her a "friend" request. It seemed a bit awkward to me.

Later as a teacher, I listened quietly as a seven-year-old student talked about Facebook's Farmville. He asked if I was on Facebook and explained that he wanted to "friend" me. I smiled politely and the request was forgotten. Was he allowed to be on Facebook? Then I read about a class action suit filed in California against Facebook by parents who were angry about the likenesses of their children being used in advertising. I didn't see a Facebook response about the litigation. My fears about Facebook concern minors and their ability to make good choices. Who are they "friending" and accepting as "friends?" Who's seeing their pages? Where does corporate responsibility begin and end? What do you say to a college student who places questionable photographs of him/herself on a Facebook page? Scientists say that much of brain development in the area of decision-making happens in the mid-twenties. Mistakes on Facebook can be far-reaching. The world is large and information travels quickly – for good or bad.

**A Secondary School Teacher's View of Facebook (C):** As a middle and high school teacher, I think Facebook is in many ways hurting our students. Facebook and similar sites are called social networking sites; however, I strongly believe this is a skewed interpretation of what social networking really is. While it is true that student's can network with their friends by "friending" them on the different websites, I sometimes wonder if the digital communication between friends is as effective as face to face (f2f) communication.

At my school, Facebook is unblocked and students can, and constantly do, access Facebook at all times of the day. I literally see students on Facebook when I am walking to my classroom in the morning, when I'm eating lunch, and when I leave school at the end of the day. I've even seen times when a group of friends are sitting at a table with their laptops logged into Facebook and instant messaging their friends sitting at the same table! We recently had the Internet go down because of a power outage at school and it was funny to watch the students being forced to make conversation with their friends. It was actually awkward for some of those students! While I am an Educational Technology major, and I believe in social networking, virtual reality, and even online and virtual learning, I also think that face to face communication is an important skill to have and I'm not convinced this seeming addiction to Facebook is a good thing for our students.

**A Parent's View of Facebook (D):** As a parent of a teenager, there are specific concerns that placate my every waking moment and these concerns seem to be growing as my child gets older. Things like the current need to drive, relationship woes, academic load, sports, diet, among other necessary teenage wants were all part of the parenting package. When my child's school decided to institute their laptop initiative 3 years ago, all parents and students were required to undergo a laptop workshop that dealt with safety concerns, cyberbullying, and the technical issues we all would face. However, there was no session regarding the then craze of social network sites.

The novelty has since withered but not after constant reminders of how much a distraction Facebook had become in my child's life. Every waking moment my child would find some way of getting on to the site, chat with classmates who were sometimes sitting across, and Facebook had become the evil of every dinner conversation, reprimand, and argument. What it boiled down to was the inability to discipline oneself on time management when maintaining a moderate G.P.A., athletic participation and extracurricular activities.

What was troublesome was more that the school blocked everything else except Facebook. There was no monitoring system on student use and it became an issue of treating students like adults and having them decipher how to manage their time better. I always thought of the analogy of sticking a donut in a dieting person's face and telling them they can't eat it. The temptation is there and 13-year-olds were expected to have the discipline enough to just say no.

As said earlier, the novelty is gone, in part to my child's own understanding that Facebook time does not count towards college credits nor is it allowed in most work environments. As a parent, the only positive Facebook



attribute is perhaps the social immediacy in knowing that you're able to meet your friend in 5 minutes down the hall. Beyond this notion, it is a big distraction to say the least and has not benefited us in any aspect, added value to our family dynamics, or made the bonds of our family stronger. It has kept us updated with birthdays, family photos, and gossip but a simple phone call, letter, or email could accomplish this. Perhaps understanding that my child is an only child and this was an outlet that pacified the loneliness is up for debate, but I question whether I would allow such people into my family to begin with.

**A Parent's View of Facebook (E):** I am a Facebook (FB) user and I have benefited from the strong sense of connectedness to current and past associates. The ability to reconnect with past associates is great and I appreciate the ways that FB allows me to share my experiences. It is also a great tool for establishing new associations and communicating with current contacts.

As a mature adult I am able to better differentiate between associates and friends. I know that it is possible to have many, many associates however friends are rare. I have three sons, one adult and two young adult sons, the youngest being 15. I am concerned about their ability to limit their exposure to people who might not have their best interest in mind. Also, the amount of Friends in a young user's account is a status indicator. My 23-year-old son has 796 FB friends and my son who just turned 18 has 1,561 FB friends. The 18 year old has always been a social child but it is difficult for me to believe that he has and maintains real friendships with 1,561 people. I cannot report numbers for my 15-year-old because he has not responded to my friend request.

The negative effect of "friendship perception" worries me. I question the ability of young people to keep their associations in proper perspective. The dangers associated with sharing information with the wrong people can have long lasting consequences. Facebook should be more realistic in their use of the term friend. Perhaps they should offer users associate as an option.

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# Higher Education Sub-Cultures and Open Source Adoption for Distance Learning

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## Abstract

Successful adoption of new teaching and learning technologies in higher education requires the consensus of two sub-cultures, namely the technologist sub-culture and the academic sub-culture. This paper examines trends in adoption of open source software (OSS) for online learning by comparing the results of a 2009 survey of 285 Chief Academic Officers and Chief Information Officers with the 2006 administration of the same survey. Results indicate that while the key drivers of OSS adoption continue to differ for the academic and technologist sub-cultures, both sub-cultures converge in deeming total cost of ownership as the most important metric for making a go/no-go adoption decision.

## Introduction

In its sixth annual report on the state of online learning in U.S. higher education, the Sloan Consortium reports that more than three quarters of all public institutions in the U.S. are engaged in offering education online and that future enrollment growth will be fueled by adults seeking to switch or advance careers in a changing labor market (Allen & Seaman, 2008). Additionally, technology expectations of students are forcing institutions to improve efficiencies and enhance organizational performance while adopting new technologies to remain competitive. One way that organizations have approached technology cost control has been to deploy Open Source Software (OSS), software that is distributed with its source code according to the criteria established by the Open Source Initiative (Open Source Initiative, 2006). Examples of popular OSS applications include the Linux Operating System, Apache for Web servers, and OpenOffice suite. There are also OSS applications for teaching and learning, particularly learning management systems (LMSs). The leading OSS LMS products are Moodle (<http://www.moodle.org>), originally developed in Australia, but currently with a global user base that includes nearly 30,000 registered sites, one million courses, and available to anyone for downloading, and; Sakai (<http://www.sakaiproject.org>), a platform developed by a group of U.S. institutions that includes generic collaboration tools along with teaching and portfolio tools available under an Education Community License. Moodle is built on OSS technologies such as PHP, while Sakai is largely Java-based. Other OSS LMS products include Claroline (<http://www.claroline.net>), available in more than 35 languages and used in 80 countries; .LRN (<http://www.dotlrn.com>), a system that has e-commerce and project management applications built in; ATutor (<http://www.atutor.ca>), developed in Canada and includes more than 17,000 registered user sites, and; Bodington (<http://www.bodington.org>), developed in the U.K. and implemented at the University of Leeds and the University of Oxford.

LMSs have become mission-critical services for U.S. colleges and universities. Nearly all (97.5%) U.S. institutions of higher education have deployed at least one LMS campus-wide (Green, 2008), enabling them to maximize the use of technology investments to support multiple instructional models. Further, more than 3 in 4 (76.9%) have standardized on a single LMS enterprise-wide, primarily a commercial vendor product (EDUCAUSE CORE Data Service, 2007). However, over the past ten years, the number of commercial LMSs has declined from several dozen to just a few. This has caused many in higher education to become concerned about a possible monopoly in the commercial LMS marketplace. Moreover, proprietary systems do not allow users to modify or access the database, making it difficult to produce targeted usage reports, to integrate the system with other campus technologies such as student information and financial systems, or to customize the system for a particular campus environment (Collins & Committee, 2009). Open source has been touted as a hedge against commercial marketplace fluctuations (Lambert, 2005; Villano, 2006; Wheeler, 2007).

In international education, adoption of OSS teaching and learning applications is relatively mainstream. Results of a periodic survey of open and closed source software conducted among more than 450 further and higher education institutions in the U.K. (Cornelius, 2006) indicated that the use of open source is on the rise at U.K. institutions, with 77% of further and higher educational institutions considering open source in the software

selection process and 25% mentioning open source in institutional policy. With respect to survey questions about virtual learning environments and LMSs, open source dominates, with Moodle adoption at 39%, followed by Blackboard (19%) and WebCT (9%). The 2008 survey indicates an increase in these adoption trends (Canas, 2009). Consistent with European goals for free software development, deployment and collaborative research, and the European Union's desire to maintain its lead in the open source arena, the University of Maastricht in The Netherlands and the University of Cambridge in the U.K. established a consortium focused on open source projects, including the single largest knowledge base on open source usage and development worldwide (Ghosh, 2006).

In the U.S., however, campus-wide adoption of OSS LMS products is relatively limited, despite the use of selected OSS applications by individual faculty or departments (Williams van Rooij, 2007a; Green, 2008). The incidence of campus-wide adoption of OSS for teaching and learning can be viewed as a reflection of the divergent perspectives of two organizational sub-cultures in higher education: The technologist sub-culture and the academic sub-culture.

### Sub-Cultures and Technology Adoption

Adoption of new technologies requires change, placing pressure on organizational culture - the values, symbols, beliefs, stories, heroes, rites and shared assumptions that have special meaning for the organization's employees (Hofstede, 1980; Schein, 1985; Parker, 2000; Hill & Jones, 2001). Organizational cultures are composed of discrete sub-cultures or clusters of ideologies, cultural forms and practices, the most distinctive sources of which are people's occupations. Centered around defined, interrelated tasks that create self-definitions and self-perceptions as well as perceptions of relationships to other sub-cultures, occupational sub-cultures can serve as potential sources of conflict concerning decisions about such issues as the allocation of resources, future goals, changes in practices, and criteria used to evaluate performance (Trice & Beyer, 1993).

Members of the academic sub-culture include faculty, non-technical instructional and research support staff (e.g., instructional designers, library staff), and other non-technical staff under the Chief Academic Officer (CAO). Although institutional characteristics (Carnegie classification, number of students, public vs. private, for-profit vs. non-profit, etc.), culture, discipline, and other factors provide the context in which the academic sub-culture exists, concepts basic to this sub-culture include the pursuit and dissemination of knowledge through teaching and research, academic honesty, and academic freedom (Umbach, 2007; American Association of University Professors (AAUP), 2009). Commitment to these basic concepts means understanding the impact of technology on the processes of teaching and learning, on the role of sub-culture members, particularly the faculty, and on how student performance is assessed.

Members of the technologist sub-culture include the institution's information technology (IT) staff, academic computing as well as administrative computing, and the technical instructional and research support staff under the Chief Information Officer (CIO). As the pace of technological innovation has increased, the essence of this sub-culture, i.e., what it means to be a technologist, is also changing. Keeping abreast of emerging technologies means that there is more to think about and process, more perspectives to consider, more complexity to IT as an occupation and contributor to the education experience (Alexander, 2009).

The impact of culture and sub-cultures on technology adoption has been richly explored. In their review of the literature on information technology and culture, Leidner and Kayworth (2006) conclude that cultural values play a role in determining patterns of technology development, adoption, usage, and outcomes. The occupational sub-culture of technologists must be perceived as possessing the knowledge necessary to deploy and maintain a new technology. For the academic sub-culture, the ability to capitalize on the maximum learning affordances offered by various technologies based on solid pedagogy as well as on awareness of available technologies (Dabbagh and Bannan-Ritland, 2005) is a key input to adoption.

### Research Questions

Examining the effects of the academic and technologist sub-cultures on OSS adoption for online learning first requires a clear identification of the penetration of OSS campus-wide. This paper presents the 2009 results of a Web-based survey designed to track trends in the adoption of OSS for online learning among U.S. institutions of higher education. A baseline administration of the survey was conducted in 2006, a starting point against which to measure current and future adoption trends. The specific research questions were: 1) To what extent has the U.S. adoption landscape changed over the past three years?; 2) among institutions that have adopted or are considering adopting OSS for online learning, what specific applications are being deployed?; 3) what are the key drivers for OSS adoption from the perspectives of the academic and technologist sub-cultures?; 4) what policies, processes and procedures are institutions putting place to support the adoption of OSS for online learning?

## Method

As in 2006, the target respondents for the 2009 survey were Chief Information Officers (CIOs), representing the technologist sub-culture, and Chief Academic Officers (CAOs), representing the academic sub-culture (Green, 2008; Sheehan, 2008). To obtain results generalizable to the total population of regionally and/or nationally accredited U.S. institutions, a list of 450 CAO and 450 CIO names and e-mail addresses drawn via stratified random sampling of the various Carnegie classifications was purchased from Higher Education Publications, Inc. (HEP), publisher of the Higher Education Directory (Higher Education Directory, 2009). To supplement the pool of potential respondents, a call for participation was also posted on the EDUCAUSE web site and targeted those who had participated in the 2006 administration of the survey.

The questionnaire used in 2006 remained largely intact for the 2009 survey administration. Question areas included awareness of open source; adoption stages of specific academic and administrative OSS applications; reasons for selecting open source; metrics for OSS selection decision-making, and; formal policies and procedures around the adoption of new technologies. Consistent with pilot test results used to finalize the survey instrument in 2006, the survey tool's SKIP/BRANCH logic was again used so that items related to open source's impact on teaching and learning were asked only of CAOs and items related to the financial impact of open source were asked only of CIOs (Williams van Rooij, 2007a). New questions intended to differentiate institutions that are actively deploying OSS specifically for teaching and learning versus those deploying OSS for infrastructure (e.g., operating systems, databases) were introduced in 2009 based on content reviews by the author's colleagues in the higher education software industry. Further, the software industry-standard scale used to measure the degree of OSS adoption of specific applications was expanded to capture any differences at the enterprise level versus the unit/department level. For testing the significance of 2006 vs. 2009 adoption, all data was mapped to the original 2006 scale. To obtain an overall index of the consistency of the revised scales, an item reliability index via Cronbach's Alpha was obtained (Creswell, 2002). The Cronbach's Alpha coefficient was .934, on a par with that obtained in 2006 (.914) and considerably higher than the Social Sciences norm of .700.

Target respondents were sent a hyperlink to the URL address of a secured third party server hosting the survey. Data was collected in the summer of 2009 and the total number of completed surveys was 285. The 2009 sample is smaller than that obtained in 2006 due to lower response rates (16.1% vs. 28.3% in 2006). This may reflect the overall decline in survey response rates among higher education senior administrators over the past few years. For example, the 2009 administration of the annual Campus Computing Survey, an industry research project with a 19 year history, reports a 10% decline in response rate (Green, 2009). Similarly, response rates for the 2009 EDUCAUSE Current Issues Survey (Scrivner Agee, Yang, & Committee, 2009) slipped from 2008 and 2007 levels (28% vs. 32% and 33% respectively).

Nevertheless, there is some evidence that response rate is not the primary indicator of survey quality, particularly in light of (a) declining response rates across all modes of survey administration (b) studies comparing survey estimates to benchmark data from the U.S. Census or large governmental sample surveys, and (c) experimental comparisons showing few significant differences between estimates from surveys with low response rates and short field periods and surveys with high response rates and long field periods (AAPOR, n.d.). A better indicator of whether non-response bias may have affected the 2009 results is the profile of 2009 vs. 2006 respondents. As shown in Table 1, the 2009 sample demographics are nearly identical to those of 2006. The overrepresentation of Doctoral/Research institutions in 2009 is also consistent with 2006, reflecting the first-mover role that Doctoral/Research institutions have traditionally assumed in OSS higher education projects, such as Sakai, a platform for teaching, learning, and research (The Sakai Project, 2009) and Kuali, an administrative software system exclusively for higher education (The Kuali Foundation, 2009). Another check against response bias is the extent to which the survey results correspond with other research findings (AAPOR, n.d.). Consequently, the results of the 2009 administration of the survey will be compared with other empirical studies as well as with the 2006 survey results.

Table 1. Respondent Demographics, 2006 vs. 2009

	2006 (n=772)	2009 (n=285)	% Total HEP Population (2009)
Carnegie Classification			
Associates	24.5%	28.9%	40.5%
Baccalaureate and Baccalaureate/Associates	23.1%	19.8%	18.2%
Masters	23.8%	24.7%	15.7%
Doctoral/Research	23.1%	23.6%	7.0%
Specialized Institutions	4.7%	3.0%	17.8%
Other/Unclassified	0.8%	0.0%	0.5%
Governance (2008 Digest of Education Statistics)			
Public	54.3%	50.2%	38.7%
Private, Non-profit	42.3%	44.9%	37.3%
Private, For-profit	3.4%	4.9%	24.0%

### Summary of Findings

#### The Adoption Landscape

Adoption of OSS for online learning is gaining traction, with dramatic increases in awareness and in campus-wide deployment of OSS LMSs. Awareness of OSS is nearly universal (86.4%), increasing slightly from the already high levels observed in 2006 (82.6%). This increase is largely due to a rise in CAO awareness levels (80.5% vs. 68.5% in 2006), which Chi-Square testing confirms as being significantly higher than in 2006,  $\chi^2(1, n=551)=7.4027, p=.01$ . To identify potential trends in OSS adoption for teaching and learning versus adoption at the technical infrastructure level, CAOs who are aware of OSS were presented with a list of teaching and learning applications and technologies and asked to indicate the extent to which their institution has implemented OSS in each area using the expanded software industry-standard scale where “1” means “deployed campus-wide”; “2” means “deployed in some units/departments”; “3” means “piloting campus-wide”; “4” means “piloting in some units/departments”; “5” means “considering campus-wide”; “6” means “considering in some units/departments”; “7” means “not planned”, and; “8” means “don’t know”, with “2” and “4” being additions to the original 2006 scale. Figure 1 illustrates the overall growth in the proportion of CAOs reporting deployment or piloting of OSS. Learning management systems (LMSs) show the most dramatic growth (41.1% vs. 22.3% in 2006), which Chi-Square testing confirms as statistically significant,  $\chi^2(5, n=395)=23.830, p=.001$ . Further, 2009 adoption of OSS LMSs tends to be campus-wide rather than at the individual department/unit level. One in four CAOs also reported adopting OSS testing/assessment tools (26.8%) and computer-aided instruction (CAI) tools (25.0%), two applications introduced in the 2009 survey administration. CIO-reported adoption levels of LMSs (see Figure 2) have increased significantly (40.5% vs. 25.8% in 2006),  $\chi^2(5, n=486)=29.9593, p=.001$ , as has adoption of digital repositories (32.4% vs. 19.9%),  $\chi^2(5, n=486)=18.5815, p=.01$ . Adoption of OSS infrastructure applications (computer operating systems, portals) remained relatively unchanged.

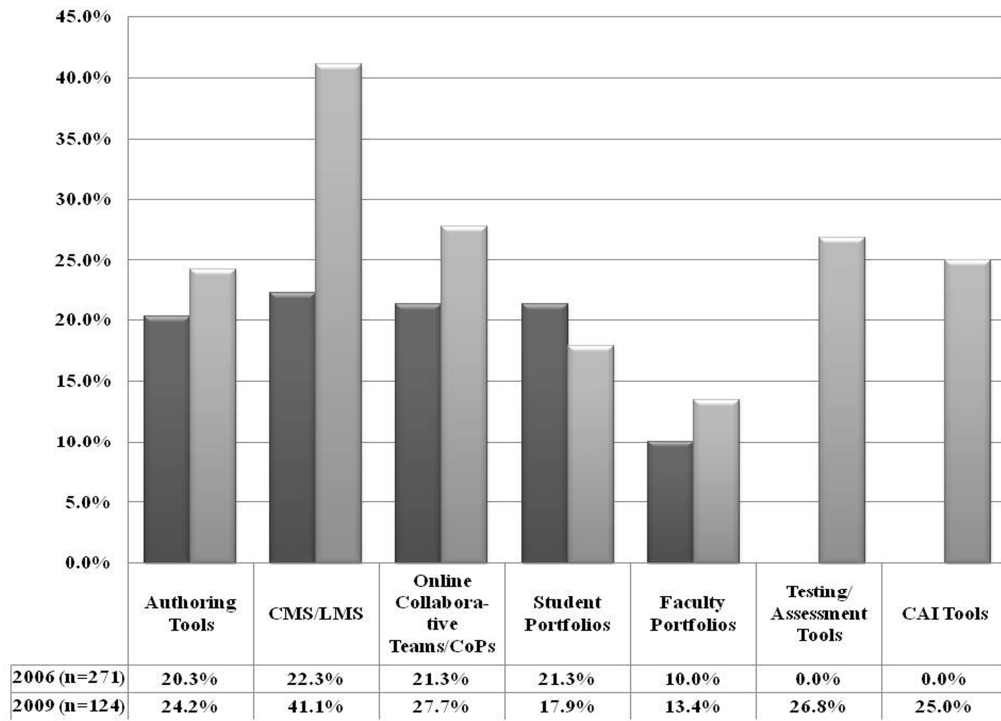


Figure 1. OSS Adoption among CAOs

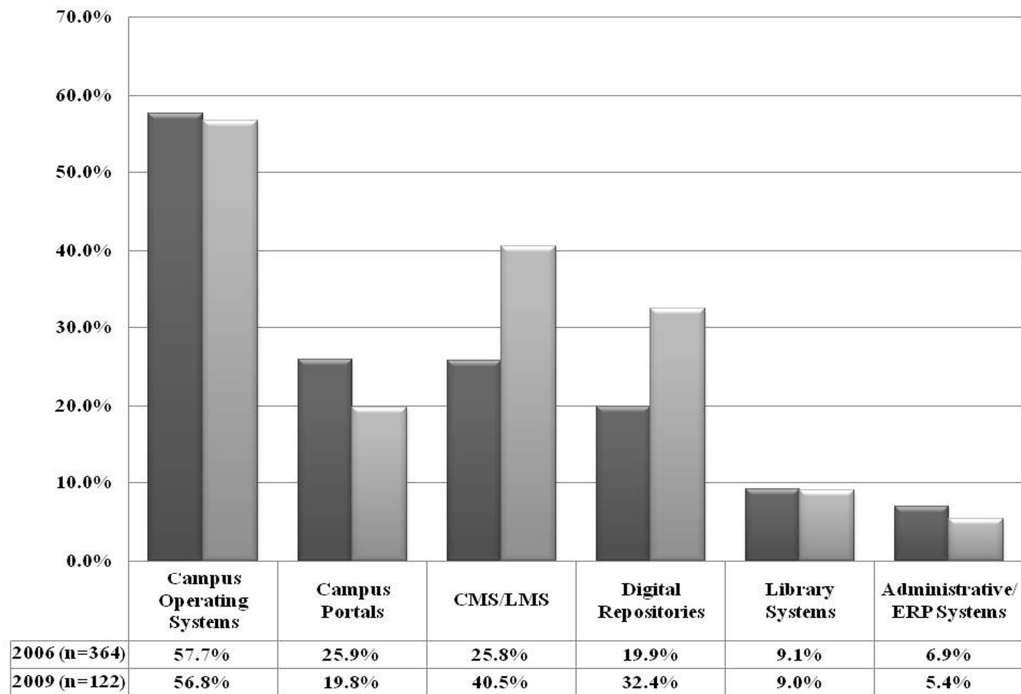


Figure 2. OSS Adoption among CIOs

## Applications Deployed

Although Moodle and Sakai are the leading OSS teaching and learning systems in U.S. higher education, Carnegie classification is a key differentiator of Sakai adoption. More than half (52.9%) of all 2009 respondents stated that they are deploying/planning to deploy OSS teaching and learning applications. When presented with a list of OSS teaching and learning applications and asked to identify which of those applications are in active or pending deployment, more than 2 in 3 (67.7%) mentioned Moodle, while 1 in 3 (33.0%) mentioned Sakai. Further, Sakai deployments were more likely in Doctoral/Research institutions than in institutions in other Carnegie classifications (see Figure 3). This finding is consistent with the fact that Sakai was designed as a platform for research as well as for teaching and learning. Other OSS teaching and learning applications (e.g., ATutor, ClassWeb, Claroline) each generated fewer than 4% of total mentions.

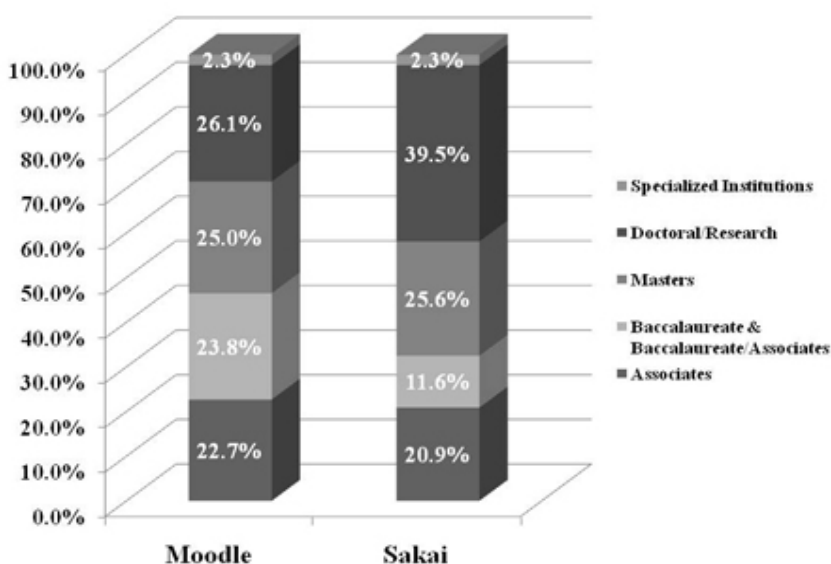


Figure 3. Moodle and Sakai Deployment by Carnegie Classification

## Key Adoption Drivers

Student engagement and the support of active learning continue to be the dominant drivers of OSS adoption among CAOs, while CIOs continue to focus on reducing software license fees and on gauging the experiences of other institutions who have adopted OSS. Nevertheless, both CAOs and CIOs deemed total cost of ownership as the number one metric for making a go/no go decision about OSS adoption.

Although Chi-square testing showed no significant differences in CAO 2006 vs. 2009 ratings, there were some interesting directional changes. In the 2009 survey administration, the strongest positive influence on CAO consideration of OSS for teaching and learning was the ability of open source to support engaged learning, to create a high-challenge, low-threat environment (47.9% stating “strong positive/positive influence”). This is a modest increase from 2006 (43.0%) and slightly displaces the ability to support active learning, to involve students in real-world tasks, practice, reinforcement, as the top adoption driver (46.9% stating “strong positive/positive influence” vs. 52.6% in 2006). A modest increase in the positive impact of OSS’ ability to support the need to share instructional content with other institutions also differentiated the 2009 respondents. At the other end of the spectrum, nearly one-third of CAO respondents stated that some of the teaching and learning attributes were not a factor in OSS adoption, which is similar to 2006 results. More than one in four (27.8%) stated that a push for open source from faculty was a strong positive/positive influence on OSS adoption.

The largest single influence on CIO consideration of OSS remains the desire to reduce or eliminate software license fees, with 3 in 4 (71.0% in 2009 and 75.7% in 2006) CIO respondents stating that this attribute was a “strong positive/positive influence”. The second largest influence in 2009 was the experiences of other institutions



(48.5%), an increase from 2006 (42.3%) and displacing the need for application functionality as the second largest influence (40.0% vs. 47.3% in 2006). Further, Chi-square test results confirmed significant differences between 2006 and 2009 on four of the ten influence attributes: Need for application functionality not available in commercial software,  $\chi^2(5, n=486)=18.5542, p=.01$ ; Negotiate license agreements with commercial vendors,  $\chi^2(5, n=486)=13.7386, p=.05$ ; Integrate academic & administrative technology services,  $\chi^2(5, n=486)=34.4826, p=.001$ ; Establish/maintain campus-wide standard for software,  $\chi^2(5, n=486)=18.6723, p=.01$ .

As a cross-check on the key drivers of OSS for teaching and learning, respondents in the 2009 survey administration were presented with a list of seven institutional metrics and asked to indicate the most important metrics that their institutions use to make a go/no go decision on OSS for teaching and learning by ranking each metric from “1/most important” to “7/least important”. As illustrated by the mean rankings in Figure 3, the most important metrics for making a go/no go decision on adopting OSS for teaching and learning were the total cost of ownership (3.03) and faculty satisfaction (3.10), followed by return on investment/value on investment (3.40) and student academic performance (3.62). Further, there were no significant differences in mean rankings between CIO and CAO rankings.

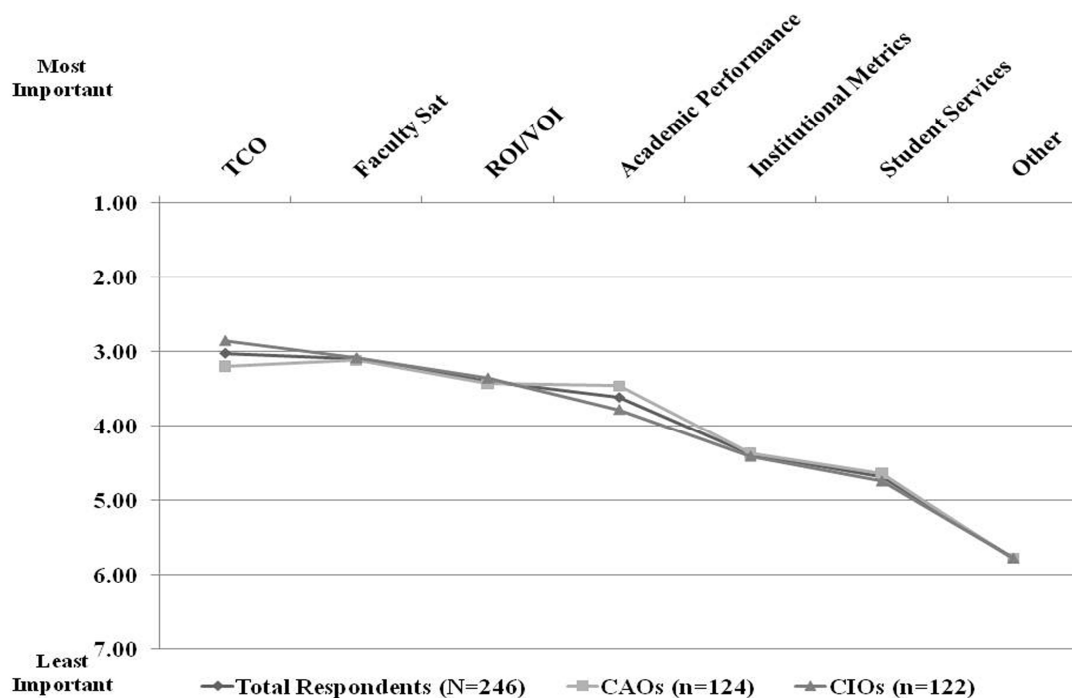


Figure 3. Metrics for Go/No-go Decision-making, 2009 Mean Ratings

#### Policies, Processes/Procedures

CIOs reported great strides in developing formal policies and procedures around the adoption of new technologies, particularly in the areas of security (67.0% in 2009 vs. 21.2% in 2006); compliance with the appropriate Federal and state regulations (e.g., FERPA, Section 508) (64.8% vs. 14.1%), and ; ownership of intellectual property developed by faculty (60.4% vs. 50%). There was almost no difference between CIO and CAO responses.

## Discussion

The results of the 2009 survey reveal dramatic growth in the campus-wide deployment of OSS LMSs at U.S. institutions of higher education. These results are consistent with the latest administration of the Campus Computing survey (Green, 2009), which indicated that OSS LMS penetration has increased from about 5% of all U.S. institutions in 2007 to nearly 30% in 2009, with the highest adoption rates among 4-year institutions. Nevertheless, Blackboard remains the single campus standard at more than half of the institutions participating in the 2009 Campus Computing survey.

Barriers to campus-wide OSS adoption include (a) the difficulty in calculating the true cost of ownership of OSS LMSs, (b) the lack of formal support mechanisms, (c) the need for highly skilled and highly motivated technical personnel, (d) the lack of efficient tools for migrating from commercial LMSs, and (e) the lack of interoperability with other campus systems (Molina & Committee, 2006; Williams van Rooij, 2007b; EDUCAUSE Constituent Group, 2008). Since the original 2006 administration of this survey, however, there has also been some discussion of how to overcome those barriers. For example, there are two well-known published guidelines to assist institutions in conducting OSS assessments. The Business Readiness Rating (Business Readiness Rating, 2006) provides a framework advanced by developers from education and industry to assess the organizational fit of OSS based on seven weighted criteria: Functionality, including communication, collaboration, learner assessment, and instructional management tools; usability, particularly the ease with which faculty and students can become proficient in using the software; the availability and quality of user-maintained documentation for system administrators, faculty, and students; the size and activity level of the developer community, as measured by the e-mail forums and number of people contributing code; the number and severity of security alerts and the speed with which they are addressed; the amount and quality of volunteer and commercial support available, and; the number and size of current installations at other institutions. The Open Source Maturity Model (Navica, 2008) is another published guideline that enables organizations to self-identify as to how they rate themselves in terms of overall maturity in information technology adoption. Based on where they fall in the maturity rankings, organizations then assess OSS systems on features/functions, support, documentation, training, product integration, and available professional services.

Individual institutions have also done a better job of placing their own OSS assessment models and migration experiences in the public domain (Chao, 2008; O'Laughlin & Borkowski, 2008; Uys & Morton-Allen, 2007). Live case studies with best practices for selection and implementation have been published by institutions from a variety of Carnegie classifications and include information about total cost of ownership of OSS vs. commercial software applications, as well as strategies for faculty support (Lakhan & Jhunjunwala, 2008; Trappler, 2009; Oakland University, 2009). As more institutions share what they have learned about both the process and the impact of OSS selection, OSS adoption for teaching and learning should continue to gain traction.

Adoption patterns and key drivers as reported by the CAOs and CIO indicate a shift from the strong dichotomy seen in the 2006 survey administration to some meeting of the minds in 2009. In 2006, CAO engagement with OSS lagged far behind that of CIOs, consistent with what the software engineering literature identified as the gap between the technologist who is the end-user of infrastructure-level software and the non-technologist who is the end-user of business or academic application-level software, and the need for mutual understanding between users and developers (Behlendorf, 1999; Evans, 2002; Glass, 2003; Courant & Griffiths, 2006). Although CAO focus remains on technology in the service of pedagogy, the 2009 data indicate that CAOs are beginning to recognize total cost of ownership as a critical factor in OSS adoption decision-making. In the same vein, CIOs are beginning to recognize the importance of faculty satisfaction and support, along with technical efficiencies and cost effectiveness. Consequently, it could be argued that economics is the great equalizer and that the current economic climate has pushed cost of ownership into the minds of both academics and technologists (Green, 2009; Claffey, 2009). In addition, there is now considerable evidence that OSS teaching and learning applications, particularly Moodle and Sakai, have evolved into sustainable communities that provide support mechanisms as well as technical expertise, reducing traditional barriers to widespread OSS adoption (McDonald, 2009; Collins & Committee, 2009). Consequently, the Mellon Foundation's recent cessation of grant funding to Sakai and other OSS projects is not expected to be fatal to Sakai adoption (Parry, 2010).

Evidence of success is important to the academic sub-culture, particularly for faculty transitioning from commercial systems to OSS teaching and learning applications (Sclater, 2008), but also for non-technical support staff seeking to build their own best practices inventory. The academic sub-culture responds favorably to OSS for teaching and learning when, like any technological change, it is (a) evident, so that there is an awareness of OSS and of how OSS is being used, (b) easy to use, without having to choose from a host of features, functions, and complex

user interfaces, and (c) essential, so that the what's-in-it-for-me (WIFM) is clear, rather than being a mandate from above (Haymes, 2008).

## Conclusions

The purpose of this research was to track trends in the adoption of OSS for teaching and learning among U.S. institutions of higher education and to explore those trends through the lenses of the academic and technologist sub-cultures. Although the research currently has only two waves of measurement – 2006 and 2009 – it offers some insights into the pace and patterns of OSS adoption for teaching and learning in the U.S. This suggests opportunities for further research in terms of (a) the relationship between the incidence of OSS adoption and the number of institutional case studies in the public domain, (b) the continued erosion of adoption barriers through evidence-based models that also include data from institutions that utilize third party commercial vendors for OSS implementation and maintenance services, as well as institutions utilizing in-house talent and resources, and (c) the pace of OSS adoption in the U.S. versus that of the international postsecondary community. Even when the economic environment improves, there will continue to be a need to maximize technology investments while providing quality postsecondary education. To achieve this requires an ongoing effort to recognize the different perspectives of the academic and technologist sub-cultures and striking a balance in which the drivers of one sub-culture are not realized at the expense of the other sub-culture.

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# **Instructional Design and Project Management: Which Competencies are Which?**

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## **Abstract**

In the digital age, instructional designers must possess both a sound instructional design knowledge base and solid project management skills that will enable them to complete courseware projects on time, on budget, and in conformance with client expectations. This paper reports the results of a study to identify the extent to which an organization's project management implementation maturity affects roles and responsibilities in educational/training product development projects, particularly as regards the instructional design and the project management roles. Results show no significant difference by project management maturity level in the roles of instructional designer and project manager. However, there appears to be some relationship between maturity level and how organizations perceive the skills/competencies of project managers vs. those of instructional designers. Further, organizational decision-makers tend to have very specific expectations about the formal education and training of educational/training product development project leaders.

## **Introduction**

The American Society for Training & Development (ASTD) estimates that U.S. organizations spent \$134.1 billion on employee learning and development in 2008, nearly on a par with the \$134.39 billion spent in 2007 (Paradise & Patel, 2009). These spending levels bode well for educational/training product development projects and for the job market for instructional designers. There are many graduate degree programs in the U.S. that prepare students for careers in instructional design. The standards for instructional design competencies developed by the International Board of Standards for Training, Performance, and Instruction (IBSTI) are among the professional standards to which advanced degree programs in instructional design adhere, with the ability to plan and manage educational/training product development projects listed among the IBSTI advanced competencies for experienced instructional designers (International Board of Standards for Training, Performance, and Instruction, 2000).

Although the instructional design literature is clear about the need to effectively manage educational/training product development projects, most models of instructional design view project management as embedded within the instructional design process, rather than as a separate methodology (Greer, 1992; Gentry, 1994; Yang, Moore, & Burton, 1995; McDaniel & Liu, 1996; Stubbs, 2002; Li & Shearer, 2005). However, project management is a distinct and evolving discipline, with its own methodology, body of knowledge, and professional standards and practices. Further, instructional designer positions require not only instructional design skills/competencies, but also project management skills, including the ability to lead a project team, estimate project requirements, and develop processes and standards for completion of educational/training product development projects.

## **Project Management**

The Project Management Institute (PMI), the global standards and credentialing body for the project management profession, defines project management as the application of a body of knowledge, skills, tools and techniques to project activities to meet project requirements, all of which is documented in the Project Management Body of Knowledge (PMBOK® Guide) (Project Management Institute, 2009). Effective project management also requires knowledge of the characteristics of the project's environment (e.g., technology, industry, etc.) as well as general management knowledge and skills, and interpersonal skills. Those interpersonal skills – particularly communication skills and leadership skills – are deemed essential to today's successful project manager, where a good portion of project activity often takes place in virtual environments (Horine, 2009). Although project management has its strongest presence in industries where projects tend to be complex, multi-year and require extensive human and financial resources (information technology, construction, etc), project management processes and procedures can be used in a variety of industries and for a variety of project types and sizes.

To assess how much of the project management methodology organizations actually use, Thomas and Mullaly (2008) offer a five-level model for assessing the project management maturity of an organization: 1) Ad hoc, with no organizational implementation of project management; any use of project management processes depends on the expertise of individual project managers; 2) some practices, with incomplete or inconsistent application enterprise-wide; 3) consistent practices, with a complete project management process in place and applied consistently enterprise-wide; 4) integrated practices, with project management as an integral management capability that is fully integrated with the organizational lifecycle, and; 5) continually improving practices, with a holistic, fully integrated approach to managing projects with a formal and consistently followed process of evaluating, assessing, and improving project management implementation. Although the organizations in the Thomas and Mullaly study represent a variety of industries and project types, there is no indication as to whether any of the projects were educational/training product development projects.

#### Educational/Training Product Development and Project Management

In developing educational/training products, organizations engage in instructional design, a process guided by systematic design models and principles focused on establishing and maintaining effective and efficient human performance (Rothwell & Kazanas, 2008). The International Board of Standards for Training, Performance, and Instruction (IBSTPI) publishes a list of skills and competencies for the instructional design professional, spanning novice, experienced and expert designers, with project management listed among the advanced competencies for experienced instructional designers. Project management complements the instructional design process by offering a set of repeatable processes with which to describe, organize and complete the work required for each phase of the project lifecycle, with deliverable complexity also determining how much process is used at each phase (Williams van Rooij, 2010).

Consistent with the success criteria for any type of project, an educational/training product development project is deemed successful if it is delivered on time, within budget, and meets the requirements of the project stakeholders (Rowe, 2007; Crawford & Pollack, 2007; Horine, 2009; Stubbs, 2002). Even when the roles of instructional designer and project manager are filled by the same individual, using project management processes enables the educational/training product development project manager to (a) clearly define the project, develop realistic schedules, and manage change, (b) choose those processes, levels of detail, and methodology components appropriate to the specific project, (c) operate in an organized and efficient manner, and (d) have more time to devote to the management “soft” skills, such as team building. However, the ability to apply the specific project management processes and knowledge areas are skills that are distinctly different from those of a subject matter expert or an instructional designer. When it comes to educational/training product development, the boundaries between the instructional design professional and the project management professional are often unclear, with conflicting and/or overlapping roles and responsibilities (Dobrovolsky, Lamos, Sims, & Spannaus, 2002; Layng, 1997; Greer, 1992). What is needed is a clear understanding of how these boundaries play out in the real world of work.

#### Research Questions

Examining the boundaries between the instructional designer’s role and the project manager’s role requires an initial understanding of an organization’s commitment to project management as a distinct methodology. This paper reports the results of a Web survey designed to determine the extent to which an organization’s project management implementation maturity (PMIM) affects roles/responsibilities in educational/training product development projects. The specific research questions were: 1) How much of the project management methodology do organizations purport to be using in their educational/training product development projects, as measured by Thomas and Mullaly’s (2008) five-level model of project management implementation maturity (PMIM)?; 2) to what extent does PMIM affect organizational expectations of an instructional designer’s skill/competencies as set down by the International Board of Standards for Training, Performance, and Instruction (IBSTI), versus the skills/competencies of a project manager as documented in the Project Management Body of Knowledge (PMBOK® Guide) by the Project Management Institute (PMI)?

#### Method

Three segments are essential to the identification of project management maturity in educational/training product projects: (a) project management professionals who lead educational/training product development projects but are not necessarily instructional designers themselves; (b) instructional designers, and; (c) organizational decision makers charged with defining the skills and competencies essential to educational/training product project

team leaders (e.g., Chief Learning Officers, Directors of Training and Development). Target respondents were recruited via a purposive sampling of members of the Project Management Institute (PMI), the American Society for Training and Development (ASTD), and the e-Learning Guild obtained through a call for participation message and two reminder messages posted to their respective discussion boards in January – February 2010.

A total of 115 responses were received. However, 12 of those responses were dropped from the analysis because the respondent's organization either did not design/develop educational/training products or the respondent did not answer this screening question. Consequently, a total of 103 responses were retained for analysis. About one-third (33.7%) of respondents were organizational decision-makers, more than one in four (29.6%) were instructional designers, while one in five (21.4%) were project management professionals. The vast majority (76.5%) of respondents were in the United States and were employed by companies and departments of various sizes, with one in four (24.5%) of those companies in the consulting/contracting sector. There were relatively equal percentages of male and female respondents (51.6% and 48.4% respectively), with more than half (57.9%) employed in educational/ training product development for 5-15 years.

The unit of analysis is the respondent because the sampling method (a) enables (but cannot verify) more than one individual from an organization to respond and (b) assumes that any respondent is knowledgeable enough about his/her organization to respond to the questions about organizational characteristics, including level of project management implementation maturity, although this possibility is less worrisome given that one-third (33.7%) of respondents are organizational decision makers and as such, are assumed to know what goes on in their respective organizations.

The survey questionnaire used in this research is a composite of the following sources: 1) The self-assessment components of the Thomas and Mullaly (2008) study of PMIM that presented respondents with definitions of each of the five levels and asked them to select the level that best describes the extent to which project management has been implemented in their organization; 2) the professional competencies published by IBSTPI and PMI respectively, and; 3) the list of instructional design project manager skills/competencies in Brill, Bishop and Walker's (2006) study of the core success criteria for educational/training product development projects. In constructing the survey instrument, generally accepted survey creation guidelines were followed (Wiersma, 2000). The questionnaire also included closed-ended demographic questions to obtain information about the characteristics of the respondents and of their respective organizations. To identify expected competencies of project managers and instructional designers, respondents were presented with a list of IBSTPI and PMI competencies and were asked to identify whether each competency is essential for the instructional designer, the project manager, or for both using the following 7-point scale adapted from Zimmerman & Kitsantas' (2005) Perceived Responsibility scale: "1" means "always the project manager"; "2" means "mainly the project manager"; "3" means "slightly more the project manager"; "4" means "both equally"; "5" means "slightly more the instructional designer"; "6" means "mainly the instructional designer", and; "7" means "always the instructional designer".

To assess the instrument's content validity – a subjective assessment of how appropriate the instrument seems to subject matter experts as well as members of the target population (Litchenham & Pfleeger, 2002), a group of six experts who have published articles in peer-reviewed journals in the fields of instructional design and project management respectively were invited to review the draft survey in October 2009. The most notable outcome of this preliminary validation was the recommendation to eliminate the redundancies in the list of project management and instructional design competency attributes. The questionnaire was revised to reduce the list of competencies from 38 to 24, was uploaded to a web hosting service, and the URL posted to the target respondent discussion boards.

Data validation was conducted to test for the presence of data anomalies such as outliers and missing values. Frequency distributions and crosstabs were run to obtain descriptive statistics about respondent characteristics as well as project management implementation at the organizational level and at the departmental level. The attribute list containing instructional designer and project manager skills/competencies was subjected to an item reliability analysis via Cronbach's Alpha, to measure the extent to which the items are related to each other and to obtain an overall index of the internal consistency of the scale (Creswell, 2002). The coefficient for the skills/competencies items was .924, which is well above the Social Sciences norm of .700.

## Summary of Findings

### Reported Use of Project Management/PMIM

The first research question concerns the extent to which organizations purport to be using the project management methodology in their educational/training product development projects, as measured by Thomas and Mullaly's (2008) five-level model of project management implementation maturity (PMIM). To that end, respondents were presented with Thomas and Mullaly's (2008) five-level model and were asked to select the level



that best describes their organization's PMIM. Nearly two-thirds (61%) reported low (ad hoc or some practices) PMIM levels. When asked to describe the extent to which project management has been implemented in the department or function area responsible for educational/training product development, about half (51.3%) described those areas as having low PMIM levels. Only about one in four respondents characterized either their organization or their educational/training product development department as having a high level of PMIM.

Looking at PMIM at the departmental/functional level, there are some demographic differences (see Table 1). Respondents reporting a medium or high PMIM in the departments/functional areas responsible for educational/training products were more likely than those reporting low PMIM levels to be responsible for their organization's learning and development strategy, budgeting, and staffing. They tended to be employed in higher education, telecommunications, and the non-military sector of government. Their organizations tended to have 500 or more employees in total, and had 21 or more employees in the educational/training product development area. Organizational-level PMIM showed similar differences, although not as pronounced as at the departmental/functional area level.

Table 1

Selected Sample Demographics by Departmental/Functional Area PMIM

	Low Maturity <sup>a</sup> (n=56)	Medium/High Maturity <sup>b</sup> (n=47)*
Respondent's Primary Focus		
Responsibility for an enterprise-wide learning & development strategy, budget & staffing	24.3%	44.4%
Working on educational/training product development projects, either as a team member or team leader	75.7%	55.6%
Industry		
Higher education	2.4%	20.0%
Telecommunications	0%	8.6%
Government/non-military	2.4%	8.6%
Company Size		
Less than 100 employees	28.6%	17.7%
101-500	18.7%	14.9%
501-1,000	17.1%	15.3%
1,001-5,000	21.3%	32.1%
More than 5,000	14.3%	20.0%
Area Size		
Less than 5 employees	37.5%	22.9%
5-20	32.5%	22.9%
21-50	20.4%	34.3%
More than 50	9.6%	19.9%

*Note.* <sup>a</sup> Low Maturity=Ad hoc/level 1, some practices/level 2. <sup>b</sup>Medium/High Maturity=Consistent practices/level 3, integrated practices/level 4, or continually improving practices/level 5. \*Caution: Small cell sizes

Respondents were then asked whether the roles of instructional designer and project manager are fulfilled by the same individual or by different individuals. Although 4 in 10 (40.2%) respondents stated that in their organization, the instructional designer fulfilled both the roles, there were some differences when looking at the responses by project management implementation maturity level. Table 2 shows that as expected, the likelihood of the project manager and the instructional designer each fulfilling separate roles was significantly higher (at the 95% level of confidence) in organizations characterized by a medium or high level of PMIM in the department/functional area responsible for educational/training product development. However, organizations with a medium/high level of PMIM appeared to be as likely to have the instructional designer fulfill both roles as they were to have separate individuals fulfill those roles. The voluntary comments for medium/high PMIM respondents tended to explain role fulfillment according to project size and complexity, while the voluntary comments of low PMIM respondents explained role complexity according to the organization's own business models.

Table 2

Fulfillment of Instructional Designer and Project Manager Roles by Departmental/Functional Area Level PMIM

	Total Respondents (%) (N=103)	Low Maturity <sup>a</sup> (%) (n=56)	Medium/High Maturity <sup>b</sup> (%) (n=47)*
Instructional Designer Fulfills Both Roles	40.2	43.9	36.4
Project Manager Fulfills Both Roles	11.0	14.6	9.1
Project Manager and Instructional Designer Each Fulfill Separate Roles	28.0	17.1	39.4
Some Other Arrangement	20.8	24.4	15.1

*Note.* <sup>a</sup> Low Maturity=Ad hoc/level 1, some practices/level 2. <sup>b</sup>Medium/High Maturity=Consistent practices/level 3, integrated practices/level 4, or continually improving practices/level 5. \*Caution: Small cell sizes

#### PMIM and Project Management vs. Instructional Design Skills/Competencies

The second research question concerns the impact of PMIM on skill/competency expectations. To assess the extent to which project management implementation maturity affects the skills/competencies expected of an instructional designer versus those of a project manager, respondents were presented with a list of 24 skills and competencies and were asked to rate whether each area of expertise is more essential for the project manager, for the instructional designer, or for both equally on a 7-point scale: “1” means “always the project manager”; “2” means “mainly the project manager”; “3” means “slightly more the project manager”; “4” means “both equally”; “5” means “slightly more the instructional designer”; “6” means “mainly the instructional designer”, and; “7” means “always the instructional designer”. Looking at the mean ratings in Table 3, it appears that educational/training product development departments/functional areas with low PMIM levels were fairly similar to those with medium/high PMIM levels in selecting the IBSTPI skills/competencies that are essential for the instructional designer. Instructional designers were expected to: Select and use a variety of techniques for determining instructional content (Content); select and use a variety of techniques to define and sequence the instructional content and strategies (Sequencing); apply fundamental research skills to educational/training product development projects (Research); evaluate and assess instruction and its impact (Assessment); select, modify, or create a design and development model appropriate for a given educational/training product development project (Design Models); conduct a needs assessment to identify the perceived gap between an existing situation and the desired situation (Needs Assessment); analyze the characteristics of existing and emerging technologies and their use in an instructional environment (Technologies); apply current theory to solve practical problems (Theory).

At the other end of the spectrum, project managers were expected to possess the following PMI-based competencies: Plan, estimate, budget and control costs, so that the project can be completed within the approved budget (Costs); organize and manage the project team, so that team member competencies and interactions enhance project results (Team Management); define, resource and schedule all activities required to accomplish timely project completion (Activities Scheduled); ensure timely and appropriate collection and distribution of project information to stakeholders (Information Distribution); identify and manage risks that may impact the project (Risk Management); plan and manage educational/training product development projects, including scope, budget, schedule, and resources (Project Management); promote collaboration, partnerships, and relationships among the participants and stakeholders (Collaboration); define and control what is (not) included in the project (Scope); analyze the characteristics of the project environment (Project Environment). Skills/competencies that were expected of both the instructional designer and the project manager are: Communicate effectively in visual, oral, and written form (Communicate); identify and apply the relevant quality standards, so that results satisfy project requirements (Quality); provide for the effective implementation of educational/training products and programs

(Implementation); identify and resolve ethical and legal implications of educational/training product development in the workplace (Ethical/Legal); make tradeoffs among competing objectives and alternatives (Tradeoffs); anticipate and address potential issues before they become critical (Issues).

Table 3

Mean Ratings of Project Manager and Instructional Designer Skills/Competencies by Departmental/Functional Area PMIM

Skill/ Competency	Low Maturity <sup>a</sup> (n=56)	Medium/High Maturity <sup>b</sup> (n=47)*	Skill/ Competency	Low Maturity <sup>a</sup> (n=56)	Medium/High Maturity <sup>b</sup> (n=47)*
Content	5.95	5.70	Implementation	3.81	3.73
Sequencing	5.81	6.08	Issues	3.65	3.52
Research	5.69	5.37	Tradeoffs	3.65	3.50
Assessment	5.68	5.48	Project environment	3.51	3.27
Design models	5.51	5.04	Scope	3.14	3.19
Target population	5.50	4.63	Collaboration	2.97	3.19
Needs assessment	5.24	4.67	Project management	2.92	2.54
Technologies	5.22	4.92	Risk management	2.73	3.12
Theory	4.83	4.83	Information distribution	2.73	2.77
Communicate	4.43	4.63	Activities scheduled	2.70	2.73
Quality	4.24	3.88	Team management	2.65	2.69
Ethical/legal	3.97	3.80	Costs	2.41	2.08

*Note.* <sup>a</sup> Low Maturity=Ad hoc/level 1, some practices/level 2. <sup>b</sup>Medium/High Maturity=Consistent practices/level 3, integrated practices/level 4, or continually improving practices/level 5. \*Caution: Small cell sizes

To drill down on skill/competency expectations, decision-makers – respondents who stated that their role focused on responsibility for their organization’s enterprise-wide learning and development strategy, budget, and staffing – were presented with a list of formal educational/training alternatives and were asked to select the alternative that best describes the type of formal training/education expected of potential leaders of educational/training product development project teams. The majority (60.0%) of decision-makers in organizations with low PMIM expected project team leaders to have post-graduate certification in Instructional Design, either in the form of a Masters degree or a graduate-level certificate from a college or university. Interestingly, nearly one in three (30.0%) required no formal education/training. In contrast, decision-makers in organizations with medium/high PMIM were less likely to select a “best” source of formal education/training, with one in two (50%) offering up their own expectations in the comment box next to the alternative “If other, please specify”. Typical comments focused on a preference for both formal and informal knowledge sources. In response to an open-ended question about what sources other than formal education were needed, both low and medium/high PMIM respondents mentioned experience in managing educational/training product development projects as the means of acquiring the knowledge necessary to lead project teams.

Lastly, project team leaders – respondents who identified themselves as project managers (PMP or non-PMP certified) – were asked how they acquired their knowledge of instructional design and project management respectively. Although 10 in 22 project team leaders possessed a formal degree or post-graduate certificate in instructional design, nearly all (8 in 10) were in the medium/high PMIM segment. In terms of project management knowledge, however, project leaders in both PMIM segments acquired their knowledge from a variety of formal and informal sources. Project leaders in the medium/high PMIM segment were more likely than their low PMIM counterparts to have had formal project management training.

## Discussion

This study explored the extent to which organizations that develop educational/training products are committed to project management as a methodology – as measured by project management implementation maturity (PMIM) – that is separate and distinct from the processes of instructional design. The fairly low levels of project management implementation maturity (PMIM) observed in this study may reflect the evolving nature of project management as a discipline. In a review of the development of project management best practices since 1945, Kerzner (2010) notes that project management has become less a series of processes and more of an enterprise-wide strategy used to differentiate organizations from their competitors. This relatively new application of project management has resulted in organization-specific definitions of best practice which, in turn, makes enterprise-wide implementation more complex than just adopting standardized templates and procedures. The churn in applied project management practice is also reflected in Thomas and Mullaly's (2008) finding of great disparity in implementation among different organizations and different project types.

Turner, Ledwith and Kelly (2009) conducted a study of 280 companies to determine the extent to which those companies apply project management principles and tools. Study results indicated that regardless of industry, the smaller the company, the less robust will be the use of project management processes and tools. The Small Business Administration's criterion for defining a small business is an employee base of 500 or less (U.S. Small Business Administration, n.d.). The organizations in the present study that were more likely to have low project management implementation maturity levels have fewer than 500 employees, while those with medium or high PMIM levels have 500 or more employees. Further, the number of employees in the functional areas responsible for educational/training product development in the present study tended to be less than 20 for departments with low PMIM levels versus 20 employees or more in departments with medium or high PMIM levels. Consequently, the PMIM levels found in this study appear to be in line with what the literature states about the project management maturity levels of small versus medium and large firms. In addition, the study finding that education/training departments with medium or high PMIM levels tend to be in the telecommunications and government sectors is consistent with the historical development of the discipline of project management. A new insight is the finding that higher education is also strongly represented among medium/high PMIM level departments. This may reflect the fact that higher education is the leading provider of instructional design professionals (GradSchools.com, 2010), with departments and functional areas that engage in instructional design projects to support teaching and learning at their respective institutions.

The apparent tendency of respondent organizations with low PMIM levels to have the instructional designer fulfill his/her own role plus the role of project manager is also to be expected given the size and relatively small number of staff in the organizations. What was not expected was the finding that respondents reporting medium or high PMIM levels appear to be as likely to have the instructional designer fulfill both roles as they are to have separate individuals fulfill those roles. One explanation may lie in the respondents' own roles in their respective organizations. Respondents in the medium/high PMIM segment were more likely than those in the low PMIM segment to include decision-makers responsible for the organization's learning and development strategy, budget and staffing. As such, these respondents would tend to be more knowledgeable about which projects require what functional roles. This assumption of knowledge seems to be supported by the voluntary comments in which medium/high PMIM decision-makers linked the project leadership role to the size and complexity of a specific project.

The fact that the study revealed no significant differences between the low and medium/high PMIM segments on the skills/competencies expected of an instructional designer versus a project manager suggests a general consensus as to the expected knowledge base of instructional designers and project managers respectively. A more puzzling finding is the apparent disconnect between decision-maker expectations about how candidates for leadership of educational/training product development project team should acquire their knowledge of instructional design and of project management, and how practicing project team leaders acquire their working knowledge of project management and instructional design respectively. On the one hand, decision-makers in both the low PMIM

and the medium/high PMIM segments expect team leaders to have an advanced degree in instructional design or related field plus solid experience in managing complex educational/training product development projects. However, they do not require formal education/training in project management and seem to emphasize “learning by doing” as the means of acquiring project management experience. On the other hand, project team leaders reporting college/university education/training in instructional design appear to be concentrated in the medium/high PMIM segment, while those in the low PMIM segment report relatively limited formal/education in instructional design. Further, project team leaders in both PMIM segments have had formal as well as informal training in project management. This suggests that practitioners deem formalized project management knowledge as the “ticket to entry” for project team leadership, affording them the opportunities and grounding to gain project management experience.

One possible explanation for this disconnect lies in the disciplines that offer formal project management education versus those offering formal instructional design education. Project management has its roots in production industries and the military, then diffused to other commercial entities and organizations. As such, project management is a natural fit with the curricula of degree and certificate programs that educate professionals for those industries (e.g., Business, Engineering). Instructional design programs, however, are usually offered by colleges of Education whose long-standing mission has been the education of teachers, the development of education leaders, and the advancement of teaching excellence. Although these programs have evolved to capitalize on the teaching and learning affordances of technology and prepare students to design instruction in a variety of settings and environments, the notion that instruction is a product that requires process management beyond the processes provided by instructional design models, is not a good fit with the values, beliefs and shared assumptions of the discipline (and sub-disciplines) of Education prevalent in the U.S. (Williams van Rooij, 2010).

### Conclusions

This study provides insights into the reported usage of project management methodology and perceived competencies and roles of project managers and instructional designers in educational/training product development project teams. However, the study does have limitations. The study is constrained by the relatively small number of survey respondents. The associations to which the call for participation was issued collectively have nearly two million active members representing a diversity of organizations, industries, and geographic regions. As such, the results obtained from the survey sample are not generalizable to either the association memberships or to specific categories in the data (industry sectors, occupational groups, etc.). In addition to the hypotheses offered in this study, there may be alternative hypotheses about why elements of managing projects were embedded into instructional design models rather than as separate but complementary processes. Nevertheless, comparison with other studies facilitated interpretation of the findings and allowed a richer picture of the observed phenomena to emerge.

The study also signals opportunities for future research. For example, a scale-up of this study to a larger sampling of target respondents would enable an analysis of PMIM by various sample segments. The impact of industry, region (including national versus international organizations), and other organizational characteristics on PMIM is a research opportunity area. The path to project team leadership of instructional designers with advanced degrees and limited/no formal project management training versus those with formal project management training is another area that should be tracked. Similarly, the path to team leadership of project managers without advanced degrees in instructional design but with formal project management training should be tracked. A comparison of the two paths would help determine which combinations of formal/education training take priority in the selection of educational/training product development project team leaders. It would also contribute to the exploration of the impact of gaps in project management competencies among graduates of instructional design degree and certificate programs.

The findings from this study should contribute to the dialog about how institutions of higher education keep the scope of their offerings in instructional design degree and certificate programs targeted toward practitioners current with the needs of the job market. By the same token, the impetus for the inclusion of project management courses in the instructional design curricula needs to be stressed by the project management community. For example, the Project Management Institute (PMI) could do a much better job of advocacy with educational institutions, generating awareness beyond the traditional disciplines of business, information technology, etc. PMI has begun to take steps in this direction through its educational foundation (Project Management Institute Educational Foundation (PMIEF), 2008) offering a project management training fellowship program to assist in-service primary and secondary school teachers and administrators in learning the fundamentals of project management. The goal of the program is to enable teachers and administrators to utilize project management in schools and/or classrooms as a means of enhancing the education of students learning 21st century skills. It is hoped

that efforts such as this will contribute to the ongoing dialogue about the relationship between instructional design and project management, and that the skills/competencies of the two professions are increasingly seen as complementary rather than divergent.

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## **An Exploratory Study of Cyberbullying With Undergraduate University Students**

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### **Abstract**

Understanding the covert events surrounding the undergraduate university students' experience is essential to educators and counselors involvement in a students' success. Past research into bullying behaviors has documented emotional feelings of anger, sadness and poor concentration as an impact bullying has on the victim. The advent of affordable technologies has propagated this concern into cyberspace. This exploratory study was designed to evaluate the instances of direct and/or indirect cyberbullying experienced by the undergraduate university student. Additionally, the forms of technology utilized in cyberbullying were queried. Surveyors distributed a 27-item survey to 120 undergraduate university students in the social science, technology and education departments. The majority of all respondents (54%) and one hundred percent of male respondents indicated they knew someone who had been cyberbullied. Cell phones, Facebook and instant messaging were the primary forms of technology used to perpetrate cyberbullying. Living arrangements and hours of daily technology usage provided statistically significant results. The study results provide legitimate concerns regarding the undergraduate university students' exposure to cyberbullying and numerous areas for future research. (*Keywords: cyberbullying, bullying, cyberharrassment, undergraduate university students, technology and information systems*)



Growing up, most people have experienced bullying behavior – many times on the playground or on the school bus.

Negative memories often accompany such reminiscing. Consequently, it seems natural that bullying behavior became a research topic, which has evolved with the advent of new technologies. The following section describes the research focused on the social and psychological aspects of traditional bullying and serves as a basis for understanding technological bullying – cyberbullying in current age, where bullying takes a disturbing twist.

In the late 1970's Dan Olweus led social and psychological bullying research and provided a generalized understanding of two primary forms direct and relational, or indirect, bullying (Smith & Gross, 2006; Chapell et al., 2006). Much of this research focused on students who were either bullies or victims.

Chapell, et al (2004) explored bullying in university with a sample of 1,025 undergraduates and found that 24.6 % of respondents had been bullied. Chapell, Hasselman, Kitchin, Lomon, MacIver, & Sarullo (2006) found a significant positive correlation between being a bully in university, high school and elementary school, with 21 % having been bullied.

Chapell et al. (2006) evaluated 119 undergraduate students to determine the continuance of being a bully, victim, or bully-victim from elementary school through university. Interestingly, over 70 % of students who were bullied in high school and elementary school bullied others in university. Forty to over 50 % of students who had been bully-victims or bullies (respectively) in elementary and high school repeated the pattern in university.

Victims of bullying struggle with undesirable emotions. They report feelings of anxiety, depression and suicidal ideation. Ybarra and Mitchell (2004a) reported an increase of psychosocial problems in those reporting cyberbully/victim behaviors including: problem behaviors, drinking alcohol, smoking, depression and low commitment to academics. Somewhat alarming are the incidences of school shootings where the perpetrators report suffering from bullying behavior. In addition, university counseling centers report increasing concerns of anxiety, depression and suicidal ideation with the undergraduate university student (Chapell et al., 2006, p.644). Research regarding incidents of bullying on campus is imperative to providing a pro-active approach to the education of the 21<sup>st</sup> Century student.

The advent of affordable, user-friendly technology has brought bullying into cyberspace. Haber and Haber (2007) define cyber-bullying as:

The use of information and communication technologies such as e-mail, cell phone and pager text messages, instant messaging, personal Web sites or blogs and online personal polling Web sites.

The technology is used to promote deliberate, repeated and hurtful behavior by an individual or group, with the intent to harm others (p. 52).

This new format of communication has initiated new areas of concern and thus new avenues for analytical research and study.

Past studies of cyberbullying have primarily focused on the adolescent years with emphasis on technologies used, reactions to cyber-harassment and the extent of the experience.

Li (2007) investigated the nature and extent of adolescences' experience of cyber-bullying. This study surveyed 177 students in grade seven of an urban city. The results showed over 25 % of students had been cyber-bullied and almost 15 % had cyber-bullied others (Li, 2007).

A cross-cultural comparison was also undertaken by Li (2008) to determine the extent of and cultural differences with bullying noted between students in Canada and those in China. Data from Canada was analyzed from two schools in a large western Canadian city with a survey of 157 seventh grade students. The Chinese data, from two secondary schools in a large city in Southern China, was gathered from 197 students. In Canadian schools, almost 55% of the students were victims of traditional bullying and a quarter had been cyberbullied. Thirty-three percent reported bullying others in the traditional form and almost 15% had cyberbullied others. Chinese students experienced traditional bullying at a higher rate of 67% while 60% had been cyberbullied. However, when a chi-square analysis was used to analyze the cross-cultural occurrences; proportionally, more Canadian students than Chinese students reported that they had cyberbullied others ( $p < 0.001$ ) or knew someone being cyberbullied ( $p = 0.002$ ).

Juvonen and Gross (2008) provided data from an anonymous Web-based survey (conducted in 2005) to determine the extent of online bullying experienced by youth between 12- to 17-years-old ( $N = 1454$ , mean age = 15.5,  $SD = 1.47$ ). Respondents participated via a teen Website (<http://bolt.com>) and indicated experiences of bullying described by the researchers as "*mean things*" students experienced that were defined as "anything that someone does that upsets or offends someone else." There was no requirement of a repetitive nature to the "*mean thing*." Five forms of bullying were reported: insults (66%), threats (27%), sharing embarrassing pictures (18%), privacy violation (25%), and password theft (33%). Almost one-fifth of respondents reported repeated experiences with 72% of Internet users reporting at least one online bullying encounter during the past year.

Two studies addressed aspects of cyberbullying on the university level of students. Finn (2004) found that 10 to 15 % of 339 students at the University of New Hampshire reported experiencing repeated e-mail or Instant Messenger messages that “threatened, insulted, or harassed” and more than half of the students received unwanted pornography (surveyed in 2002).

The psychological needs as a predictor of cyberbullying was also evaluated with surveys distributed to 666 students in the Faculty of Education at Selcuk University, Turkey. The primary focus of this research was to assess the psychological needs of the cyberbully and the results indicated that aggression (“engaging in behaviors which attack or hurt others”) and succorance (“soliciting sympathy, affection and emotional support from others”) positively predicted cyberbullying, whereas interception (“engaging in attempts to understand one’s own behavior or the behavior of others”) negatively predicted it (Kilmac, B., 2009, p. 1313). Additionally, 22.5% of the students reported cyberbullying another at least once and 55.3% reported being a victim of cyberbullying at least once in their lifetime (Kilmac, 2009).

The Social Dominance theory may be applied to better understand bullying. Pratto, Sidanius and Levin (2006) assessed fifteen years of research that evaluated the social dominance theory. Social groups are divided into three classifications: *age system*, adults have social power over children; a *gender system*, men have disproportionate power compared to women; and an *arbitrary-set system*, arbitrary groups have access to things of positive and negative social value. Arbitrary-set groups may be defined by social distinctions meaningfully related to power. Discrimination, that favors dominant groups over subordinate groups, is the primary dynamic that produces these group-based social hierarchies. It is the ideologies shared by society, or *legitimising myths*, that permit this discrimination (Pratto, Sidanius, & Levin, 2006).

Discrimination by individuals is also prevalent. *Social dominance orientation* (SDO) defines the psychological orientations that delineate dominant and subordinate group relations. Although these intergroup processes produce better outcomes for dominants than for subordinates, both groups justify their actions and relative positions with legitimising myths (Pratto, Sidanius, & Levin, 2006).

Bullying may be the result of legitimising myths that allow the *gender* and *arbitrary-set systems* to delineate this power struggle. Technology allows this struggle to exist surreptitiously away from the watchful eye of the educator.

As technology becomes more accessible to today's youth more questions arise. CTIA, the International Association for the Wireless Telecommunications Industry (2010), indicated that the wireless penetration in the United States increased 78% from 1995 to 2009, with 276.6 million wireless subscribers. Subscribers accrue \$151.2 billion in annualized wireless revenues and 1.36 trillion annualized SMS messages. Facebook (2010) has more than 350 million users with more than 3.5 billion pieces of content (web links, news stories, blog posts, notes, photo albums, etc.) shared each week.

What impact does the inexpensive, readily available cell phone have on the interactions of undergraduate students as they maintain their status according to the social dominance theory? How do social networking sites impact these students? Has the ability to reply instantly, without personal contact, augmented the bullying scene? Additional research is necessary to address the upsurge of technology, and its impact on the age-old events of bullying. This study will guide the exploration of the extent of cyberbullying on the university campus to address some of these concerns:

1. What instances of cyber-bullying does the undergraduate student experience, and what role does gender play in cyber-bullying at the undergraduate level?
2. What forms of technology do undergraduate students use to perpetrate or receive bullying, and how often does it occur?

## Method

### *Participants*

Department chairs were contacted in four departments at a university in Northeastern Pennsylvania to obtain permission to distribute surveys. The selection was designed to diversify the respondents in four divisions of study. Ultimately, surveys were distributed in three departments: social science, technology and education.

A total of 131 students (73 female and 57 male) were surveyed from seven undergraduate classes during the 2008 spring semester. Survey questionnaires were distributed to students in class. Students were informed that they were not obligated to complete the surveys, and they were instructed to check a box and not complete the packet if they had done so in another class. An Information Sheet was provided, for the respondent to keep, that defined cyberbullying, as developed by Haber and Haber (2007) and gave the location and hours of operation for campus counseling and security. Anonymity was guaranteed with instructions not to record their names on the survey; packets were also returned face down in a box provided that was placed away from the surveyor.

### *Measures*

The author adapted and combined surveys from Li (2006) and Spitzberg and Hoobler (2002) to develop a 27-item survey to address the purpose of this study (see Appendix). Closed-ended questions addressed demographic data and asked about instances of hearing about and experiencing cyberbullying at the university where the data was collected. An open-ended question was included to allow respondents to offer other instances of cyberbullying experienced.

A pilot study was conducted with twelve undergraduate students ranging in age from 19 to 22. The participants reviewed the Information Sheets and completed the study privately. Following completion, a group forum was utilized to discuss the Information Sheets, survey format and question specifics. This author obtained valuable input that was taken into consideration as the final 27-item survey was created.

Participants received a six-page packet. The Information Sheet, page one of the packet, contained detailed information regarding the purpose of the study, a definition of cyberbullying, and the contact information for the university's counseling and psychological services as well as for campus security. The Haber and Haber (2007) definition for cyberbullying was used to introduce the survey. Respondents were directed not to write their names on the survey papers and were directed to keep the Information Sheet.

The second page provided information to the participants regarding the researcher and the purpose of the research. Also included was a discussion of the risks, the voluntary nature of the study and informed consent.

The survey contained a demographic questionnaire to determine gender, age, living arrangements, ethnicity, school grade average and hours of technology use per day. When mortalities were removed, data was analyzed from 120 students (70 female and 50 male) ranging from age 18 to 24. Of these respondents, two percent classified themselves as Asian, two percent Hispanic, seven percent Black, one percent Indian, 85 percent White and three percent Other. When queried about living environment, 16 % lived at home with parent/guardian; 53 % lived in campus housing; and 31 % lived off campus but not at home. School grade averages were reported at 51 % in the A-B range, 47 % in the B-C range, two percent reported grades in the C-D range and no respondents reported a lower than D range. No respondent reported daily use of technology (computer, cell phone, PDA, etc.) below one hour daily. Fourteen percent of students use technology between one and two hours daily, 31 % between three and four hours and 55 % of respondents use technology more than four hours daily.

Twenty-one questions were utilized to gather data. Respondents specified their knowledge of students being cyberbullied and technologies used. Their direct experience with cyberbullying was analyzed based on technologies used, who perpetrated the bullying, the frequency of cyberbullying and whether they told a parent/guardian or other adult. The survey was concluded with fourteen specific instances of undesirable and obsessive communication via computer or other electronic means.

## Results

As shown in Table One, 54 % of all respondents indicated knowing someone who has been cyberbullied. Of the students that stated they knew someone who had been cyberbullied 50 of the 65 were male; 100 % of male respondents knew someone who was cyberbullied.

**Table 1: Number of Students Reporting Knowing Someone Who Has Been Cyberbullied (N = 120)**

	n	%
Total	65	54
Female (N=70)	15	23
Male (N= 50)	50	77

Specific examples of technologies used to cyberbully were also delineated (Table 2). Of the items listed Facebook (56%), Cell phones (45%) and AIM (43%) were the most often reported.

**Table 2: Number of Students Reporting Technologies Being Used to Cyberbully University Students (N = 120)**

	n	%
E-mail	23	19
Cell Phones [text, pictures, video, or messages]	54	45
Video cameras, Web cam	8	7
AOL Instant Messaging (AIM)	52	43
Facebook	67	56
My Space	37	31
Blogging	11	9
Twitter	1	1
Chat Rooms	5	4

Eleven percent of the respondents indicated having experienced cyberbullying at the university (Table 3). Of those, Facebook (64%), Cell Phones (43%) and AIM (43%) were the most frequent technologies used. Of the respondents who were cyberbullied, 57 % were bullied less than four times, 29 % were cyberbullied four to ten times and 14 % over 10 times. Students indicated that 50 % of the cyberbullies were university classmates, 57 % someone outside of university and 43 % did not know who was cyberbullying them. Seventy-one percent of the students replied they had told a parent/guardian or other adult about the cyberbullying incident(s).

**Table 3: Number of Students Victimized by Cyberbullying (N = 14)**

	n	%
Email	3	21
Cell Phones [text, pictures, video, or messages]	6	43
Video cameras, Web cam	0	0
AOL Instant Messaging (AIM)	6	43
Facebook	9	64
My Space	4	29
Bloggag	0	0
Twitter	0	0
Chat Rooms	0	0

Frequency of Cyberbullying (N = 14)		
	n	%
Less than 4 times	8	57
4 – 10 times	4	29
Over 10 times	2	14

When participants were queried regarding the extent of undesirable and obsessive communication through computer or other electronic means (Table 4) four areas were reported at or above 30 %: sending tokens of affection (33 %), sending excessively ‘needy’ or demanding messages (30 %), pretending to be someone he or she wasn’t (34 %) and ‘friending’ people you know to get personal information about you 31 %. An independent-samples t-test was conducted to compare these categories. There was no significant difference in scores for males and females.

Table 4. Number of students reporting being undesirably and obsessively communicated with or pursued through computer or other electronic means (N = 120)

	n	%	ITEM
Sending tokens of affection (e.g. poetry, songs, electronic greetings, praise, etc.)	40	33	A
Sending exaggerated messages of affection (e.g. expressions of affections implying a more intimate relationship than you actually have, etc.)	33	28	B
Sending excessively explicit messages (e.g. inappropriately giving private information about his/her life, body, family hobbies, sexual experiences, etc.)	31	26	C
Sending excessively 'needy' or demanding messages (e.g. pressuring to see you, assertively requesting you to go out on a date, arguing with you to give him/her 'another chance,' etc.)	36	30	D
Sending pornographic/obscene images or messages (e.g. photographs or cartoons of nude people, or people or animals engaging in sexual acts, etc.)	28	23	E
Sending threatening written messages (e.g. suggesting harming you, your property, family, friends, etc.)	15	13	F
Sending sexually harassing messages (e.g. describing hypothetical sexual acts between you, making sexually demeaning remarks, etc.)	14	12	G
Sending threatening pictures or images (e.g. images of actual or implied mutilation, blood, dismemberment, property destruction, etc.)	3	3	H
Exposing private information about you to others (e.g. sending e-mail out to others regarding your secrets, embarrassing information, unlisted numbers, etc.)	14	12	I
Pretending to be someone he or she wasn't (e.g. falsely representing him/ herself as a different person or gender, claiming a false identity, status or position, pretending to be you, etc.)	41	34	J
'Sabotaging' your private reputation (e.g. spreading rumors about you, your relationships or activities with friends, family, partner, etc.)	19	16	K
'Sabotaging' your work/school reputation (e.g. spreading rumors about you, your relationships or activities in organizational networks, electronic bulletin boards, etc.)	8	7	L
'Friended people you know to get personal information about you	37	31	M

A one-way between groups analysis of variance (Table 5) was conducted to explore the impact of living environment on whether respondent felt their private reputation had been 'sabotaged' via rumors spread with computers or other electronic means. Subjects were divided into three groups based on their living arrangements (Group 1: at home with parent/guardian, Group 2: in campus housing, or Group 3: off campus but not at home).



Twenty-three percent ( $n = 28$ ) of participants answered “yes” to feeling that their private reputations were damaged. There was a statistically significant difference at the  $p < .05$  level for the three groups:  $F(2,117) = 3.9, p = .02$ . The effect size, calculated using eta squared, was .06. With only six percent of variability explained by living arrangement, future research should address this issue.

Table 5. ANOVA: Impact of Living Arrangements on ‘Sabotage’ of Private Reputation

ANOVA					
K					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.007	2	.503	3.930	.022
Within Groups	14.985	117	.128		
Total	15.992	119			

Table 6. Tukey HSD Comparison of Living Arrangements and Item K: ‘Sabotage’ of Private Reputation

### Post Hoc Tests

#### Multiple Comparisons

K Tukey HSD						
(I) D3	(J) D3	Mean Difference (I- J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1	2	.238	.093	.033	.02	.46
	3	.100	.101	.587	-.14	.34
2	1	-.238	.093	.033	-.46	-.02
	3	-.138	.074	.152	-.31	.04
3	1	-.100	.101	.587	-.34	.14
	2	.138	.074	.152	-.04	.31

\*. The mean difference is significant at the 0.05 level.

As noted in Table 6, post-hoc comparisons using the Tukey HSD test indicated the mean score for Group 1 ( $M = .32, SD = .478$ ) was significantly different at the  $p < .05$  level ( $p = .03$ ) than Group 2 ( $M = .08, SD = .27$ ). Group 3 ( $M = .22, SD = .417$ ) did not differ significantly from either Group 1 or Group 2. The finding that students at home with parents/guardians reported a higher incident than those on campus (21.9% and 28% respectively) is an interesting result. It could be that students who choose to stay at home feel more susceptible to the comments and actions of others.

A one-way between groups analysis of variance (Table 7) was also conducted to evaluate the effect of hours of technology use on the experience of being cyberbullied on the college campus. Subjects were divided into four groups based on their technology (computer, cell phone, PDA, etc.) use: Group 1, less than an hour daily ( $<1$

hour), Group 2, between one and two hours daily ( $1^2$ ), Group 3, between three and four hours daily ( $3^4$ ) and Group 4, more than four hours daily ( $>4$ ). There was a statistically significant difference at the  $p < .05$  level for the four groups:  $F(2, 117) = 3.16, p = .05$ . The effect size, calculated using eta squared, was .05. With only five percent of variability explained future research is needed.

**Table 7. ANOVA: Effect of Hours of Technology Use on Being Cyberbullied**

ANOVA					
Q2					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.634	2	.317	3.163	.046
Within Groups	11.732	117	.100		
Total	12.367	119			

As noted in Table 8, post hoc comparisons using the Tukey HSD test indicated that the mean score for Group 3 ( $M = .03, SD = .164$ ) was significantly different at the  $p < .05$  level ( $p = .049$ ) that Group 4 ( $M = .18, SD = .389$ ). Groups 1 and 2 did not differ significantly from either group 3 or 4. Recently, an undergraduate college student stated that he was “online practically 24 hours straight” during a snowstorm. Future research should analyze this in more depth to better understand what  $>4$  hours entails.

**Table 8. Tukey HSD Comparison of Individual Being Cyberbullied and Hours of Computer Use**

### Post Hoc Tests

#### Multiple Comparisons

Q2 Tukey HSD						
(I) D6	(J) D6	Mean Difference (I- J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
2	3	.032	.093	.937	-.19	.25
	4	-.123	.086	.330	-.33	.08
3	2	-.032	.093	.937	-.25	.19
	4	-.155	.065	.049	-.31	.00
4	2	.123	.086	.330	-.08	.33
	3	.155	.065	.049	.00	.31

\*. The mean difference is significant at the 0.05 level.

When students were given the opportunity, in an open-ended question, to express individual experiences with being undesirably pursued through computer or other electronic means, three students responded. One recalled the following event:

I have a friend who was dating a boy named Jim on my space for an entire year. She met Jim though a friend on the basketball team we will call LL. For a while it was going very well with my friend and Jim. Then he started getting obsessive. He was never home when she tried to see him. Finally, after a year and being in love with Jim she finds out that Jim and LL are the same person. She was heartbroken because LL created the perfect guy and is a girl. So, my friend was harassed by LL for a long while and then the cops were involved. LL sought help. In the end, my friend lost her senior year to false promises and hope.

Additionally, a respondent discussed a random person who signed in to a chat room and pretended to be the respondent to harass their friends. This occurred on several occasions before the person quit. A third participant stated they were “rick rolled.” Defined by Wikipedia (2010) as being directed to a Web link unrelated to the topic being discussed. The Web link actually takes the user to the Rick Astley music video, “*Never Gonna Give you Up*.”

### *Discussion*

This study explores a little examined area of the undergraduate experience. The dearth of literature in this area left this researcher with only two similar studies to evaluate. The preliminary analysis of the 120 participants indicated that the majority (54%) of respondents knew someone who had been cyberbullied. One hundred percent of the males surveyed indicated they knew someone who had been cyberbullied.

Eleven percent had personally experienced cyberbullying, with 57 % having been cyberbullied less than four times, 29 % four to ten times and 14 % over ten times. Finn’s (2004) findings support the results since 10 – 15 % of his respondents received email or Instant Messaging that “threatened, insulted, or harassed.”

When specific examples of incidents of undesirable and obsessive communication through the computer or other electronic means were queried 33 % of respondents had received unsolicited tokens of affection, 34 % had someone pretend to be someone he or she wasn’t and 30 % experienced excessively ‘needy’ or demanding messages. Twenty-three % of respondents had received pornographic or obscene images. This is relatively lower than Finn’s (2004) finding of 58.7%. Finn did not query if the pornography was sent directly to respondent or via group messages.

The findings bring to light a discrepancy. Interestingly, 30% or more students indicated that they had experienced incidents of undesirable and obsessive communication. Based on the operational definition of cyberbullying that was given in the student survey, the incidents of undesirable and obsessive communication *are forms* of cyberbullying. One would expect that all of those who indicated that they had experienced these incidents would have also reported yes to cyberbullying. Instead, only 11% reported “yes” to being cyberbullied, instead of the expected 30%. One questions why these undesirable incidents are higher than the 11 % that responded yes to

being cyberbullied. Is it possible that these instances are not considered bullying but are accepted as a part of social life “online?”

From the data, 71 % of the respondents indicated that they had told a parent/guardian or other adult about the cyberbullying experience. Upon reflection, the researcher questions whether a respondent considers a university peer to be an “other adult?”

To better understand who was doing the cyberbullying, question four queried if the respondent was cyberbullied by classmates (50 %), someone outside of university (57 %) and “I don’t know” (43 %). The combined percentage of greater than 100 % brings the question as to whether the victims were being bullied by more than one person.

A statistically significant difference was noted in two areas of the study. There is a 95 % confidence that the apparent difference in students who felt their private reputation had been ‘sabotaged’ among students living at home with parent/guardian or in campus housing is a genuine one and not a sampling error. A lower percentage of students who lived on campus reported feeling ‘sabotaged’ (21.9%), than those living at home with parent/guardian (28%). Twenty percent of students living off campus but not at home felt their reputation had been damaged.

The second area of research that indicated a statistical significance indicates a 95 percent confidence that the apparent difference in students that were cyberbullied among students who used technology between three and four hours daily and those on technology more than four hours daily is also genuine and not a sampling error. Those students who used technology more than four hours daily reported more incidents of being cyberbullied.

When studying traditional bullying at the university level, the findings produce smaller results than this research. Chapell, et al (2004) explored bullying in university with a sample of 1,025 undergraduates and found that 24.6 % of respondents had been bullied. Other research, conducted by Chapell, et al (2006) found a significant positive correlation between being a bully in university, high school and elementary school, with 21 % having been bullied. Unlike traditional bullying, this exploratory research indicates an increase of bullying, via a cyberbullying format, to up to 34 %. The advent of affordable technology and thus an increase in technology usage over the past several years may contribute to this increase.

Students report feeling angry, sad and hurt when cyberbullied. Poor concentration and low school achievement is also a concern (Beran and Li, 2005, p. 270). Chapell et al. (2006) report on a number of studies that found that most school shooters had been bullied. This supports a concern that further campus violence is possible

due to this relatively new form of bullying, via technology. University educators and counseling centers need to be aware of the ability of undergraduate students to surreptitiously and repeatedly bully victims via technology.

Pratto, Sidanius and Levin (2006) evaluation of the *Social Dominance Orientation* (SDO) provides a basis of understanding for the cyberbullying actions of the undergraduate student. In the stressful environment of university, students may feel they must dominate to succeed. The relative ability to feel control of a situation as the dominant bully may allow the cyberbully to justify their actions. Kilmac (2009) supported this theory with the finding that aggression and succorance positively predict cyberbullying.

This researcher faced several limitations. Data gathered from 120 participants inhibits the ability to provide overall generalizations at the university being studied. Also, it is not possible to generalize to a national level. The convenience sample format of this exploratory research may not have provided a widely diversified study group. Finally, standardization of the surveying procedure was not possible since the researcher did not administer the survey to every group.

Future research is needed to expand our understanding of cyberbullying at the university level. One area of research would further analyze the undergraduate university student's concept of cyberbullying versus the undesirable and obsessive communication through computer or other electronic means. More detailed gender data would be valuable to determine if the males who responded they knew someone that had been cyberbullied were referring to men or women. Are they more often the confidant of fellow female students? In addition, more information needs to be gathered to determine if one or more perpetrators are victimizing those being cyberbullied. When one considers the relatively high percentage of respondents who told a parent/guardian or other adult about being cyberbullied, it would be valuable to know if these respondents are considering university peers as the "other adult." Finally, a nation-wide survey of undergraduate students would provide valuable data of cyberbullying experienced.

### *Conclusion*

To the best of my knowledge, this study is the first to closely examine the extent of cyberbullying that undergraduate students experience. It provides a basis for future research in cyberbullying on the undergraduate campus. The ability of individuals to surreptitiously bully others via technology combined with results indicating 54% of respondents knowing someone who had been cyberbullied and up to 34% having been cyberbullied indicates a need for such research.

The academic college setting values the mature, eschewing the sophomoric behavior of bullying, but even the university is not safeguarded from cyberbullying in a technological age. Those concerned with the welfare of students need to be abreast of their cyber troubles.

## INFORMATION SHEET

(Please read before starting)

**PLEASE DO NOT WRITE YOUR NAME ON THE SURVEY PAPERS.**

As part of my MCOM research study, I am looking at what characteristics of cyber harassment students at University experience. The information in this packet will help me in that area and will be kept confidential. I appreciate your help, but if you do not wish to participate, you can return an empty packet.

Cyberbullying is defined by Haber and Haber (2007) as the use of information and communication technologies such as e-mail, cell phone and pager text messages, instant messaging, personal Web sites or blogs and online personal polling Web sites. The technology is used to promote deliberate, repeated and hurtful behavior by an individual or group with the intent to harm others (p. 52). This may include a course of conduct, with repeated actions over time and an invasion of a person's relative right to personal privacy (Spitzberg & Hoobler, 2002: 73). This survey, being conducted to fulfill graduate requirements at University, does not qualify me to help with issues of cyberbullying. The following services are available at THE UNIVERSITY:

- ❑ University Counseling and Psychological Services, often called CAPS, is available to assist you with family issues, depression, anxiety, relationship difficulties, loneliness, eating issues, alcohol and drug concerns, career decisions and more. The office is open Monday through Friday 8:00 AM to 4:30 PM.
- ❑ The University has made a commitment to ensure the safety of its students, employees and visitors. Through the implementation of safety procedures, policies and educational programs, the university has enhanced the awareness of safety throughout the campus. Campus security is located at . . .

When you are finished with this survey, please place it in the box at the front of the room with the print side down. If you have any questions about this study, I can be contacted at [cmw8410@esu.edu](mailto:cmw8410@esu.edu).

*This Information Sheet is yours to keep. Thank you for your time ☺*

February 2008

### Cyber Harassment and the Undergraduate University Student

You are being invited to participate in a research study about cyber harassment and its impact on university students. I am conducting this study from the Media Communications and Technology department, at University, under the supervision of my professor. This study is being conducted in fulfillment of a graduate student project for the completion of a master degree in education.

There are no known risks if you decide to participate in this research study. There is no cost to you for participating in the study. The information you provide will be used to compile data regarding the characteristics of cyber harassment at University. The questionnaire will take about twenty minutes to complete. The information collected may not benefit you directly, but the information learned in this study should provide more general benefits.

**This survey is anonymous. Do not write your name on the survey. No one will be able to identify you or your answers, and no one will know whether or not you participated in this study.** Individuals from the Institutional Review Board may inspect these records. Should the data be published, no individual information will be disclosed.

Your participation in this study is voluntary. By completing and placing this survey in the collection box on the front desk, you are voluntarily agreeing to participate. You are free to decline to answer any particular question you do not wish to answer for any reason. I hope you will take a few minutes to complete this survey.

If you have any questions about the study, please contact . . .

The Institutional Review Board has reviewed my request to conduct this project. If you have any concerns about your rights in this study, please contact Dr. . . .

*Date of IRB Approval:* March 2008

*IRB Number:*

*Project Expiration Date:* March 2009



☐

PLEASE CHECK THIS BOX AND DO NOT COMPLETE THE SURVEY IF YOU HAVE ALREADY PARTICIPATED IN ANOTHER CLASS.

- ☐ Please answer each of the following questions as accurately as you can.
- ☐ For those in which multiple responses are provided, you need only fill in the appropriate response(s) for you.
- ☐ For the others, please place your answer in the blank space provided for each.

1. I am a \_\_\_\_\_ female \_\_\_\_\_ male.
2. My age is, please check one: \_\_\_\_\_ 18 – 24 \_\_\_\_\_ 25 & above

3. During this university semester I am living: Please check one

\_\_\_\_\_ At home with parent/guardian

\_\_\_\_\_ In campus housing

\_\_\_\_\_ Off campus but not at home

4. How do you describe yourself, please check one:

\_\_\_\_\_ Asian \_\_\_\_\_ Hispanic \_\_\_\_\_ Black

\_\_\_\_\_ Indian \_\_\_\_\_ White \_\_\_\_\_ Other

5. My school grade average is usually, please check one:

\_\_\_\_\_ A - B range \_\_\_\_\_ B - C range \_\_\_\_\_ C - D range

\_\_\_\_\_ Lower than D range

6. I use technology (computer, cell phone, PDA, etc.), please check one:

\_\_\_\_\_ Less than an hour a day

\_\_\_\_\_ Between 1 and 2 hours a day

\_\_\_\_\_ Between 3 and 4 hours a day

\_\_\_\_\_ More than 4 hours a day

I understand that completion of this survey implies informed consent and voluntary participation.

- 1) Have you heard of students at University using technology to bully/harass other students, if yes please check all that apply:

\_\_\_\_\_ E-Mail

\_\_\_\_\_ Cell phones [text, pictures, video or messages]

\_\_\_\_\_ Video cameras, Web cam

\_\_\_\_\_ AIM

\_\_\_\_\_ Facebook

\_\_\_\_\_ My Space

☐ Blogging  
☐ Twitter  
☐ Chat Rooms

- 2) I have experienced cyberbullying at THE UNIVERSITY (e.g. email, cell phones, video/Web cams, AIM, Facebook, My Space, Blogging, Twitter, Chat Rooms, other) **If no; please go to question #6.**

☐ Yes  
☐ No

- 3) **If yes, I experienced cyberbullying via (check all that apply):**

☐ E-Mail  
☐ Cell phones [text, pictures, video or messages]  
☐ Video cameras, Web cam  
☐ AIM  
☐ Facebook  
☐ My Space  
☐ Blogging  
☐ Twitter  
☐ Chat Rooms  
☐ Other: please explain \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

- 4) **If yes, I was cyberbullied by (check all that apply):**

☐ University classmates  
☐ Someone outside of university  
☐ I don't know

- 5) **If yes, I have been cyberbullied, please check one:**

☐ Less than 4 times  
☐ 4 – 10 times  
☐ Over 10 times

- 6) I know someone who has been cyberbullied:

☐ Yes  
☐ No

- 7) When I was cyberbullied, I told a parent/guardian/or other adult about it:

☐ Yes  
☐ No

Has anyone ever undesirably and obsessively communicated with or pursued you through computer or other electronic means by (CHECK ALL THAT APPLY):

- a. ☐ Sending tokens of affection (e.g. poetry, songs, electronic greetings, praise, etc.)  
b. ☐ Sending exaggerated messages of affection (e.g. expressions of affections implying a more intimate relationship than you actually have, etc.)  
c. ☐ Sending excessively explicit messages (e.g. inappropriately giving private information about

his/her life, body, family hobbies, sexual experiences, etc.)

- d. \_\_\_\_\_ Sending excessively 'needy' or demanding messages (e.g. pressuring to see you, assertively requesting you to go out on a date, arguing with you to give him/her 'another chance,' etc.
- e. \_\_\_\_\_ Sending pornographic/obscene images or messages (e.g. photographs or cartoons of nude people, or people or animals engaging in sexual acts, etc.)
- f. \_\_\_\_\_ Sending threatening written messages (e.g. suggesting harming you, your property, family, friends, etc.)
- g. \_\_\_\_\_ Sending sexually harassing messages (e.g. describing hypothetical sexual acts between you, making sexually demeaning remarks, etc.)
- h. \_\_\_\_\_ Sending threatening pictures or images (e.g. images of actual or implied mutilation, blood, dismemberment, property destruction, etc.)
- i. \_\_\_\_\_ Exposing private information about you to others (e.g. sending e-mail out to others regarding your secrets, embarrassing information, unlisted numbers, etc.)
- j. \_\_\_\_\_ Pretending to be someone he or she wasn't (e.g. falsely representing him/ herself as a different person or gender, claiming a false identity, status or position, pretending to be you, etc.)
- k. \_\_\_\_\_ 'Sabotaging' your private reputation (e.g. spreading rumors about you, your relationships or activities with friends, family, partner, etc.)
- l. \_\_\_\_\_ 'Sabotaging' your work/school reputation (e.g. spreading rumors about you, your relationships or activities in organizational networks, electronic bulletin boards, etc.)
- m. \_\_\_\_\_ 'Friended' people you know to get personal information about you
- n. \_\_\_\_\_ Other: Please explain

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Survey adapted from:

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Spitzberg, Brian H. & Hoobler, Gregory. (2002). Cyberstalking and the technologies of interpersonal terrorism [Electronic Version]. *New Media & Society*, 4, 71 – 92.

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# Investigating Mixed Methods Studies in the Field of Instructional Design and Technology

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**Descriptors:** mixed methods; content analysis

## Abstract

The purpose of this content analysis study was to investigate how mixed methods were used by researchers in the Instructional Design and Technology (IDT) field. This study reviewed multi-data studies, studies that collected both quantitative and qualitative data, from three major journals in the IDT field. The results indicated that multi-data studies were rare in IDT literature. In addition, only 64.4% of the selected multi-data studies were mixed methods studies, while the rest of them were multi-method studies. Amongst the mixed methods studies, the embedded and triangulation designs with the emphasis on the quantitative data were preferred by IDT researchers.

## Introduction

The increasing importance of the mixed methods research across the social sciences has turned more and more researchers into this comparatively new research methodology (Clark, Huddleston-Casas, Churchill, Green, & Garrett, 2008; Creswell, 2003; Hanson, Creswell, Clark, Petska, & Creswell, 2005). In mixed methods studies, both qualitative and quantitative data are collected, analyzed, and mixed in a same research project instead of emphasizing the contrasting paradigmatic features between the qualitative and quantitative methods. Researchers suggested that the qualitative and quantitative method has different strengths and bias; therefore, integrating these two methods has the possibility of combining the strength from both research methods while reducing the weakness of either approach (Creswell & Plano-Clark, 2007). For example, the strength of qualitative methods lay at its thick and rich description of a focused phenomenon, while quantitative methods are valued for their ability to find the relationship between phenomena to provide generalizable results. Following up a quantitative dominated study with a comparatively small qualitative data to increase the depth of the study's findings is one of the approaches to make use of the combined effects of qualitative and quantitative methods.

Education research, as a sub-branch of social sciences research, is inherently complex and multi-faceted. The learning processes are exposed to the impact of the delivery mode, the interaction between learners and the instructor, the group dynamic, the learning environment, the learners' characteristics, and the design of the content. The Instructional Design and Technology (IDT) field is an academic field that concerns itself with these issues through the instructional designs. It has great impact on the integration of instructional technologies into instruction and the development of appropriate instructional strategies for effective learning. IDT is also believed to hold the



new era of e-learning (Woodall, 2004), which requires the consideration of more variables for effective learning. Mixed methods research has great promise to improve the understanding of the complex phenomena in integrating technologies into instruction and explorations of instructional designs by providing researchers with both quantitative and qualitative perspectives.

Albeit the beneficial of mixed methods research, there is sparse literature in the IDT field that employed mixed methods research design. The discussion about the mixed methods studies is difficult to locate, and little has been written about how the mixed methods designs were applied in the IDT field. This study sought to investigate how mixed methods studies were used by researchers in the IDT field through investigating journal articles from three major IDT journals. This study reviewed the concepts of mixed methods research; stated the study purpose and scope; investigated the nature of mixed methods IDT research; and discussed the findings and the future applications.

### Overview of Mixed methods Research

#### Mixed Methods and Multi-method Research

Hanson and his colleagues (Hanson, et al., 2005) pointed out that the use of multiple data collection methods could date back to the earliest social science research. Under the same using- multiple-data- collection-methods canopy (Tashakkori & Teddlie, 2003b), mixed methods and multi-method research are terms that are often used interchangeably by some researchers (e. g. Clark, et al., 2008). However, they are not necessarily the same. As the mixed methods research gradually became the third research paradigm in educational research (Johnson & Onwuegbuzie, 2004), it is necessary to differentiate it from multi-method research (Tashakkori & Teddlie, 2003b).

Multi-method research, as defined by Hunter and Brewer (2003), is “the practice of employing different types, or styles, of data-collecting methods within the same study or research program” (p. 577). This definition indicates that multi-method studies include studies that employ both quantitative and qualitative data collection methods, or multiple forms of either qualitative or quantitative methods (Creswell & Plano-Clark, 2007).

Mixed methods research, on the other hand, has more specific qualifications. There are several versions of definitions of mixed methods research. Mixed methods research was defined as “the collection or analysis of both quantitative and qualitative data in a single study in which the data are collected concurrently or sequentially, are given priority, and involve the integration of the data at one or more stages in the process of research ” (Creswell, Clark, Gutmann, & Hanson, 2003, p. 212). Greene, Caracelli, and Graham (1989) defined it as a design “that include at least one quantitative method (designed to collect numbers) and one qualitative method (designed to collect words), where neither type of method is inherently linked to any particular inquiry paradigm ” (p.257). Tashakkori and Teddlie (2003a) defined mixed methods as a research design that combine qualitative and quantitative approaches into the methodology of sing-or-multi-phased research study. The mixed methods research was also defined as “a research design with philosophical assumptions as well as methods of inquiry.” “As a method, it focuses on collecting, analyzing, and mixing both quantitative and qualitative data in a single study or series of studies” (Creswell & Plano-Clark, 2007, p. 5). Although these definitions have slightly different focuses and details, they share the same emphasis on collecting, analyzing, and mixing both quantitative and qualitative data for conducting a mixed methods study. In sum, although multi-method and mixed methods research may both collect

quantitative and qualitative data, multi-method research does not have to mix the data as mixed methods research does.

As suggested by Hartley and Morphew (2008), content analysis requires a clear measure of judgment. In order to serve this purpose, this content analysis study used Creswell and Plano-Clark's (2007) definition to identify mixed methods studies. That is to say, only when a study that collected, analyzed, and mixed both quantitative and qualitative data within the same study or research project would be identified as mixed methods study. According to this definition, studies in which the researcher collected only one type of data, but used "mixed methods way of data analysis" would not be counted as mixed methods studies. For example, in a study that the researcher only collected qualitative data and transformed it into quantitative data by counting, coding, or developing themes would not be counted as mixed methods research in this content analysis study. In addition, two types of studies that fall into the category of multi-method would be not counted as mixed methods studies either. First, multi-method studies that used multiple quantitative or qualitative data- collecting methods would not be taken as mixed methods study. Second, multi-method studies that collect and analyze both quantitative and qualitative data without mixing them would not be counted as mixed methods studies either.

When a particular study was only a part of a serial study, it was difficult to found out how the entire serial study was conducted without sufficient information. For that reason, this specific content analysis study focused only on single studies. In sum, mixed methods research is different to multi-method research. One of the goals of this study was to differentiate the mixed methods studies from the multi-methods studies in the pool of selected research articles.

#### Characteristics of a Mixed Methods Study

Hanson, Creswell, Clark, Petska, and Creswell (2005) suggested that other than three traditional steps, designing a mixed methods study involved three additional steps. The three traditional steps are deciding on the purpose of the study, the research questions, and the type of data to collect. The three additional steps include deciding whether to use an explicit theoretical lens, identifying the data collection procedures, and identifying the data analysis and integration procedure. The theoretical lens refers to the theories that underline a researcher's study and subsequent methodological choices. The second step is about deciding on data collection procedure and priorities. To be specifically, this step decides on whether the quantitative and qualitative data will be collected concurrently or sequentially, and whether the emphasis will be put on one method or put equally on both methods. The third step involves deciding the point at which data analysis and data mixing will occur. Step two and step three resonate with the three characteristics of mixed methods research that was suggested by Creswell and Clark (2007): timing, style, and priority. In the following section, these three characteristics will be discussed through the introduction of the two mixed methods designing steps.

*Data collection timing, design type, and priority.* According to Creswell and Clark (2007), there are two types of data collection procedure or timing: concurrent and sequential. The four mixed methods research designs suggested by Creswell and Clark were triangulation, embedded, explanatory, and exploratory design. Any one of these four designs can fit into these two procedures. The exploratory and explanatory use sequential data collection procedure while triangulation uses concurrent data collection procedure. Unlike the other three designs they can only use one data collection procedure, the embedded design, however, can use both concurrent and sequential data collection procedure depend on each specific study.

In a triangulation design, the qualitative and quantitative methods are implemented during the same timeframe with equal weight. The data were mixed during the interpretation or analysis stages. In an embedded design, the qualitative method is a small complementary portion of the overall quantitative design or vice versa. The exploratory design is a two-phase design, in which the qualitative data is often used to develop a quantitative instrument or taxonomy. The explanatory design is also a two-phase mixed methods design, in which the qualitative data helps explain or build upon initial quantitative results. The explanatory design has two design models: follow-up explanation model and participant selection model. In the participant selection model, the quantitative information is collected to identify and purposefully select participants for a follow-up, in-depth, qualitative study. In embedded, explanatory, and exploratory design, priority is usually unequal and gives to only one type of data, qualitative or quantitative data. This specific content analysis study used triangulation research design.

*Points of data analysis and data mixing.* In mixed methods studies, data analysis and integration may occur by analyzing the data separately, by transforming, or by connecting them depending on the type of design (Creswell & Plano-Clark, 2007; Hanson, et al., 2005). In the concurrent approach, the quantitative and qualitative data analyses are separated, while the data are merged during the interpretation or analysis. In the sequential approach, the quantitative and qualitative data are connected in which the analysis from the first phase of the research is used to guide data collection in the second phase.

The quantitative section of this content analysis focused mainly on the mixed methods designing step two and three suggested by Hanson, Creswell, Clark, Petska, and Creswell (2005). This study first used the data mixing as the key criterion to differentiate the mixed methods studies from the multi-methods studies. After that, this study looked into the data collection procedure, the design type, and the priority in the mixed methods studies. The qualitative section of this study focused on investigating the rationales provided by researchers for collecting both quantitative and qualitative data.

### Advantages of Mixed Methods Research Design

Researchers have pointed out various advantages that mixed methods research design could bring into a research project. For example, Johnson and Onwuegbuzie (2004) suggested that the “mixed methods research offers great promise for practicing researchers who would like to see methodologists describe and develop techniques that are closer to what researchers actually use in practice” (p.15). Because all methods have inherent biases and limitations, mixed methods design may offset or counteract these biases and limitations (Greene, et al., 1989). Mixed methods research have the possibility to bridge the schism between quantitative and qualitative research (Onwuegbuzie & Leech, 2005), offer insights that could not be gleaned from quantitative or qualitative approach alone (Bryman, 2007), provide a better understanding of research problems (Creswell, 2005), and clarify the nature of research intentions for researchers and writers (Bryman, 2006). Despite the advantages of mixed methods research design, the mixed methods research was rarely used in the IDT research. Among 1,134 articles from three major IDT journals from 2004 to 2009, the researcher only found 14 (1.2%) of them used both qualitative and quantitative methods without differentiating mixed methods and multi-method studies. This preliminary result indicated the necessity and importance of future investigation on the use of mixed methods research design in the IDT field. Guided by the advantages of mixed methods design, this content analysis study chose to use a mixed methods design.

## Research Purposes and Research Questions

The purpose of this content analysis study was to investigate how mixed methods studies were used by researchers in the IDT field. A concurrent triangulation mixed methods design was used for this study in order to “validate and expand quantitative results with qualitative data” (Creswell & Plano-Clark, 2007, p. 62). The quantitative questions were used to find out the characteristics of selected mixed methods studies. Concurrent with this data collection, the qualitative analysis explored the rationales that were provided by researchers for using both qualitative and quantitative methods. The reason for collecting and mixing both quantitative and qualitative data was to bring together the strengths of both forms of research methods in order to have a more complete view of the research questions and findings.

The merging of quantitative and qualitative data happened at all stages of this study, including the design, data collection, data analysis, and interpretation stages. In the results phase, a mixing table was used to demonstrate the interrelationship between the research type (mixed methods or multi-method research) and the provided rationales for using both quantitative and qualitative data. In order to find out how mixed methods studies were conducted and reported in the IDT field, this study reviewed three first tier IDT journals guided by the following research questions:

*Quantitative:* What was the type of the study that collected both quantitative and qualitative data in IDT literature, multi-method or mixed methods study?

*Quantitative:* What were the characteristics of mixed methods studies in IDT literature in terms of their data collection timing, design type, and priority?

*Qualitative:* What were the rationales for collecting both qualitative and quantitative data in IDT literature?

*Mixed:* How did emerged rationales for collecting both qualitative and quantitative data related with the type of study in IDT literature?

## Research Methods

Content analysis is an empirical method for examining text and images in order to identify messages and meanings (Krippendorff, 2004), which is popular in the social sciences research (Hartley & Morpew, 2008). In order to find out how mixed methods studies were conducted and reported in the IDT field, this study first identified whether a single study was a mixed methods study or a multi-methods study when it employed both qualitative and quantitative methods. After that, this study investigated the characteristics of mixed methods studies in terms of their data collection procedure, design type, and priority according to the definition and categorization suggested by Creswell and his colleagues (Creswell, 2003; Creswell, et al., 2003; Creswell & Plano-Clark, 2007). At last, this study summarized the rationales provided by researchers for using both qualitative and quantitative methods in the mixed methods studies and the multi-methods studies. The qualitative analysis included coding of themes of authors’ rationales for using both quantitative and qualitative methods. Mixed analyses included merging the quantitative and qualitative data during the analysis and interpretation.

### Sampling

Fourteen research articles were selected from three major IDT journals: *Educational Technology Research and Development* (ETRD), *Journal of Research on Technology in Education* (JRTE), and *TechTrends: Link Research & Practice to Improve Learning* (TT). These three journals are first-tier IDT journals suggested by instructors in

Virginia Tech. This study included articles that were published in these three journals from January 2004 to November 2009. Year 2009 was truncated to exclude December since the search was conducted in November of 2009. The researcher used the EBSCOhost Education Databases to locate the journals.

The researcher searched titles and abstracts for the following logic operators and terms: mixed methods, multi-method, [quantitative AND qualitative], or [survey OR questionnaire OR experimental) AND (focus group OR interview)]. Table 1 shows the criteria that were used to identify whether a study is a mixed-method study or a multi-method study. A study was identified as a mixed method study only when it collected, analyzed, and mixed both quantitative and qualitative data in a single study based on Creswell and Plano Clark's (2007) "methods definition" (p. 12) of mixed methods research.

Table 1

*Criteria for Identifying a Mixed Methods Study*

Collection	Analysis	Mixing	Single Study	Study Type
Yes	Yes	Yes	Yes	Mixed methods Study
Yes	Yes	No	Yes	Multi-methods Study
Yes	No	Yes	Yes	Multi-methods Study
No	Yes	Yes	Yes	Exclude
Yes	Yes	Yes	No	Exclude

A summary sheet was developed and used to collect both quantitative data and qualitative data by the researcher. The summary sheet included three sections. The first section dealt with the article's basic information such as title, year of publication, and journal name. Section II included four close-ended quantitative research questions. The first research question was used to identify the research type of a study: a mixed methods or multi-method study. When identified as a mixed methods studies, the three following questions were used to identify the studies' data collection procedure/timing, design type, and priority. Section III focused on the qualitative research question about the rationales that were provided by researchers for using both qualitative and quantitative methods.

## Results

This research search located a total of 20 articles with the following hits in each journal: ETRD (4), JRTE (8), and TT (8). From this pool, 6 articles were excluded as they did not meet the inclusion criteria for several reasons. These articles were excluded because they were conceptual articles in which qualitative and quantitative data collection were only discussed without the conduction of data collection. The final sample consisted of 14 empirical studies with the following distributions in each journal: ETRD (4), JRTE (7), and TT (3) (see Appendix A). In 2004, none of the three journals published studies that collected both quantitative and qualitative data. JRET has most evenly distributed publication of the studies that collected both quantitative and qualitative data while JRET's publication of the studies was clustered in 2008.

### Quantitative Research Question 1: Mixed methods or Multi-method Studies

Among the selected 14 articles, 9 articles (64.4%) were mixed methods studies, and 5 articles (35.7%) were multi-method studies. In addition, 50% of the selected articles (n=7) either had "mixed methods" in their titles or

indicated using mixed methods directly in the article. About 86% (n=6) of the studies that had stated the intention to conduct a mixed methods study were actually mixed methods studies. In other words, about 67% of the mixed methods studies in IDT literature had clear indication of conducting a mixed methods study. The study found that the majority of articles from ETRD and JRTE were mixed methods studies in which 75% of the ETRD articles (n=3), 71% of the JRTE articles (n=5), and 33% of TT articles (n=1) were mixed methods studies. The two multi-method studies from TT reported the results from one research method, though both quantitative and qualitative data were collected.

#### Quantitative Research Question 2: Characteristics of the Mixed methods Studies

This study investigated the time, type, and priority of the nine mixed methods studies. As shown in table 2, among the nine mixed methods studies, six of them collected qualitative and quantitative data concurrently, and three of them collected data in a sequential manor. In other words, more researchers in IDT field preferred concurrent mixed methods design.

Table 2

##### *Data Collection Procedure*

		Time			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	concurrent	6	66.7	66.7	66.7
	sequential	3	33.3	33.3	100.0
	Total	9	100.0	100.0	

As indicated in Table 3, 55.6 % of studies (n=5) used embedded mixed methods design; 33.3% of studies (n=3) used triangulation design; and 11.1% of studies (n=1) used explanatory design. None of the mixed methods study used exploratory design. In addition, most studies that used the embedded design conducted experimental studies and used qualitative data for supplementary purposes.

Table 3

##### *Mixed Methods Design Type*

		Type			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	triangulation	3	33.3	33.3	33.3
	embedded	5	55.6	55.6	88.9
	explanatory	1	11.1	11.1	100.0
	Total	9	100.0	100.0	

As shown in table 4, no study put the priority on qualitative data. About 66.7% of studies (n=6) put more weight on quantitative data while 33.3% of studies (n=3) put equal weight on both quantitative and qualitative data. In addition, no single mixed methods study emphasized qualitative data over quantitative data in the IDT literature.

Table 4

*Priority on Qualitative or Quantitative Methods*

		Priority			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	quantitative	6	66.7	66.7	66.7
	equal	3	33.3	33.3	100.0
	Total	9	100.0	100.0	

## Qualitative Research Question: Reasons for Using Both Methods

The analysis of the content found that multi-method studies tended to provide only general rationales or even no rationales for collecting both qualitative and quantitative data (n=3). Among the five multi-method studies, three of them did not provide reasons for collecting both qualitative and quantitative data. The other two studies only provided reasons such as “though understanding” or have a “more complete picture” of the study. Other than that, the qualitative data were also used to compensate quantitative data when quantitative data found not significance (Mouza, 2008).

On the other hand, mixed-method studies tended to provide more specific reasons for employing both quantitative and qualitative data-collecting methods. As to the embedded design the rationales provided by researchers suggested the supplemental role of the qualitative data collection to “corroborate”, “better explain”, “help”, “compensate”, and “supplement” the quantitative findings or methods. Studies that used triangulation, in general, emphasized the characteristic of the study design or the requirement of research questions as the reasons of employing both quantitative and qualitative methods. In addition, their description of the rationales were more likely to place the equal weight on both quantitative and qualitative data by using word such as “cross-validate”, or bidirectional statement such as “Quantitative data were gathered to answer quantitative research questions; qualitative data helped supplement and explain the quantitative findings” (Williams, Ma, Prejean, & Ford, 2007, p. 206). The first column of table 5 lists the themes of authors’ rationales for collecting both quantitative and qualitative data.

Table 5 presents the number of each themes used by mixed methods or multi-method studies. If an article’s rationales fit into two themes, then it would be counted into the final number of each theme. For example, if an article statement the reason for collecting both quantities and qualitative data was to use qualitative data to validate quantitative data and to provide better understanding of the results, in this case, number “1” will be added to both themes. From this table, we can see, using one data set to “corroborate” or “validate” another data set was the most popular rationales (n=4) provided by mixed methods studies in IDT literature while “improve depth” and “minimized errors” were the least used rationales (n=1).

Table 5

*Reasons for Collecting both Quantitative and Qualitative Data*

Themes	Type of Study	Mixed methods Studies (n=9, 64.3%)	Multi-method Studies (n=5, 35.7%)
Corroborate/validate		n=4	n=1
Supplement		n=2	
Compensate		n=3	
Provide better understanding of results		n=2	n=1
Improve the breadth		n=3	n=1
Improve depth		n=1	
Minimize errors		n=1	
Decide by the natural of the study		n=3	
No reason			n=3

## Discussion

This content analysis study was conducted with a purpose to investigate how mixed methods design was used by researchers in the IDT field. The results indicated that both mixed methods and multi-method studies were still rare in IDT research. The lack of mixed methods and multi-method studies may attribute to the eight barriers suggested by Bryman (2007), such as researchers' faith in one method, publication issues, and so on.

Results from the quantitative data indicated that 64.4% of studies (n=9) were mixed methods studies in IDT literature. About 67% of the mixed methods studies specified themselves as mixed methods studies in their titles or in the content. It implies that most IDT researchers, who collected both quantitative and qualitative data for their studies, considered the mixing of different data sets necessary for conducting a mixed method study and knew how to mix data.

The quantitative data indicated that among the four mixed methods designs suggested by Creswell (Creswell, 2003; Creswell, et al., 2003; Creswell & Plano-Clark, 2007), the concurrent embedded (55.6 %) and triangulation design (33.3%) were the most popular design in IDT research while the exploratory design was the least popular one. The preference of concurrent design may due to the research design, time management, or researchers' data collection preference. Within the limitation of this content analysis, the reason why the concurrent data collection approach was more popular in IDT studies was not explored. The reason of the popularity of the embedded mixed method design in IDT literature might be the reasons that was concluded by Mathison (1988) "the experimentally inclined are enjoined to use qualitative research methods to help conceptualize their studies" (p. 13). The popular of triangulation design might due to the researchers' desire to use multiple methods, data sources, to enhance the validity of research findings (Mathison, 1988). These might be the possible reasons why researchers in IDT field preferred to use triangulation and embedded mixed methods design. However, these assumptions are not proved by scientific research. Therefore, in order to find out why these two designs were preferred by IDT researchers, a separate study is required.

Generally, mixed methods studies tended to emphasize the quantitative data in IDT literature. In studies that used embedded design, the qualitative data tended to take a secondary role to complement the quantitative data. Because the priority and design are closely related, the reference of the embedded experimental mixed methods



design may explain why most mixed methods studies put more weight on the quantitative data instead of qualitative data. In addition, since triangulation design normally put equal emphasis on both quantitative and qualitative design, it also explains why the number of studies that had equal emphasis on both qualitative and quantitative data was same to the number of the studies used triangulation design.

The qualitative data suggested that IDT researchers who conducted mixed methods studies tended to provided more specific reasons for collecting both quantitative and qualitative data than researchers who conducted multi-method studies. Some multi-method studies provided no reasons regarding to collecting both quantitative and qualitative data. It may imply that mixed methods researchers had careful study design in terms of the data collection, data analysis, and data use. Contrary to the careful design of mixed methods studies, the design of multi-method studies might be more based on the researchers' hunch. Moreover, the qualitative data indicated that the most frequently used reason for collecting both quantitative and qualitative data in IDT literature was using the qualitative data to valid and compensate quantitative data. In addition, researchers also believed that using both quantitative and qualitative data could help them to get a better understanding of the nature of their study.

### Conclusion

The purpose of this study was to investigate how mixed methods studies were conducted in the IDT field. With this purpose in mind, three most popular journals in the IDT were selected; and studies that collective both quantitative and qualitative data from 2004 to 2009 reported in these three journals were located and investigated. From 1134 articles, only 14 articles collected both quantitative and qualitative data in a single study and 9 of them were identified as mixed methods studies. The small amount of the mixed methods study indicated that albeit the advantages of mixed methods design, the mixed methods studies were still rare in the IDT field. The findings of this study indicated that the IDT researchers preferred concurrent and triangulation mixed methods design. The findings also indicated that most researchers who conducted mixed methods research (66%) had intention to conduct a mixed methods study by indicating it directly in the titles or in the articles. In addition, this study also found researchers who conducted mixed methods studies tended to provide more specific reasons for collecting both qualitative and quantitative data than researchers who conducted multi-method studies.

The findings of this study suggested confliction between the advantages of the mixed methods research and the lack of it in the IDT field. By helping IDT researchers to be aware of this confliction, this study may encourage more IDT researchers to get to know and conduct more mixed methods research. In addition, this study can also help IDT researchers to be aware of the important components of a mixed methods study, such as deciding the timing for mixing quantitative data and qualitative data and clarifying reasons for mixing. At last, this study can also be considered as a sample for conducting a mixed methods study.

In addition to the academic contributions, this study had several limitations. First of all, because this study only traced back to empirical studies from 2004, it limited the generalizability of the findings. Second, this study only investigated studies reported in three IDT journals; therefore, it may not be broad enough to represent the entire IDT field. Last, the author was the only researcher who searched the articles, selected the articles, and judged whether a study was a mixed methods study or a multi-method study. It is possible that the author missed some articles during the article search process, as well as mislabeled articles in the data analysis phase. For the future research, the researcher triangulation, in which multiple researchers are involved in the data collection, analysis, and present is expected to enhance the validity of research findings (Mathison, 1988).

In the future, a study that investigates the characteristics of mixed methods studies such as the frequency of mixed methods studies spreading over time, the data collection instruments, and the research topics can contribute to the understanding of mixed methods studies in the IDT field. In addition, the specific reasons why researchers choose to use a certain mixed methods design can also be explored in the future.

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## Appendix A

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# Examining Instructional Design Principles Applied by Experienced Designers in Practice

Cindy S. York & Peggy A. Ertmer

For many years, there has been an ongoing conversation about how to improve instructional design (ID) education (Bennett, 2010; Larson & Lockee, 2009; Shambaugh & Magliaro, 2001; Silber, 2007). This conversation has included questions regarding the efficacy of teaching ID models to novice designers, based on the fact that, in practice, models are applied neither consistently nor uniformly (Wedman & Tessmer, 1993; Dick, 1996). For example, Wedman and Tessmer determined that practitioners frequently omitted recommended ID activities from their projects. While some have argued that we should continue to teach models to novice designers due to the foundational knowledge they provide (Dick, 1996), others believe we should be teaching relevant skills, such as problem solving, instead (Jonassen, 2008).

If ID models are ineffective in helping novices learn how to practice ID, what alternative approaches are available? Three of the more common recommendations include contextualizing ID by presenting students with real-world design situations (Hartt & Rossett, 2000), teaching problem solving strategies students can use to solve real design problems (Jonassen, 2008), and using case-based instruction to engage students, vicariously, in the realities of practice (Bennett, 2010; Ertmer & Quinn, 2007; Ertmer & Russell, 1995).

The first method involves presenting instructional design students with real-world contexts in order to develop the skills necessary to function as competent designers (Dabbagh & Blijd, 2010; Hartt & Rossett, 2000). For example, Dabbagh and Blijd used a situated and problem-based environment in which they engaged students in a team-based, authentic instructional design problem for a real client. Hartt and Rossett (2000) also paired students with real organizations to act as instructional design consultants. This allowed students to experience the daily activities of an ID practitioner such as interacting with the client, understanding project management, and working on a team to solve real problems.

A second suggestion for improving ID education is to teach students how to solve ill-structured problems, as opposed to how to follow step-by-step procedures, as suggested by ID models (Jonassen, 2008). Jonassen argued that learning how to solve ill-structured problems leads to more effective designers. In addition, Jonassen argued that because design problem solving comprises a cyclical decision-making process, students should be taught how to meet constraints and client satisfaction while simultaneously solving the problem. Silber (2007) supported this notion when he argued that ID is comprised of a set of principles, or heuristics, used by designers.

A third recommendation for teaching instructional design is case-based learning (Bennett, 2010). Case-based learning (CBL) consists of students working on instructional design cases, presented through text or multimedia (Bennett, 2010), to discuss, analyze, reflect on, and make recommendations for solving the presented design problems. CBL can promote decision making by requiring students to reflect on the experience while explaining, justifying, and critiquing decisions made during the process (Bennett, 2010). Like situated learning, CBL utilizes authentic design problems, but in a safer environment where students can make mistakes without dire consequences. Similarly, Jonassen and Hernandez-Serrano (2002) proposed using practitioners' stories to help situate design problems, thereby enabling students to better understand the ill-structured nature of real design problems.

## Applying ID Models in Practice

The conversation on improving ID education has included debate over whether, and to what extent, practitioners use ID models in their practice (Jonassen, 2008; Silber, 2007; Wedman & Tessmer, 1993). Wedman and Tessmer surveyed 73 practicing instructional designers to determine which parts of the ID models they used in their work. Results showed that designers selectively chose which ID activities to complete or omit and that only 1 of the 73 participants reported completing every activity for every design project on which they worked.

The use of ID models has been recommended and supported by a number of textbooks in the field (Dick, Carey, & Carey, 2008; Smith & Ragan, 2005; etc), as well as by personnel in the military (Branson, 1977; Finch, 1987), and industry (Branson, 1977). However, Jonassen (2008) stated that adhering to a process model seldom leads to successful outcomes. Silber (2007) agreed when he stated, "teaching the ADDIE model step-by-step... does NOT provide learners with either complete mental models of ID principles or sets of heuristics ... that can be selected and modified based on the uniqueness of the ill-structured problem presented in each situation" (p. 11). In

1996, Dick countered that his text was written for beginners and was never intended to describe “what practitioners actually do” (p. 58). Still, for novice learners, the model offers a workable strategy for how to approach design problems encountered in practice (Dick, 1996). According to Dreyfus and Dreyfus (1986), novices must first follow learned rules until they have accumulated enough experience, at which point they can set aside those rules and proceed using their past experiences to guide them.

Yet, experts in the field have described a number of problems related to relying on ID models to solve authentic design problems. For example, Gordon and Zemke (2000) stated that although “every training designer is schooled in some version of it,” (p. 43), the ADDIE model should be abandoned for a number of reasons: (a) it is “too slow and clumsy to meet today’s training challenges” (p. 44), (b) when “used as directed, it produces bad solutions” (p. 44), and (c) it is better at describing what excellent designers “do, but [is] not very useful for *doing* those things” (p. 48).

Silber (2007) suggested that instructional designers do not actually follow procedural ID models. Rather, they engage in problem solving throughout the ID process, using principles derived from a multitude of sources: standard basic textbooks, different ID philosophies, research, and commonly accepted design practices. In place of a procedural model, Silber proposed “The Silber ID Principle-based Model” to represent a *mental model* used by an expert instructional designer (p. 11). Silber’s model is based on principles derived from the four aforementioned sources and is intended to be considered and used, as needed, as designers “define and solve ID problems” (p. 10). However, Jonassen (2008) argued, “teaching students a set of principles and heuristics, specifically if done in the absence of context, will not help students learn to make decisions” (p. 26).

To what extent do the mental models of ID experts include the principles proposed by Silber? How, exactly, do experts apply their ID knowledge, including their knowledge of ID models, when solving complex problems of practice? In order to answer these questions, we turned to the literature describing the practice of expert instructional designers.

### Examining Expert Practice

In the field of instructional design, advancement has been made in defining expertise (Ertmer & Stepich, 2005; Eseryel, 2006; LeMaistre, 1998), including delineating the differences between novices and experts when solving ill-structured design problems (Ertmer et al., 2009; Ertmer et al., 2008; Eseryel, 2006; LeMaistre, 1998; Nelson, 1988; Perez & Emery, 1995; Rowland, 1992). For example, Rowland (1992) found that experts interpret, analyze, and represent problems differently than novices. Experts generated a list of potential solutions (versus establishing firm solutions), which were different than those proposed by novices. In addition, experts retrieved and utilized different resources and considered different and additional factors than novices when solving the design problem. Rowland proposed that some of these differences could be related to the *mental models* used by the experts.

In a study by Perez and Emery (1995), five experts and four novice designers were provided with a troubleshooting problem and asked to think aloud in order to examine their design problem-solving processes. In their results, Perez and Emery reported that experts and novices used different types of knowledge; that is, whereas novices used theoretical knowledge (such as ID models), experts also used strategic knowledge, which was based on experience. In a follow-up article on the same study, Perez, Johnson, and Emery (1995) described how their expert instructional designers used ID principles during the design process. For example, one of their participants “suggested that his practice was to treat theoretical principles as heuristics” (p. 340). This is similar to what Romiszowski reported in 1981: experienced designers used principles, based on the ID models learned in school, to solve ill-structured problems.

More recently, Ertmer et al. (2008) described how the seven experts in their study used organized collections of domain-specific knowledge, acquired through years of experience, to solve an ill-structured design problem. One of the main findings from this study was that the experts narrowed the problem space and interpreted the problem situation using specific, and unique, frames of reference, built from their knowledge and experiences.

### Frames of Reference

Although personal frames of reference have been described in the literature, the specifics related to these frames of reference are unknown; although we have a general idea of where they come from (knowledge and experience), we do not know the principles or models that comprise them.

In an attempt to answer these questions, Visscher-Voerman (1999) conducted a study with 24 experienced designers to determine the design strategies used by professional, high-reputation designers in various training and

education contexts. According to Visscher-Voerman, one of the factors that influenced the design process and solution was the designer's *frame of reference*, which was comprised of their experiences, perspectives, and ideas from previous projects on which they had worked. Other researchers, in describing how experts work, have used similar terms; for example, Dreyfus and Dreyfus (1986) referred to this as *perspective*; Bransford, Brown, and Cocking (2003) described how experts organized their thinking around the *core concepts* or *big ideas* in the field; while Walker (1971) referred to experts' frames of reference as a *platform of ideas* (p. 52), which he described as including ideas about what is, as well as what ought to be. According to Walker, this platform, then, guides the curriculum developer [designer] in determining "what he should do to realize his vision" (p. 52). Wilson (1997) noted similarities between personal theories and mental schemas, stating that they both "provide a framework for acting intelligently" (p. 22). Based on the work of Kelly, Wilson defined frames of reference as "personal theories that guide our perceptions and actions in what would otherwise be an impossibly confusing world" (cited in Wilson, p. 22).

In the Ertmer et al. (2008) study, the frames of references used by the seven experts to solve the given ID problem were somewhat unique from each other and seemed to be related to their current roles in the field. In addition, during problem analysis, all of the experts incorporated a mental model of the instructional design process within their frames of reference. This was verified in a subsequent study (Ertmer, York, & Gedik, 2009), in which we analyzed the stories of 16 "seasoned" professionals who described complex or challenging ID projects on which they had worked. We determined that the vast majority of our participants applied an adapted or modified ID model when analyzing the problem. We concluded that experts use instructional design models, although not necessarily in the manner described in ID textbooks.

An additional finding from this research was the existence of rules of thumb, or a set of guiding principles, used by the participants. These rules of thumb were found to be relevant to the individuals telling the stories, but also included universal elements across participants. However, given the limited scope of this research (i.e., relatively few participants, primarily representing academia), we felt that these 'shared' principles needed verification from a larger participant population, working in a wider variety of contexts.

Therefore, the overarching purpose of this research was: (1) to examine and describe the principles that guided instructional designers' practice and (2) to identify the extent to which participants' frames of reference included components of the instructional design model.

## Method

The current study was designed to examine the ID principles used by experienced instructional designers during the design process. The Delphi technique (Linstone & Turoff, 1975) was used to present the guiding principles identified in the 2009 study (York, Ertmer, & Gedik, 2009) to a panel of experienced instructional designers (n=31). Successive Delphi rounds were conducted until panel consensus was reached.

### Delphi Process

The Delphi process in this study comprised 10 steps: (1) selection of participants, (2) creation and review of the first Delphi survey, (3) execution of the first Delphi survey to present principles from the 2009 study and provide an open-ended forum for new possible principles, (4) data analysis of Round I responses, (5) creation and review of the second Delphi survey, (6) execution of the second Delphi survey, (7) data analysis of Round II responses, (8) creation and review of the third Delphi survey, (9) execution of the third and final Delphi survey to determine stability or consensus of principles, and (10) final analysis and dissemination of Delphi results to participants.

### Selection of Participants

An initial email was sent to 54 instructional designers requesting their participation in a study about principles used by experienced instructional designers during the design problem-solving process. This initial list was generated by the researchers and included the names of designers known to be experienced in the field. However, only 14 responded. Therefore, a request was posted on LinkedIn.com asking for experienced instructional designers to participate by completing a demographic survey. An additional 80 people responded to the survey for a total of 94 responses to the demographic survey. The demographic survey requested the following information: name, email, gender, age range, current position and title, formal education, summary of instructional design background, and instructional delivery formats they currently use in instructional design. From the demographic

survey, a purposeful sample (Patton, 1990) of the 50 most experienced instructional designers was selected according to criteria published in the instructional design and expertise literature (Eseryel, 2006; LeMaistre, 1998; Perez et al., 1995; Rowland, 1992). This criteria included the following, in order of importance: (1) minimum of 10 years of hands-on experience, (2) currently practicing ID, (3) number and level of educational degrees, (4) nominated or recognized by peers, (5) diverse experiences, (6) on-going training/education/certification, and (7) manager/trainer (for apprentice instructional designers).

The 50 selected participants were emailed an invitation to participate on the Delphi panel. Of those emailed, 35 responded as willing to participate. For the Round I survey, 35 participated, however, from Round I to Round II, 4 dropped out of the study. This left a panel of 31 participants who completed all three surveys.

The final panel membership consisted of 18 females (58%) and 13 males (42%). Ages were listed by range: 5 were in the 31-40 range (16%), 14 were in the 41-50 range (45%), 10 were in the 51-60 range (32%), and 2 were in the 61+ range (7%). The panel had an average of 19.7 years of experience with instructional design, ranging from 10 to 43 years.

### Delphi Process and Timeline

The three Delphi rounds were conducted over a 2-month period in summer 2009. Surveys were provided online, hosted on a secure server. An email was sent to participants describing the Delphi procedure as well as how to access the surveys. Follow-up emails were sent to participants if they did not respond to a survey during the 2-week open period. Successive rounds of surveys were initiated by an email to the participants informing them the survey was open and requesting their responses within 2 weeks. Once consensus was reached, an email was sent to inform participants that the Delphi rounds had ended, to thank them for their participation, and to request their possible participation during the verification of the results.

Each Delphi survey was reviewed by a five-member team before being presented to the Delphi participants. The review team consisted of an experienced instructional designer (Ph.D.) currently practicing at a higher education institution, two professors of educational technology, and two Ph.D. students who had completed all required coursework in instructional design. This helped ensure clarity of the questions and also provided an estimate of the time needed to complete the survey. Feedback was used to revise the survey questions as well as test the online survey tool.

The first round survey included the principles determined during the 2009 study (York et al., 2009), in a randomly ordered list. The survey contained specific instructions as to how to access the survey, rate principles, and provide open-ended comments. The survey contained three parts: (a) a list of 59 principles to be rated on a 6-point Likert-scale (from 1 = strongly disagree to 6 = strongly agree), (b) a space for comments after each principle, and (c) a space for additional possible principles to be added by participants. Participants were asked to include comments to justify their ratings, to question or clarify the given principle, or to elaborate on the principle.

Responses from Round I were analyzed and used to create the Round II survey. Panel ratings were analyzed using mean, median, mode, standard deviation, plus interquartile range (IQR). Frequency distributions and graphical representations were created for each principle. Principles that reached panel consensus in Round I were not included in Round II (Anderson-Woo, 2008). A principle reached consensus in Round I if either of the two following conditions were met:

1. IQR less than/equal to 1 AND 75% agreement on a rating of 5 and 6 (agree, strongly agree) OR 1 and 2 (disagree, strongly disagree).
2. A 97% frequency rating in the 4, 5, 6 (mildly agree, agree, strongly agree) categories OR in the 1, 2, 3 (mildly disagree, disagree, strongly disagree) categories (97% indicated all but 1 participant).

The first condition allowed 29 principles to be removed and the second condition resulted in the removal of 1 principle prior to the Round II survey. This means that the panel agreed that 30 of the original 59 represented instructional design principles.

Any new principles suggested by participants were qualitatively analyzed in order to determine if that principle was new, or should be integrated into a previously existing principle (perhaps the participant used different wording but the meaning was the same). Before adding any new principles to the Round II survey, the research team reviewed the suggested principles, reworded some, and broke some into more than one. This resulted in 15 new possible principles for the Round II survey. Based on participants' suggestions, six principles were reworded for Round II.

Statistical measures (e.g., mean, median, mode, frequency, standard deviation) were included in Round II for each of the remaining 29 original principles. Panel comments from Round I were also included so participants could read other panel members' justifications for their ratings. Participants also were presented with their original



responses to Round I and asked to either retain their original ratings or modify them based on the new information. Thus, in this round, participants rated 44 principles and provided comments to support their ratings.

The results of the Round II survey were statistically analyzed within a week of the final submission to determine consensus. Those that reached consensus in Round II were not included in Round III. In Round II, the criteria for determining level of consensus were not as restrictive as Round I. That is, we decided to retain the first criterion but to lower the second criterion from 97% to 80% as this seemed more reasonable than the high level set for Round I. No literature was found regarding changing the level of consensus from one round to the next, only that level of consensus for any Delphi study is determined by the researcher (Hasson, Keeney, & McKenna, 2000; Powell, 2003).

In addition, if a principle received a 20% or less stable rating from Round I to Round II, it was an indication that participants were not likely to change their ratings enough to come to consensus. To calculate stability, the frequency of Round I and Round II responses was determined. Following this, the net person-changes (total units of change/2) for a particular question was divided by number of participants (Scheibe, Skutsch, & Schofer, 1975, p. 279). Using a criterion of 20% or less stability from Round I to Round II, seven principles were eliminated before the Round III survey.

In addition, two principles were determined not to be instructional design principles and were deleted before Round III. This was based on the fact that 80% or more of the participants disagreed with the principle (i.e., rated their level of agreement with the principles as 1, 2, or 3). This left 10 principles from Round II to be included in Round III.

The Round III survey was created, reviewed, and disseminated to the panel within 1 week of receiving Round II submissions. Participants were again asked to submit their responses within 2 weeks. This final survey allowed the participants to review the feedback their fellow participants provided during Round II. As in Round II, participants were provided statistical measures such as mean, median, mode, frequency, and standard deviation for each of the 10 principles included in the survey. Similarly, participants were presented with their original responses and all panel comments from the previous survey and asked to retain or revise their original opinions based on the new information.

The responses from the Round III survey were analyzed. Consensus and stability criteria remained the same as Round II. Analysis resulted in five additional instructional design principles, one statement determined not to be a principle, two statements that reached stability, and two statements that did not reach either stability or consensus.

## Results and Discussion

This study was designed to identify the principles instructional designers use to organize their knowledge of the field, in general, and more specifically of the ID process. How do the principles designers use relate to the steps in the ID model and/or other “big ideas” (Bransford et al., 2003) in the field?

Three rounds of the Delphi resulted in panel consensus on 61/75 instructional design principles (see Appendix). Of these 61, 32 were identified as readily fitting into a general ID model (e.g., ADDIE). Thus, we organize the first section of our results and discussion to highlight how the identified principles address the five ADDIE components: Analysis, Design, Development, Implementation, and Evaluation. The second section discusses additional principles that, although they did not readily relate to the general ID model, related to other key concepts in the field, such as communication and project management.

### Analysis

What principles do designers use when completing the analysis phase of the design process? Based on the responses of the Delphi participants, 10 principles were identified that relate to analysis tasks (see Table 1). These analysis principles centered around four main ideas: (1) determining if instruction is the solution to the problem, (2) examining the project constraints, (3) understanding the learner/audience and their prerequisite knowledge, and (4) determining the objectives or goals of the project. It also includes understanding the scope of the project and creating a statement of work with the client in order to reduce the possibility for miscommunication.

Results reported by Rowland and DiVasto (2001) support our finding that analysis is one of the “big ideas” that designers use when engaging in design work. The 14 experts in the Rowland and DiVasto study all agreed that the instructional design “process includes thorough analysis, for example, of learners, task, and setting” (p. 14). In addition, three of their experts claimed that, in general, not enough analysis takes place. Their statement supports the principle, “Invest as much time as you can in your audience analysis.”

The principle, “Ask yourself, ‘Is instruction the solution to this problem?’” is also supported by Rowland and DiVasto (2001), whose instructional designers’ analyses “determined when instruction was the right answer” (p. 15). Designers generally ask this question during the needs analysis phase. The ID literature also supports this principle (Romiszowski, 1981). Determining if instruction is necessary tends to be one of the first things a designer must do after communicating with the client in the first project meeting.

Table 1  
*Analysis Principles*

Component	Principle
ANALYSIS	<ul style="list-style-type: none"> <li>• Ask yourself, “Is instruction the solution to this problem?”</li> </ul>
• Problem	• Invest as much time as you can in your audience analysis.
• Need	• Know your learners/target audience.
• Goals	• Know your learners' prerequisite knowledge.
• Learners	• Needs analysis is the foundation for evaluation.
• Context	• Negotiate the scope of the project with the client and create a statement of work upfront.
• Constraints	• Determine what it is you want your learners to perform after the instructional experience. What is the criterion for successful performance?
• Content	• There are things that need to be determined at the front end in order to make you successful at the back end.
• Task	• Constraints are a key to design. Look for constraints that have been placed on a project.
• Timeline	• Never look at the problem at face value. You have to get to the core of the problem and solve all of the subproblems.

## Design

What principles do designers use during the design phase of the ID process? Related to design, 17 principles were identified by the panel of participants (see Table 2). This component included the largest number of principles identified by the panel. The design principles centered on the following three main ideas: (1) solving the problem, (2) identifying potential learner activities, and (3) considering the technology.

Similar to the results of this study, experts in the Rowland and DiVasto study (2001) agreed that design was one of the most important features of an instructional design project. Project goals, outcomes, and/or deliverables are widely discussed in the instructional design literature (Rowland, 1993).

The principle, “Generate multiple possible solutions that will solve the problem,” is supported by Liu, Gibby, Quiros, and Delps (2002) who suggested that instructional designers must use their best judgment in creating a solution for the client. Their discussion does not specifically mention developing *multiple solutions*, however because ill-structured problems typically have multiple solutions, the designer needs to decide which is the best to recommend to the client (Jonassen, 1997).

The principle, “When designing instruction, consider active learning,” is supported by Mayer (2003), who recommended different methods to promote active learning, even when using non-interactive media. Participants also agreed that scaffolding was needed, but disagreed as to the timing and quantity of the scaffolding. The instructional design literature supports the concept of using scaffolding, but the use of it depends on the context (Van Merriënboer, Kirschner, & Kester, 2003).

Table 2  
*Design Principles*

Component	Principle
DESIGN / SELECT	<ul style="list-style-type: none"> <li>• When faced with something complex, look for previous examples that have characteristics you can draw upon, that can give you ideas on how to solve the problem.</li> </ul>
• Objectives	• Approach the design problem with the end in mind. What are the deliverables? What are the learning/performance outcomes?
• Instructional Strategies	• Generate multiple possible solutions that will solve the problem.
• Visual design / storyboards	• When designing instruction, consider the context in which the learning will
• Assessments	

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<ul style="list-style-type: none"> <li>Media / Methods</li> </ul>	<p>be applied. Ask yourself, "How can I put learning into context?"</p> <ul style="list-style-type: none"> <li>When designing instruction, consider active learning. Ask yourself, "How can I make learners more actively engaged?"</li> <li>Determine what will keep the learner motivated during the instructional experience.</li> <li>Consider utilizing scaffolding in your instructional experience. Give the learner the tools they need to succeed.</li> <li>Be sure the instruction gives learners the opportunity to make choices.</li> <li>Ensure that design speaks to a value chain of learning, i.e., that learning contributes to behaviors and that behaviors contribute to organizational or business results.</li> <li>Understand the learning associated with the technology.</li> <li>Don't let technology drive the design.</li> <li>Resist the technical expert's propensity to focus on the most complex or innovative aspects of a product. Remember the novice learner who needs to build basic skills.</li> <li>It is the instructional designer's job to press for quality in the design.</li> <li>Resist the SME's (subject matter expert's) desire to teach the solution to the hot problem of the day... unless it is a common problem seen by the average learner.</li> <li>Prepare to do a lot of work that is never going to show up in the final product.</li> <li>When designing instruction, think about Elaboration Theory. Ask yourself, "What's the 'big picture' to which the components are attached?"</li> <li>Design continues through the delivery or implementation phase.</li> </ul>
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## Development

What principles do designers use when completing the development phase of the ID process? In the development component, three principles were identified (see Table 3). The three principles related to being part of the production process, dealing with the technology involved, and allowing the content, not the technology, to guide how users interact with the training. Similarly, Liu et al. (2002) described how designers needed to understand the project's needs and determine which technologies could produce the best product for the learner.

Table 3  
*Development Components and Principles*

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Component	Principle
DEVELOPMENT <ul style="list-style-type: none"> <li>Production of content and learning materials</li> </ul>	<ul style="list-style-type: none"> <li>Allow the content to guide how users interact with the training (linear, user-driven, etc.) – not the tools used to develop the training.</li> <li>Technology can get in your way, and if you don't deal with it you can get yourself into trouble.</li> <li>Make every effort to be part of the production process.</li> </ul>

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## Implementation

The panel of participants in this study did not identify any principles that related directly to the implementation phase. This could be due to the fact that many designers tend to "pass" the instructional solution over to the client, who then implements it. Thus, the designers surveyed in this study may not have played a role in the implementation process and so the principles they used in practice did not fit into the implementation category. Furthermore, the Dick and Carey model does not contain a "box" for implementation (Dick, 1996), as implementation is not considered one of the main activities of an instructional designer (Wedman & Tessmer, 1993).

An alternative explanation for the lack of implementation principles being identified in this study could be that the original 59 principles were derived from the stories of only 16 participants. Perhaps the second set of participants, in reading through the list, failed to consider additional principles, specifically related to implementation, that went beyond those on the initial list.

## Evaluation

What principles do designers use when evaluating the design solution? In this study, two principles were identified by the participants (see Table 4) that related to evaluation. These included conducting a pilot test and having both a SME and non-SME review the final project. Interestingly, Wedman and Tessmer (1993) found, based on the survey results of 73 designers, that pilot testing was the most-often omitted step of the instructional design process. There were several reasons for this omission such as time, money, and lack of support from the client. Keppell (2001) supported the principle that reviews with subject matter experts were a necessary component of the instructional design process. The content being designed could be quite unfamiliar to the designer, whereas the subject matter expert is highly knowledgeable about the subject. Keppell described an iterative process of explanation and clarification between the designer and the subject matter expert throughout the design process.

Table 4  
*Evaluation Components and Principles*

Component	Principle
EVALUATION	<ul style="list-style-type: none"><li>• Always conduct a pilot.</li></ul>
<ul style="list-style-type: none"><li>• Formative</li><li>• Summative</li></ul>	<ul style="list-style-type: none"><li>• When possible, have a subject matter expert AND a non-subject matter expert review the final product.</li></ul>

In addition to the principles that related to the main components of an ID model, there were 29 additional principles identified by the Delphi panel. These principles clustered around three other components of design: (1) communication, (2) working with a client, and (3) project management, as well as those that related to specific characteristics of the designer and the design process (e.g., recognize your limitations, recognizing the uniqueness of each situation).

## Communication

Communication is an important component in the instructional design process. The designer must have interpersonal skills such as being able to communicate with a number of people including the client, design team members, and other stakeholders, all of whom may use different terminology. McDonald (2008) explained, “Given the importance of communication in the work of instructional design, it is worthwhile to use the metaphor of instructional designers and their clients speaking different languages...” (p. 19). This component centered on two communication principles, “You need to understand and speak the language of your client,” and “Don’t use technical instructional design terminology with the client unless you have to.” Liu et al. (2002) suggested that instructional designers should either use the jargon of the client or everyday terminology when communicating. Miscommunication can be avoided by verifying information, asking questions, and by using visuals and other documents when communicating.

Table 5  
*Communication*

<ul style="list-style-type: none"><li>• As a designer you need to listen more than you talk.</li><li>• When verifying information, you often will learn more information.</li><li>• Verify all the information you receive from the client to prevent miscommunication.</li><li>• You need to understand and speak the language of your client.</li><li>• Don’t use technical instructional design terminology with the client unless you have to.</li><li>• Ask all possible relevant questions throughout the entire design process.</li><li>• You are rarely going to collect all the desired outcomes with just one interview with the client.</li><li>• When communicating with the client, use visuals and documents in order to prevent miscommunication.</li></ul>
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## Client

The relationship between the instructional designer and the client is an important one. Working with a client is one of the major responsibilities of an instructional designer (Liu et al., 2002; Rowland, 1993). There are a number of different principles noted by our participants related to the designer-client relationship. The client could be the subject matter expert (SME), owner, manager, or other stakeholder. It is the designer’s job to understand the

client, their culture, language, expectations, documentation, and communication. In addition, the designer needs to recognize the root of the problem, take prodigious notes, mock up a prototype, and make sure all stakeholders are updated throughout the process.

This seems to imply that the designer needs to help the client understand how their stated expectations might translate into a design product (Liu et al., 2002). Liu et al. (2002) stated, “Some clients need assistance in producing a clear definition of the problem they are trying to solve” (p. 205). The designer needs to explain the process of moving from a design to an actual product. As Liu et al. (2002) stated, “Clients may not be aware of the steps and tasks that a designer takes to get to the end product. Some clients expect the designer to start from scratch and create a polished product within a short time” (p. 205).

Table 6

*Client*

- 
- Be honest with the client.
  - You have to be sensitive to the context and the culture of the client.
  - You need to build trust with the client. This can be done through explaining what you are doing, why you are doing it, and how it is of value to them.
  - Figure out who all the stakeholders are in the room. And figure out who is not in the room that is still a stakeholder.
  - You need to manage the client’s expectations.
  - You have to determine if the client really knows what they want.
  - Subject matter expert’s documentation often fails to provide the necessary critical thinking. The SME forgets to tell you basic steps and concepts he forgot he once learned.
  - When multiple stakeholders are involved, ask your client to identify your "single point of contact" - make sure that person understands what is expected - gathering feedback on your design for you, getting approvals, etc.
  - Bring together the client and other stakeholders for synchronous meetings at each "gate" in a phased process.
  - The instructional designer should take prodigious notes during meetings. Do not rely purely on documentation or the SME.
  - Sometimes the client will not tell you all there is to know about a problem.
  - You may have to mock up something to show the client to make sure that you get all of the desired outcomes right.
  - The client thinks it is much easier to move from the conceptualization to the implementation than it actually is.
- 

Project Management

Project management is a component of design that may or may not be the responsibility of the instructional designer. According to Liu et al. (2002), the instructional designer “must have design and project management skills” (p.197). As David Merrill stated, “you’re not going to go out and be designers even though we’re training you to be designers; you are going to go out and be managers” (personal communication, 2007). The one project management principle noted by practitioners was to involve the right people at the right time because design is a people process (as noted in Design Characteristics).

Table 7

*Project Management*

- 
- The team is critical. Involve the right people at the right time.
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Design Characteristics

Finally, there are some general characteristics of design that designers embrace when working on a project. Some of these characteristics focus on the designer. For example, the designer needs to think abstractly yet acknowledge their own limitations. Nelson (1988) discussed that “the success of initial understanding and problem specification is directly related to the designer’s experience and knowledge in the problem domain” (p. 18). His statement indicates that if a designer accepts a job outside his/her area of expertise, he/she could have difficulties understanding and defining the design problem.

The designer also needs to take into account foundational domain knowledge such as learning theories and different design models. Perez et al. (1995) noted that the novice instructional designers in their study were not able

to transfer “theoretical knowledge into practice” (p. 339), despite having completed foundational instructional design courses. Thus, experience appears to play a part in how designers utilize that foundational knowledge during the design process (Liu et al., 2002; Perez et al. 1995).

Although every design situation is unique, if designers have previous experiences they can use as a starting point, they should do so. This has been widely corroborated in the instructional design literature (Ertmer et al., 2008; Hmelo-Silver et al., 2002; Liu et al., 2002; Nelson, 1988; Perez et al., 1995). Researchers agree that experienced instructional designers pull from their past experiences during the design process. The panel participants supported this principle with only three of them mildly disagreeing.

Table 8

*Design Characteristics*

- 
- Acknowledge your limitations. Don’t accept a job that is outside of your expertise.
  - You often don’t get to do the best instructional design you want due to constraints, resources, time, budget, etc.
  - Use previous experiences, if possible, as a starting point for new projects.
  - Be prepared to think abstractly.
  - Understand that every design situation is unique.
  - You need to know the theories. You need to know the models. You need to have that foundation.
  - Design is a people process.
- 

Summary and Implications

Experts, in any field, have knowledge that is both well-organized and “conditionalized” (Bransford et al., 2003). This means that experts can readily search their personal *libraries* to find information that is relevant to the particular situation (Kolodner, Owensby, & Guzdial, 2004). Bransford et al. provided an example of physics experts, who organized their mental models around the *big ideas* in the field (momentum, energy, etc.), and when asked to analyze a problem, went beyond the surface details to consider the underlying *big idea*. Similarly, Walker (1971) described how curriculum developers [designers] used a *platform of ideas*, comprising their beliefs and values, to determine the path to take during the design process. Dreyfus and Dreyfus (1986) also found that the *perspective* of expert brought to the task influenced their plan of attack. No matter the terminology used (big ideas, platform of ideas, frames of reference, etc.), designers are described as utilizing guiding principles during the design process.

The overarching purpose of this study was to examine the principles that guided instructional designers’ practice and to identify the extent to which these principles incorporated components of the instructional design model. Based on the results of the Delphi process, we identified 61 principles that instructional designers used in their practice, of which 31 related to a general ID model (e.g., ADDIE). The other 29 principles related to three components of ID not typically described in models (communication, client, project management) as well as some general characteristics of design.

In this study, more than half of the principles identified by participants related to components of the instructional design model, suggesting its continued importance to the practice of ID. Although the participants in this study did not refer to an ID model by name, and did not add a guiding principle to the Delphi list of principles that specifically mentioned using an ID model, many of the resulting principles related to the major tasks outlined by the model. Perhaps as Romisowski (1981) suggested, designers use the model as a heuristic, adapting it, as needed, to address the specific problem with which they are faced. Additionally, it is quite likely the 31 principles that related to the model would not exist in the experienced designers’ repertoire had they not been taught an ID model at some point in their education. Without having this foundation on which to build, their new knowledge and experiences may not have been as readily “categorized.” Similar to the concept of “indexing” in the case-based reasoning literature (Kolodner et al., 2004), the practitioners in this study may have indexed their past experiences using the categories outlined by a general ID model. As noted by Stepich and Ertmer (2009), the ADDIE model may serve as a useful index for practitioners given that it is easy to remember, easy to build upon, and part of the common language of design.

In addition, 29 principles were identified that were not directly related to the instructional design model; instead they related to client interaction, communication, management, and other design characteristics. This suggests that the education of ID novices should incorporate concepts that go beyond the ID models. That is, ID education should be an amalgamation of both models and skills. Case-based learning is one method that has been used successfully to foster the necessary skills (e.g., communication, problem solving) within novice instructional designers. As Ertmer and Russell (1995) stated, using case studies in ID education provides “an effective means for

*bridging the gap between theory and practice*” because it “*integrates content knowledge with strategic thinking*” (p. 25).

Previous research (Ertmer et al., 2008; Visscher-Voerman, 1999) has demonstrated that designers utilize “frames of reference” when solving design problems. These frames of reference are derived from the designer’s knowledge, experiences, and fields in which they work (Ertmer et al.). Although our participants did not mention frames of reference, explicitly, the guiding principles identified in this study were likely part of these frameworks. That is, the participants in our study delineated principles that were *based on their prior knowledge and experiences*. For example, one participant commented that he believed that experienced instructional designers had an “internalized theory” from which they approached new design projects. In many ways, this is similar to the definition of a frame of reference as described by Wilson (1997). Another participant described how her prior experiences are always influencing her work and decisions.

If we equate principles with the *core concepts* or *big ideas* in the field, then the core concepts of design, with 17 principles, and analysis, with 10, as well as client interaction, with 13, may, perhaps, be most salient to designers’ practice. Of the 11 activities listed by Wedman and Tessmer (1993) as being common to the ID process, all but two comprise analysis and design components. The remaining two activities were evaluation activities. This supports the idea that analysis and design are two of the core concepts of ID. Client interaction was not included in Wedman and Tessmer’s survey because they only included components that were common to ID models. Of course, greater numbers of principles does not suggest greater importance. Rather, it may be possible that there are simply more elements contained in the design, analysis, and client interaction components of design. It would be necessary to verify this by surveying the participants and querying what they believe are the core concepts of ID. Again, this may differ depending on their design contexts and their current roles in the field.

The results of this study have implications for the education of instructional designers. Because design is a problem-solving process, novices should understand what practicing instructional designers do and what principles they work from, rather than just memorizing steps in a model. Still, familiarity with the models appears to offer the basis for many of these principles. According to Stepich and Ertmer (2009) expert instructional designers “use their knowledge of ID models in flexible and dynamic ways” (p. 155). Even though novice instructional designers do not yet have the amount of experience that allows them to create a robust set of personal principles, their design performance has the potential to be improved if they know, a priori, some of the principles others use when solving instructional design problems. It is possible that novices could learn, vicariously, from the stories of experienced instructional designers including lessons learned and principles used (Jonassen & Hernandez-Serrano, 2002). Just as ID models are used to help novices understand the steps involved in the analysis, design, development, implementation, and evaluation phases of the process, principles might help them understand the overarching communication and management aspects, as well as other areas. For example, if novices are taught to verify all the information they receive from a client, they could improve their communication with the client. These results imply that ID principles should be incorporated within our ID programs, if they are not already.

So, how can principles be incorporated into our ID programs, and more specifically, how can principles be used in conjunction with ID models? This could occur in a number of different ways as previously suggested: case-based learning, internships, or consulting. Vicarious learning from the stories (either narrative or video) of expert instructional designers could enhance the novice’s learning, particularly if the experts were asked to explicate the principles they applied during those problem-solving situations. A number of ID programs emphasize *reflection* at the end of lessons or internships. By including an explicit discussion of the learned instructional design principles, perhaps the learners can be *reminded* of principles they may otherwise have overlooked. Finally, ID instructors might consider integrating textbook information about the steps in the ID model with relevant principles identified in this study, as well as others found in the literature (e.g., Silber, 2007).

The results of this study suggest that in addition to teaching novice instructional designers foundational models and theories, communication and project management skills should be taught. Communication skills could come in the form of English writing courses or practical experience such as internships and/or apprenticeships with real clients. In addition, although we only identified one project management principle, we should also consider teaching project management content. A good number of the principles identified by the panel imply that there should be a project management course in instructional design curricula, if it does not already exist.

### Limitations and Suggestions for Future Research

This study was designed to generate a thoughtful analysis of principles used by experienced instructional designers. However, one limitation to this study was that the fields in which the instructional designers worked did not represent all possible areas of work for instructional designers; for example, designers working in the military

were not included because we did not have access to any. All judgments made by participants were based solely on their own knowledge, skills, and experiences and may not be representative of all instructional designers. The decision to start the first Delphi survey using the principles that emerged from the 2009 study also may have impacted the results. An open-ended question was included on the first survey to prevent the possible omission of a critical principle from the panel's perspective; however starting with an initial list still may have unduly constrained the potential principles considered by the panel participants.

This study is based on the assumption that we need to learn/teach more instructional design principles. However, it should be noted that more research needs to be conducted to determine if principles are already being taught and if not, how they might best be taught. Therefore, future research will focus on determining the best methods for sharing the resulting principles with novice designers and whether it impacts their experiences as instructional designers. Some questions we plan to pursue are: (a) Can we teach principles to novice instructional designers? (b) What methods should we use to provide this information (stories, cases, guest speakers)? and (c) How does this impact their practice? In addition, the relative importance of different principles to the instructional design process (as well as to instructional design field) needs to be examined. A more thorough examination of importance of the different principles should be undertaken. Perhaps a Delphi panel could rank order the current principles as to their importance to the instructional design process. It could also be productive to ask new instructional designers questions about their experiences such as: (a) What was the most important thing you learned, and (b) About what do you wish you learned more?

A more thorough examination of the principles found in the current study and their inclusion in, or exclusion from, various other instructional design models as well as the textual descriptions of the models is needed (besides ADDIE). From that examination, there could arise a need for the creation of a new ID model that incorporates relevant principles not found in current ID models.



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## Appendix

### *Instructional Design Principles*

Component	Principle
ANALYSIS	1. Ask yourself, "Is instruction the solution to this problem?"
• Problem	2. Know your learners/target audience.
• Need	3. Know your learners' prerequisite knowledge.
• Goals	4. There are things that need to be determined at the front end in order to make you successful at the back end.
• Learners	5. Negotiate the scope of the project with the client and create a statement of work upfront.
• Context	6. Constraints are a key to design. Look for constraints that have been placed on a project.
• Constraints	7. Needs analysis is the foundation for evaluation.
• Content	8. Invest as much time as you can in your audience analysis.
• Task	9. Never look at the problem at face value. You have to get to the core of the problem and solve all of the subproblems.
• Timeline	10. Determine what it is you want your learners to perform after the instructional experience. What is the criterion for successful performance?
DESIGN / SELECT	11. Generate multiple possible solutions that will solve the problem.
• Objectives	12. When faced with something complex, look for previous examples that have characteristics you can draw upon, that can give you ideas on how to solve the problem.
• Instructional Strategies	13. When designing instruction, consider the context in which the learning will be applied. Ask yourself, "How can I put learning into context?"
• Visual design / storyboards	14. When designing instruction, consider active learning. Ask yourself, "How can I make learners more actively engaged?"
• Assessments	15. Determine what will keep the learner motivated during the instructional experience.
• Media / Methods	16. Approach the design problem with the end in mind. What are the deliverables? What are the learning/performance outcomes?
	17. Consider utilizing scaffolding in your instructional experience. Give the learner the tools they need to succeed.
	18. Ensure that design speaks to a value chain of learning, i.e., that learning contributes to behaviors and that behaviors contribute to organizational or business results.
	19. Understand the learning associated with the technology.
	20. Don't let technology drive the design.
	21. Resist the technical expert's propensity to focus on the most complex or innovative aspects of a product. Remember the novice learner who needs to build basic skills.
	22. It is the instructional designer's job to press for quality in the design.
	23. Be sure the instruction gives learners the opportunity to make choices.
	24. Resist the SME's (subject matter expert's) desire to teach the solution to the hot problem of the day... unless it is a common problem seen by the average learner.
	25. Prepare to do a lot of work that is never going to show up in the final product.
	26. When designing instruction, think about Elaboration Theory. Ask yourself, "What's the 'big picture' to which the components are attached?"
	27. Design continues through the delivery or implementation phase.
DEVELOPMENT	28. Technology can get in your way, and if you don't deal with it you can get yourself into trouble.
• Production of content and learning materials	29. Allow the content to guide how users interact with the training (linear, user-driven, etc.) – not the tools used to develop the training.
	30. Make every effort to be part of the production process.

EVALUATION	31. Always conduct a pilot.
<ul style="list-style-type: none"> <li>• Formative</li> <li>• Summative</li> </ul>	32. When possible, have a subject matter expert AND a non-subject matter expert review the final product.

### Characteristics of Design

#### Communication

33. Be honest with the client.
34. As a designer you need to listen more than you talk.
35. When verifying information, you often will learn more information.
36. Verify all the information you receive from the client to prevent miscommunication.
37. You need to understand and speak the language of your client.
38. Don't use technical instructional design terminology with the client unless you have to.
39. Ask all possible relevant questions throughout the entire design process.
40. You are rarely going to collect all the desired outcomes with just one interview with the client.
41. When communicating with the client, use visuals and documents in order to prevent miscommunication.

#### Client

42. You have to be sensitive to the context and the culture of the client.
43. You need to build trust with the client. This can be done through explaining what you are doing, why you are doing it, and how it is of value to them.
44. Figure out who all the stakeholders are in the room. And figure out who is not in the room that is still a stakeholder.
45. You need to manage the client's expectations.
46. You have to determine if the client really knows what they want.
47. Subject matter expert's documentation often fails to provide the necessary critical thinking. The SME forgets to tell you basic steps and concepts he forgot he once learned.
48. When multiple stakeholders are involved, ask your client to identify your "single point of contact" - make sure that person understands what is expected - gathering feedback on your design for you, getting approvals, etc.
49. Bring together the client and other stakeholders for synchronous meetings at each "gate" in a phased process.
50. The instructional designer should take prodigious notes during meetings. Do not rely purely on documentation or the SME.
51. Sometimes the client will not tell you all there is to know about a problem.
52. You may have to mock up something to show the client to make sure that you get all of the desired outcomes right.
53. The client thinks it is much easier to move from the conceptualization to the implementation than it actually is.

#### Project Management

54. The team is critical. Involve the right people at the right time.

#### Other Design Characteristics

55. Acknowledge your limitations. Don't accept a job that is outside of your expertise.
56. You often don't get to do the best instructional design you want due to constraints, resources, time, budget, etc.
57. Use previous experiences, if possible, as a starting point for new projects.
58. Be prepared to think abstractly.
59. Understand that every design situation is unique.
60. You need to know the theories. You need to know the models. You need to have that foundation.
61. Design is a people process.

