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Editor: Michael Simonson

Nova Southeastern University, North Miami Beach, Florida

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Editor
Michael Simonson
Professor
Instructional Technology and Distance Education
Nova Southeastern University
Fischler Graduate School of Education and Human Services
North Miami Beach, FL

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Preface

For the thirtieth 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 instruction and training issues are contained in volume #2.

REFEREEING PROCESS: Papers selected for presentation at the AECT Convention and included in these Proceedings were subjected to a reviewing process. All references to authorship were removed from proposals before they were submitted to referees for review. Approximately sixty percent of the manuscripts submitted for consideration were selected for presentation at the convention and for publication in these Proceedings. The papers contained in this document represent some of the most current thinking in educational communications and technology.

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Motivation and Self-Regulation in Online Courses:
A Comparative Analysis of Undergraduate and Graduate Students

Anthony R. Artino, Jr. and Jason M. Stephens
University of Connecticut

Abstract

This study provides a comparative analysis of undergraduate and graduate students' academic motivation and self-regulation while learning online. Participants ($N = 82$) completed a survey that assessed several experiential, motivational, and self-regulatory factors. As hypothesized, graduate students reported higher levels of critical thinking than undergraduates. Moreover, after controlling for experiential differences, logistic regression analyses indicated that graduate student membership was predicted by higher levels of critical thinking, lower levels of procrastination, and lower intentions to enroll in future online courses. Implications for online instructors and suggestions for future research are discussed.

Background

Online learning[1] has become the format-of-choice for numerous postsecondary institutions eager to provide students with the opportunity to learn from a distance (Bernard et al., 2004; Larreamendy-Joerns & Leinhardt, 2006; Moore & Kearsley, 2005; Tallent-Runnels et al., 2006). Evidence of the explosive growth in online learning is not difficult to find. For instance, a recent survey of 2,200 U.S. colleges and universities by the Sloan Consortium (2006) found that 96% of large institutions (greater than 15,000 total enrollments) have some online offerings; 62% of Chief Academic Officers rated learning outcomes in online education as the same or superior to traditional, face-to-face instruction; 58% of schools identified online education as a critical long-term strategy; and overall online enrollment increased from 2.4 million in 2004 to 3.2 million in 2005.

As online learning has grown, so too has interest in students' academic motivation and self-regulation (Greene & Azevedo, 2007). Self-regulated learners are generally characterized as active participants who efficiently control their own learning experiences in many different ways, including organizing and rehearsing information to be learned; monitoring their thinking processes and seeking help when they do not understand; and holding positive motivational beliefs about their capabilities and the value of learning (Boekaerts, Pintrich, & Zeidner, 2000; Schunk & Zimmerman, 1998). Self-regulated learning (SRL)—sometimes referred to as academic self-regulation—has also been described as an active, constructive process whereby students set goals for their learning based on past experiences and the contextual features of the current environment (Pintrich, 2000). These learning goals then become the standards against which academic progress is compared (Greene & Azevedo, 2007). It is important to note, however, that academic self-regulation is not an all-or-nothing phenomenon. Instead, students are self-regulating to the extent that they are cognitively, motivationally, and behaviorally involved in their own learning activities (Zimmerman, 2000).

Recently, several scholars (e.g., Azevedo, 2005; Dabbagh & Bannan-Ritland, 2005; Dabbagh & Kitsantas, 2004) have suggested that to be successful in highly autonomous online learning situations, students may require well-developed SRL skills to guide their cognition and behavior. Moreover, some researchers (Greene & Azevedo, 2007; Pintrich, 2003; Schunk, Pintrich, & Meece, 2008) have indicated that there may be important developmental differences in students' self-regulatory skills, differences that warrant further empirical investigation. For example, Greene and Azevedo (2007) have encouraged researchers to ask whether there might be a developmental progression within SRL. In their words, "research in this area would perhaps not only allow us to more clearly examine individual phenomena in SRL but also provide clues as to how good SRL behaviors might be taught" (Greene & Azevedo, 2007, p. 364). What's more, such developmental differences, if they do exist, could have important educational implications for instructors, determining, for example, the cognitive demands of learning activities faculty design, as well as type and level of scaffolding they provide during instruction.

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[1] Online learning is commonly referred to as online education, Web-based learning, or Web-based education (Zhao, Lei, Yan, Lai, & Tan, 2005).

Purpose of the Study

The purpose of the present study was to begin exploring potential developmental differences in academic self-regulation, as described by several scholars in the field of academic motivation (e.g., Greene & Azevedo, 2007; Pintrich, 2003; Schunk et al., 2008). In particular, this study was designed to determine if there are experiential, motivational, and self-regulatory differences between undergraduate and graduate students enrolled in several online courses. We hypothesized that graduate students would exhibit more adaptive SRL profiles than their undergraduate counterparts, due, in part, to their greater experience as learners at the university level. Ultimately, identifying such differences could help faculty as they attempt to employ effective online teaching strategies for students who may have varying levels of academic motivation and diverse self-regulatory capacities.

Method

Participants

Participants for this study included a convenience sample of 82 students from a large public university in the northeastern United States. Of these students, 39 (48%) were undergraduates and 43 (52%) were graduate students. Participants were enrolled in several different courses delivered completely online through WebCT. The sample included 39 women (48%) and 43 men (52%). The mean age of the undergraduate participants was 22.9 years (*SD* = 2.5; range 19-29), and the mean age of the graduate students was 31.2 years (*SD* = 9.0; range 21-56).

Overall, participants reported a wide range of educational experience. In particular, undergraduates reported the following: High School (*n* = 3, 8%), Some College (*n* = 23, 59%), 2-Year College Degree (*n* = 8, 20%), and 4-Year College Degree (*n* = 5, 13%). In contrast, graduate students reported the following: 4-Year College Degree (*n* = 16, 37%), Master's Degree (*n* = 26, 61%), and Professional Degree (*n* = 1, 2%). In terms of experience with online learning, 36 undergraduates (92% of undergraduates) reported that they had completed one or more online courses in the past, whereas only 23 graduate students (53% of graduates) reported the same level of experience with online learning.

Procedures and Instrumentation

During the last four weeks of the semester, participants completed an anonymous, online survey. The first part of the survey was composed of 32 items; all items employed a 7-point Likert-type response scale ranging from 1 (*completely disagree*) to 7 (*completely agree*). The items in this section were further subdivided into six subscales, and all of the variables derived from this part of the survey were created by computing means of the items associated with a particular subscale. The six subscales included the following:

Motivational Beliefs (adapted from the Motivated Strategies for Learning Questionnaire [MSLQ]; Pintrich, Smith, Garcia, & McKeachie, 1993):
1. *Task Value* – students' judgments of how interesting, useful, and important the course content was to them (6 items, α = .92);
2. *Self-Efficacy for Learning and Performance* – students' perceptions of expectancy for success and confidence in their ability to perform the learning task (7 items, α = .91);[2]

SRL Strategies (adapted from the MSLQ; Pintrich et al, 1993):
3. *Elaboration* – students' use of elaboration strategies (e.g., paraphrasing, summarizing; 5 items, α = .87);
4. *Critical Thinking* – students' use of critical thinking strategies (e.g., applying previous knowledge to new situations or making critical evaluations of ideas; 5 items, α = .87);

Motivational Engagement (adapted from Wolters, 2003, 2004):
5. *Procrastination* – students' level of academic disengagement or tendency to put off getting started on the work required for their online course (5 items, α = .90); and,
6. *Choice* – students' intentions to enroll in future online courses (4 items, α = .88).

The second part of the survey was composed of background and demographic items, including two individual items that assessed students' online technologies experience and previously completed online courses.

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[2] The definition of self-efficacy used to develop the MSLQ's self-efficacy scale is a bit broader than other measures, which usually limit themselves to assessing confidence in one's ability to attain designated types of performances and do not include expectancy for success (see discussion in Duncan & McKeachie, 2005).

Results

Descriptive Statistics

Table 1 presents descriptive statistics for the eight variables measured in the present study. As indicated, five of the six subscale variables (i.e., task value, self-efficacy, elaboration, critical thinking, and choice) had means slightly above the midpoint of the response scale (5.63, 5.87, 5.62, 5.14, and 4.57, respectively) and standard deviations ranging from 0.92 to 1.73. Additionally, all five variables showed a slight negative skew. On the other hand, descriptive statistics for the procrastination variable indicated a mean just below the midpoint of the response scale (3.32) and a standard deviation of 1.61. The frequency distribution for the procrastination variable had a slight positive skew.

Group Comparisons: T *Tests*

Independent samples *t* tests were conducted to explore differences between undergraduate and graduate students on the eight variables measured. To control the type I error rate, a Bonferroni adjustment was used (alpha = .05/8 = .008). Results from these analyses, also presented in Table 1, revealed statistically significant group differences on four of the eight variables. As hypothesized, graduate students reported higher levels of critical thinking than undergraduates ($p < .008$; $d = -0.68$). Undergraduates, by contrast, reported having completed more online courses in the past ($p < .001$; $d = 1.38$); more experience with online technologies ($p < .008$; $d = 0.61$); and greater intentions to enroll in additional online courses in the future ($p < .008$; $d = 0.84$). Effect sizes for the four statistically significant findings were moderate to large (Cohen, 1988).

Table 1
Means (Standard Deviations) and Independent Sample t *and Cohen's* d *Statistics for the Eight Measured Variables*

		Group			
Variable	Overall (*N* = 82)	Undergraduate (*n* = 39)	Graduate (*n* = 43)	*t*-Statistic	Cohen's *d*
Experience					
Online Tech. Experience	5.98 (1.25)	6.36 (1.31)	5.63 (1.09)	2.76*	0.61
No. Completed Online Courses	3.37 (3.29)	5.13 (3.96)	1.77 (1.07)	5.13*	1.38
Motivational Beliefs					
Task Value	5.63 (1.16)	5.81 (1.16)	5.47 (1.14)	1.35	0.30
Self-Efficacy	5.87 (0.92)	5.65 (0.99)	6.06 (0.82)	-2.02	-0.46
SRL Strategies					
Elaboration	5.62 (1.23)	5.46 (1.36)	5.76 (1.09)	-1.11	-0.25
Critical Thinking	5.14 (1.28)	4.71 (1.33)	5.53 (1.10)	-3.03*	-0.68
Motivational Engagement					
Procrastination	3.32 (1.61)	3.75 (1.64)	2.92 (1.50)	2.42	0.53
Choice	4.57 (1.73)	5.28 (1.56)	3.93 (1.64)	3.80*	0.84

Note. Bonferroni adjustment was used to control for inflation of type I error associated with multiple comparisons: alpha = .05/8 = .008. Cohen's $d = (M_2 - M_1) / \sqrt{[(\sigma_1^2 + \sigma_2^2)/2]}$. The online technologies variable was measured on a 7-point Likert-type response scale ranging from 1 (*extremely inexperienced*) to 7 (*extremely experienced*). The number of completed online courses ranged from 1 to 17. The remaining variables were measured on a 7-point, Likert-type agreement scale.
*$p < .008$.

Group Comparisons: Logistic Regression

Logistic regression was used to investigate the unique contribution of these differences in predicting students' group membership (undergraduate = 0, graduate student = 1). Using a hierarchical method, the independent variables were grouped into four construct sets and entered into the equation as follows: Step 1, experiential variables (online technologies and online learning experience); Step 2, motivational beliefs (task value and self-efficacy); Step 3, SRL strategies (elaboration and critical thinking); and Step 4, motivational engagement (procrastination and choice).

Table 2 provides a summary of the hierarchical logistic regression. As indicated, model fit statistics improved with the addition of each construct set. In the final model, 93.9% of students were correctly classified (-2 log likelihood = 21.00; $\chi^2 (8) = 92.48$, $p < .001$), and the likelihood ratio R-square (i.e., the proportional reduction in deviance produced by final model when compared to the null model; Menard, 2000) was large (.81). Additionally, four variables were statistically significant predictors of group membership: online technologies experience (b = -3.48, $p < .05$), online learning experience (b = -1.99, $p < .05$), procrastination (b = -1.59, $p < .05$), and choice (b = -1.24, $p < .05$). The critical thinking variable approached statistical significance (b = 2.81, p = .058).

Table 2
Model Summaries for the Hierarchical Logistic Regression Predicting Group Membership (undergraduate = 0; graduate = 1)

Variables	Step 1			Step 2			Step 3			Step 4		
	b	*SE*	OR	*b*	*SE*	OR	*b*	*SE*	OR	*b*	*SE*	OR
Experience												
Online Tech. Experience	-1.34**	0.41	0.26	-1.85**	0.58	0.16	-2.26**	0.69	0.15	-3.48*	1.66	0.03
No. Completed Online Courses	-1.27***	0.31	0.28	-1.43***	0.37	0.24	-1.61***	0.45	0.20	-1.99*	0.80	0.14
Motivational Beliefs												
Task Value				-0.69	0.44	0.50	-1.24	0.67	0.29	-2.71	1.48	0.07
Self-Efficacy				1.67**	0.55	5.31	1.04	0.74	2.83	2.82	1.73	16.70
SRL Strategies												
Elaboration							-0.57	0.76	0.95	-1.01	1.76	0.37
Critical Thinking							1.63*	0.70	5.11	2.81[a]	1.48	16.67
Motivational Engagement												
Procrastination										-1.59*	0.69	0.21
Choice										-1.24*	0.53	0.29
Fit Statistics												
-2 Log Likelihood	60.67			47.82			37.04			21.00		
Model Likelihood Ratio χ^2	52.81***			65.66***			76.44***			92.48***		
Block Likelihood Ratio χ^2	52.81***			12.85**			10.78**			16.04***		
Model Likelihood Ratio R^2	.48			.58			.67			.81		
% Correctly Classified	86.6			86.6			89.0			93.9		

Note. b = unstandardized regression coefficient; OR = odds ratio.
[a]Wald χ^2 test for the critical thinking variable approached statistical significance (p = .058).
*$p < .05$. **$p < .01$. ***$p < .001$.

Next, a logistic regression was conducted using only the four statistically significant variables, as well as the critical thinking variable, as predictors of group membership. Table 3 presents results from this more parsimonious, five-predictor model. As indicated, 91.5% of students were correctly classified (-2 log likelihood = 29.10; χ^2 (5) = 84.38, $p < .001$), and the likelihood ratio R-square was large (.74). Moreover, all five variables were statistically significant predictors of group membership: online technologies experience ($b = -2.73$, $p < .01$), online learning experience ($b = -1.71$, $p < .01$), critical thinking ($b = 1.74$, $p < .01$), procrastination ($b = -0.89$, $p < .05$), and choice ($b = -0.82$, $p < .05$).

Results from the final model with five predictors indicated that the odds of graduate student membership were higher as one's use of critical thinking strategies increased, and lower as one's online technologies experience, number of completed online courses, tendency to procrastinate in one's current online course, and intentions to enroll in future online courses increased. In others words, after controlling for experiential differences, graduate students were more likely to use critical thinking strategies during online learning; whereas undergraduates were more likely to procrastinate in their online courses and, paradoxically, were more likely to report wanting to take more online courses in the future.

Table 3
Model Summary for the Logistic Regression Model with Five Independent Variables Predicting Group Membership (undergraduate = 0; graduate = 1)

				Model Fit Statistics			
Variable	*B*	*SE*	OR	-2 Log Likelihood	Likelihood Ratio χ^2	Likelihood Ratio R^2	% Correctly Classified
Online Tech. Experience	-2.73**	0.86	0.07				
No. Completed Online Courses	-1.71**	0.54	0.18				
Critical Thinking	1.74**	0.66	5.70	29.10	84.38***	.74	91.5
Procrastination	-0.89*	0.36	0.41				
Choice	-0.82*	0.34	0.44				

Note. b = unstandardized regression coefficient; OR = odds ratio.
*$p < .05$. **$p < .01$. ***$p < .001$.

Discussion

Findings from this comparative study reveal that undergraduate and graduate students learning online differ in a number of important ways. Taken together, results partially support the hypothesis that graduate students exhibit more adaptive SRL profiles. Specifically, though less experienced with online technologies and learning, graduate students reported greater use of critical thinking strategies and lower levels of procrastination. These latter characteristics are consistent with effective academic self-regulation (Pintrich, 1999; Wolters, 2003). Interestingly, undergraduates, who reported greater levels of procrastination in their current online courses, also expressed greater intentions to enroll in future online courses. This paradoxical finding was not anticipated and may warrant further investigation.

Implications for Online Instructors

Results from the present study suggest some preliminary implications for online instructional practice. In particular, findings indicate that, as Greene and Azevedo (2007) have suggested, there may be a developmental progression within academic self-regulation. With this result in mind, online instructors might consider providing their undergraduate and graduate students with differential support; that is, different types and amounts of regulatory guidance and scaffolding during online learning activities. Specifically, the following suggestions for online instructional practice are provided:

1. Provide explicit instructional support and structure. Although, as this study revealed, undergraduates may be more experienced with online technologies and learning, they may also require more explicit support and structure from the instructor, as indicated by their lower levels of critical thinking and greater tendency to

procrastinate. Examples of explicit support and structure include reflective prompting aimed at helping students self-monitor their understanding (Davis & Linn, 2000); clear and detailed syllabi and assignment instructions; and more intermediate assignment deadlines to facilitate task completion (Liu, Bonk, Magjuka, Lee, & Su, 2005). In general, these instructional tactics are designed to encourage learners to better regulate their own learning in online contexts (McLoughlin, 2002) and to discourage their use of maladaptive academic behaviors, such as procrastination.

2. Develop students' self-efficacy. Another approach to encouraging self-regulation and discouraging procrastination is to address students' self-efficacy for learning online. Research with college undergraduates in traditional classrooms has indicated that students with higher self-efficacy tend to procrastinate less often than others (Wolters, 2003). Thus, although undergraduates in the present study reported similar levels of self-efficacy as graduate students, interventions aimed at promoting self-efficacy in online settings may be an effective means of reducing procrastination. Two instructional strategies that have been known to enhance students' self-efficacy for learning in both traditional and online contexts include helping learners identify and set challenging, proximal goals (Locke & Latham, 1990; Dabbagh & Kitsantas, 2004) and providing students with timely, honest, and explicit performance feedback (Bandura, 1997; Bangert, 2004; Wang & Lin, 2007).

3. Encourage collaboration and co-regulation. Many models of self-regulation support the idea of external regulation from teachers and peers as they provide modeling of and scaffolding for regulatory behaviors (Boekaerts et al., 2000). In a collaborative online environment, this type of external regulation might be particularly effective. For example, by requiring students to work together toward a mutual goal, online instructors can encourage students to provide regulatory support for one another in the form of project planning, monitoring, and reflecting (Winters & Azevedo, 2005). This type of collaborative regulation has been called *co-regulation* (Corno & Randi, 1999), and research in traditional and hypermedia learning environments has revealed that, "under these circumstances, students' individual self-regulatory processes are mediated by the collaborative context in which they are learning" (Winters & Azevedo, 2005, p. 193).

Of course, simply placing students in groups does not guarantee collaboration and co-regulation (Johnson & Johnson, 1999). Instead, the learning environment must be intentionally designed to promote effective group behaviors and to discourage maladaptive activities such as *free-riding* and *social loafing* (Kreijns, Kirschner, & Jochems, 2003). Although a discussion of specific techniques for promoting effective collaboration is beyond the scope of this article, these instructional methods have been detailed elsewhere in the computer-supported, collaborative learning literature (see, for example, Hiltz, 1997; Johnson & Johnson, 1999).

4. Scaffold online discussions. A primary goal of online discussions is to encourage students to challenge, reform, and synthesize their current views of knowledge through in-depth interactions with others (Garrison, Anderson, & Archer, 2001). However, findings from numerous studies of online discussion forums have indicated that students' interactions are often quite shallow, and "rarely developed into a higher level of communication where negotiation, co-construction, and agreement occurred" (Tallent-Runnels et al., 2006, p. 100). One possible explanation for students' shallow participation in online discussions is lack of guidance from the instructor. Thus, as Christopher, Thomas, and Tallent-Runnels (2004) have argued, online instructors, like their counterparts in traditional classrooms, must take greater responsibility for organizing and scaffolding their students' learning within these online discussions.

In the present study, undergraduates reported lower levels of critical thinking than graduate students. This finding suggests that online instructors may need to provide additional scaffolding for these students in an effort to enhance their use of critical thinking skills and other deep processing strategies. This type of supplemental scaffolding in online contexts has been described by some as enhanced *teaching presence* (Anderson, Rourke, Garrison, & Archer, 2001; Garrison et al., 2001; Shea, Swan, Li, & Picket, 2005). For example, during online discussions, enhanced teaching presence might include some of the following teacher behaviors: setting the climate for learning by modeling appropriate discussion posts; focusing the discussion on specific issues; encouraging, acknowledging, and reinforcing student contributions; identifying areas of agreement/disagreement and seeking consensus and understanding; adding information from diverse sources to a string of student posts; critically evaluating posts and requesting clarification and elaboration where necessary; and diagnosing and correcting students' misunderstandings (Anderson et al., 2001; Shea et al., 2005). Ultimately, teaching practices such as these that facilitate productive discourse may be necessary if online learners—particularly undergraduates—are expected to engage their classmates in meaningful interactions, develop higher levels of critical thinking, and realize other educationally worthwhile learning outcomes (e.g., reduced procrastination, improved persistence, and overall satisfaction with online learning; Christopher et al., 2004; Liu et al., 2005; Shea et al., 2005; Whipp, 2003).

Limitations and Future Directions

One major limitation of the present study was the relatively small convenience sample utilized. Although significant differences were found in respondents' experience and components of their academic self-regulation, the nature of the sample limits the extent to which these findings can be generalized to other university students. For instance, it is possible that these results are unique to the individuals surveyed and the specific online contexts investigated here (Shadish, Cook, & Campbell, 2002). Future research should include larger, more diverse samples to improve the external validity of these findings.

Another limitation was the non-experimental nature of the present investigation. Specifically, it is unclear whether the higher levels of critical thinking reported by graduate students actually represents a developmental difference in these students when compared to undergraduates. Instead, these differences could have been the result of different course requirements; that is, by their very nature, graduate courses may simply require students to utilize more critical thinking strategies to successfully complete online learning activities. On the other hand, undergraduate courses may not require this type of cognitive processing, thus allowing undergraduates to get away with using more shallow processing strategies, such as rehearsal and rote memorization. If this is the case, then differences observed in the present study may be less about developmental differences in self-regulation and more about dissimilarity in the requirements inherent to graduate and undergraduate courses. That said, Christopher et al. (2004) found that higher level discussion prompts (i.e., prompts that modeled a high level of critical thinking) had no effect on the level of graduate students' responses, as coded using a rubric developed from Bloom's Taxonomy of Learning. Clearly, more controlled research is needed to further clarify the differences detected here.

Finally, most of the instructional recommendations provided in this article require more empirical testing in online environments to validate their efficacy. Future studies that utilize experimental designs might be especially useful in exploring whether online interventions, such as adaptive scaffolding during online discussions, can differentially impact undergraduate and graduate students' use of critical thinking and other deep processing strategies. The use of alternative research methods, such as content analysis of online discussion boards, could be particularly useful in exploring these relations.

Conclusion

Notwithstanding methodological limitations, results from the present study suggest that undergraduate and graduate students come to online courses with different levels of online experience and exhibit different levels of self-regulation while learning online. Moreover, these findings suggest that faculty should closely consider their online audience, as students' experience, motivational beliefs, and self-regulatory competence should determine, in large part, the type and amount of structure, support, and scaffolding teachers provide during online instruction.

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Promoting 21st Century Skills through Integration of ICT in the Classroom

Cengiz Hakan AYDIN,
Anadolu University, Turkey

Abstract

This presentation and associated paper focus on an education initiative that intends to help young learners (aged 8-16) in communities where there is limited access to technology in homes and schools acquire 21st century skills. The presentation has three parts: the first part focuses on introduction of the Intel® Learn program's organization and content; the second part reveals the results of the program evaluations; and the third part covers the lessons learned during the implementation and evaluation of such a technology integration project in an emerging market. The results are quite promising. Although bureaucratic procedures, teachers' old habits, preconceptions and students lack of previous experiences have caused some problems concerning implementation of the project, the Intel® Learn helped students acquire and/or improve technology, collaboration and critical thinking skills. Both quantitative and qualitative data showed that students' acquisition of the technology skills exceeded the expected level and that they gained collaboration skills around the expected level. However, the staff should work more to improve students' critical thinking skills.

Introduction

Over the last decade, a growing number of experts, not only from field of education but also from economics, politics, international relations and so forth, around the world has reached a consensus on a new set of skills that are needed to be able to survive in the 21st century and on providing learners alternative learning opportunities to learn more than just reading, writing, and arithmetic. The World Bank Group (2003) as well as Partnership for 21st Century Skills (2003) suggests that learners need to acquire critical thinking, effective communication, team work, continuous learning, and use of technology skills in order to help the global knowledge economy and be productive world citizens. Additionally experts, such as Kozma (2005a), express importance of a deeper understanding of core school subject including especially science, math, and technology and innovativeness in every aspect of life. On the other hand, helping learners acquire these skills requires a different instructional strategy then the traditional school approach that reflects not present day conditions but the past. Problem-based, technology-enhanced, authentic learning opportunities are considered as today's instructional strategies (Jonassen et al, 2003).

Kozma (2005b) provided a list of significant outcomes of use of ICT in education, including improving school attendance, deepening conceptual understanding in core school subjects, promoting wider involvement in community developments. Similarly SRI International (2006) notes that "enabling children to learn to use ICTs and … creating optimal opportunities for children to develop a fuller set of 21st-century skills" are the two main ways those promote 21st-century learning (p. 3). According to SRI International ICT integration programs should be designed carefully and provide authentic pathways to help novice learners find opportunities to gain 21st-century skills.

Various projects that intended to help learners acquire these skills have been suggested, such as the Partnership for 21st Century Skills, Skills: Getting on in Business, Getting on at Work, the Intel Education Initiative, etc. The Intel® Learn Program is one of these projects.

Intel® Learn Program

The Intel® Learn is an informal after-school program, designed for helping young learners (aged 8-16) in communities where there is limited access to technology in homes and schools acquire skills necessary to compete in the 21st Century: (1) technology literacy, (2) problem-solving skills and other forms of critical thinking, and (3) peer-to-peer collaboration. The program consists of a series of hands-on activities and projects that require children collaborate with fellow learners to accomplish authentic tasks, such as designing and developing a strategic action plan for the future of the learners' own community, or for the possible future disasters in their region, and so forth. The Intel® Learn Program is part of the Intel Innovation in Education initiative, requires collaboration with local public and private educational agencies. After completing an evaluation of the program pilot in China, Israel, Mexico, and India, the Intel® Learn program has been expanded to some other countries including Egypt, Turkey, Brazil, and Russia.

In Turkey, the Intel® Learn Program has been implemented in public schools since 2005. The Ministry of National Education (MEB) provides staff and logistics while Intel Foundation along with its partner institutions, such as the Institute of Computer Technology (ICT) and BilgeAdam, administer the program. After receiving training from BilgeAdam and MEB trainers, participant teachers offer the course as an after school

program. Up to January 2007, total 200 public school teachers were trained to put into practice the program in their schools. Around 180 teachers out of 200 offered the Intel® Learn in their schools at least one time (a batch) and trained more than 4000 students in 30 different provinces of the country.

Effectiveness of the staff (teacher) trainings and the implementations in schools has been evaluated by a local of research organization (a third party along with MEB and Intel). The researchers in this organization have collaborated with the Center for Technology in Learning at SRI International that is a private for-profit organization specialized in evaluation and research, to conduct the evaluation.

This paper gives details about the evaluation of the Intel® Learn Turkey Program. The reporting of data and results is organized into three sections. The first section elaborates the data collection. The second summarizes the findings on the following aspects of the program: (1) participation, (2) staff training, (3) usefulness of course materials, (4) learning outcomes, (5) staff-learner interactions, (6) program structure and organization, and (7) scale-up and future. The third section consists of our comments and recommendations about the effectiveness, efficiency, appeal and sustainability of the program.

Data Collection

A mixed method approach has been employed for the evaluation. Four survey instruments and two control lists helped researchers to collect quantitative data while semi-structured interviews with the teachers, school administrators, students and families, and class observations provided qualitative data. At the end of each staff training participant teachers were asked to fill out the End of Staff Training Survey. They were also asked to complete the Attendance Form, the Sample Works Form and the End of Education Survey. Additionally, they were required to send at least 15 works created by learners during each implementation. The evaluation team used a rubric (control list) to assess the quality of learners' works they received form the teachers and an observation log (another control list) to see how the program was working for the learners in accomplishing the project's goals (promoting technology skills, higher-order thinking, collaborative capabilities).

The evaluation team has collected quantitative data from total 114 teachers (out of 200) during July 2005-January 2007. The team also conducted 15 site (school) visits during this period. These visits help the team observe use of curriculum materials, staff-learner interactions, learner-learner interactions, and learning outcomes. They also created opportunity to conduct interviews with teachers, students, school administrators and families focusing mainly on their perceptions of the effectiveness, appeal and organization of the project.

Results

This section provides evaluations regarding seven different aspects of the program: (1) participation, (2) staff training and support, (3) course materials, (4) learning outcomes, (5) staff-learner interactions, (6) program structure and organization, (7) scale-up and future.

Participation

According to the quantitative data collected via online version of Form 2: Attendance, total 9440 students completed the program. During site visits and phone calls evaluators noticed that staff had difficulty to find students for the program. There were two major reasons for this difficulty both of which related to the time of the implementations: the first, during summertime many parents preferred to send their kids to either their hometowns where grant parents and other relatives live or tourism places near sea shores; the second, during the summer time religious programs are offered to the same age group and according to the staff as well as local center administrators a great number of parents chosen to send their kids to these courses rather than Intel Learn. The staff and administrators also mentioned that the reason of this preference had nothing to do with the program but parents' perception that kids will anyway learn these skills (promised by the Intel Learn) in their classes during the school time but they cannot learn their religion and its rules in schools. Another important point evaluators found out during our visits that allowing students play online games in the class during the breaks is an important motive to improve the participation. Some students were looking forward to play games but at the same time they were aware that they had to complete their activities and project in order to play games. This motive helped them acquire the skills the Intel Learn offered. Finally evaluators would like to state that the program attracts an important attention from students all over the country but its timing should be arranged better to be able to reach more students.

Staff Trainings and Support

Evaluators' observations, interviews, and the results of Form 1 (End of Staff Training Survey) and Form 4 (Final Survey) show that staff trainings are big success. Up to now 362 teachers have been trained in the

program. The trainers got quite an experience so that they are able to handle any situation happens during trainings. As usual, the staff feels a little bit confused during the first day and the following but later they appreciate the effort put into this training and try to get more insight about the program. On the other hand supporting trained staff after the training was problematic in previous years. The majority of staff left alone with the students due to organizational problems. Although it was not enough, the only support they could find was from other staff. However, MEB along with the Intel project coordinator developed a new model and had a new agreement concerning flow of information and support. So, now the staff are be able to get enough support not only from trainers and MEB representatives but also from the project coordinator. According to this model there is a local MEB representative who is coordinating the information flow between all parties. On the other hand, evaluators still think that an online community of practice approach should be employed to be able to provide efficient and effective support. An online portal designed and developed by volunteer staff and supported by MEB, Intel representatives, the project coordinators and evaluators might help establishing a better interaction among staff and other parties, and information and experience sharing. This environment will work better if the staff feel comfortable in it; therefore, it should be created either by themselves or by Intel.

Course materials

Evaluators' observations, interviews, and the results of Form 4 (Final Survey) reveal that course materials are well designed for the program. The staff as well as students indicated that they found all the required information in their books. However, skills book is a little bit hard to handle especially for younger students. An online version of it might work better. Additionally, in previous observations the staff were complaining about inappropriateness of some of the activities but during the last visits evaluators did not receive any such complains. Also, the staff stated that those parents who saw especially the skills book expressed their appreciation and wish to get a copy of these materials to be able to use at home.

Learning Outcomes

Each member of the evaluation team strongly agreed that the Intel Learn definitely help learners acquire the technology, collaboration and critical thinking skills but in different ratios. The program helps students develop technology skills. However, despite the developments, students are not able to develop collaboration and critical thinking skills in a satisfactory level. One of the main reasons of this problem was that these skills were not promoted before and unfortunately are still not in some classes even though new MEB curriculum focuses on these skills. Since staff and students were not accustomed to problem based collaborative learning, some of them had difficulty to adapt this approach required in Intel Learn Program which in turn affected the outcomes. On the other hand, evaluators' observations showed that after first and second batches, staff were getting more used to this approach of teaching and implementing the program as it is planned. Students of these staff also demonstrated better collaboration skills and creative thinking examples during evaluators' observations. In an interview with one of the staff she mentioned that she has a daughter a few years younger than her students in the program. Her daughter joined her class everyday because she did not have any place to leave her during summer. One day at home she told her daughter to do her homework and her daughter told her that "… why I do not have any partner. It is so easy to do the job when you have a partner and I can do better homework if I had one". The staff was shocked and asked her where she learnt all these. Her daughter's answer shocked her more: "I know because sister Ceylin [the names have changed] was working alone during the beginning of the school [the program batch] and her works were very bad although she had good ideas. But later she started to work with Selim who was better with computers and after that their works were the best." So, this case is good evidence that the program help learners gain the required skills if it is implemented as it is foreseeing. Evaluators all agreed that experience made a difference in learning outcomes of the program. In sum, students took better technology skills, collaboration and problem solving skills with them from the program.

Student and Staff Interactions

Same as learning outcomes, although staff bring their past experiences and habits into the program implementations, the experience help them get better in guiding students rather than teaching. Evaluators observed positive and negative examples of the staff-students interactions. For instance, in a center, unexpectedly a young staff, after his student asked, started to show how to change the color of a clipart on the computer rather than directing his student to skills book or other students. Later during the interview he indicated that the best way to learn a skill was watching the correct demonstration first. Evaluators tried to convince him about the exploratory learning philosophy of the program but evaluators could not succeed it. Also in another center, evaluators came across a chaotic situation in the class and the staff was not there. Evaluators found him in another room talking with other teachers. Evaluators noticed that he was not really motivated about the program

and so he was trying to fulfill the requirements of the program but had no intention to encourage students to explore and discover. He was leaving students alone and providing almost no guiding. He was an older/experienced teacher. During the interview he complained us about the money they got for this project and expressed that the project actually does not bring anything new for them and they have already been implying the same (problem based collaborative learning) approach in his classes for years. On the other hand, evaluators met another staff via emails. He was quite old as a public school teacher but was very enthusiastic about the new role he had to play in the class and looked forward for the opportunities to encourage students to ask questions and seek for their answers. He wrote us that he was giving a small prize such as a candy bar to the student who asked the best and most useful question. He also mentioned that he was thinking about retirement before the staff training. In fact he went to staff training to relax and spend several days out of his daily duties and environment. But starting from the training he felt the difference of the program that helped him remember something he lost years ago: the joy of helping students learn. Now, he is not thinking of retirement. Similarly in a center located underdeveloped part of Istanbul both of the staff were having hard time to ignore the students' request for direct demonstration of the tasks they are supposed to do. One of them had to yell students and told students that the first student who come her to ask direct demonstration of a task before going to her/his friends and/or checking the skills book was going to get the penalty of standing still at the corner of the class for at least 15 minutes. She actually did not apply this penalty to any students. In the light of these observations and more evaluators conclude that staff even with a few instinct motivation performs better than those who do not have any even though you try to provide as much as you can to motive. So that during the staff selection the project coordinator and MEB must be more careful.

Program Structure and Organization

In terms of instructional structure and organization, evaluators have not came across any problem and almost all the staff, MEB representatives and students find the program successful. However evaluators noticed several problems in terms of project management especially first half of this year. Almost all these problems related to the bureaucracy. For instance it took quite a while to find a way to pay some money to the staff involved in the program. Another problem that affected our data collection efforts was the information flow especially between MEB and the staff. MEB could not establish a healthy system to learn which staff was implementing the program when. But after attaining local MEB representatives, all the parties including evaluators are getting timely and enough information. In addition organizing all the staff trainings in one center, Ankara was a very appropriate decision. All the staff had chance to meet with MEB upper level administrators and Intel representatives. This helped them to understand the importance of the program for MEB. Evaluators definitely recommend organizing all the future trainings in Ankara if it is possible.

Scale-up and Future

MEB representatives and the project coordinator mentioned that some of the staff who joined the staff trainings will work as trainers and offer staff training in local provinces in 2007. Although this organization might help to train more staff, evaluators are not sure how effective those trainings would be. But of course this is just a feeling and this organization might work fine. Evaluators think that an online or blended version of staff training might be better. Also, establishment of an online environment where all the staff can came together and share their experiences and feelings might help to develop the sense of community and connectedness among staff. This might increase their commitment to the program and in turn might affect their performance positively. This sort of an environment also may help us establish a better interaction and get better insight about their feelings. This environment should also work for presenting the students works.

Additionally, mostly through the enthusiasm of some of the staff such as Ali Bilgi news about the implementation of the program take place in local newspapers. Especially, one news had a very impressive title: "They are still in classroom but never complain never bored". Evaluators think that these kinds of news along with MEB representatives' positive attitudes toward the program create a positive impression about the program and provide public support and recognition.

Conclusion

The results are quite promising. Although bureaucratic procedures, teachers' old habits, preconceptions and students lack of previous experiences have caused some problems concerning implementation of the project, the Intel® Learn helped students acquire and/or improve technology, collaboration and critical thinking skills. Both quantitative and qualitative data showed that students' acquisition of the technology skills exceeded the expected level and that they gained collaboration skills around the expected level. However, the staff should work more to improve students' critical thinking skills.

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Hybrid classes with flexible participation options – If you build it, *how* will they come?

Brian J. Beatty
San Francisco State University

Abstract

This presentation reports on the participation patterns observed in four graduate courses offered at a large, urban, public university in 2006-2007. All courses were taught by the same instructor. This instructor has been using hybrid teaching methods for more than a decade at several levels of public education, and recently developed a hybrid course design encouraging flexible student participation patterns – the HyFlex course. All students in this study were enrolled in a graduate program in Instructional Technologies leading to a Master of Arts degree. In each course, a mix of face-to-face and online students used a course website (hosted in an open source Learning Management System) to share files, access course information, review past class discussions in various formats, and engage in occasional topical discussions. In addition, online students had the option to participate in live online sessions using a synchronous web conferencing tool. All students were invited to participate either in face-to-face sessions or through online activities in any given week of the semester, depending on their needs and desires. Student participation mode (in-class or online) did vary considerably from week to week in each course. Most students reported that they valued in-class activities and static website resources more than synchronous online sessions or multimedia archives of synchronous (in-class or online) activities. Students felt a strong connection to the course instructor, and most students reported that they met or exceeded their learning expectations. The paper includes a sample of student comments regarding the HyFlex course experience, with a link to raw (aggregate) survey data.

Introduction

The kaleidoscope of teaching and learning continues to shift as instructional technologies evolve and revolutionize the instructional landscape. Currently, the growth in the use of online technologies to support and grow communities – social networks of people with a common interest – has led to an increased use of social networking technologies in education and training. In addition, the rush to develop online-only courses and programs in public U.S. universities seems to have abated somewhat, as the economic realities of limited online enrollments, expensive course development costs, and constricting state budgets for public education have replaced promises of masses of distant students paying dearly to attend [fill in the blank]'s latest degree program (Zemske and Massy, 2004). The "HyFlex" course design was developed to meet the needs of a graduate program to attract and serve distance learners without creating online-only course sections or stand-alone e-learning substitutes. (Beatty, 2006)

What is HyFlex?

Hybrid – combines both online and face-to-face teaching and learning activities
Flexible – students may choose whether or not to attend face-to-face sessions … with no "learning deficit"

The HyFlex course design was developed through a formative research process (Reigeluth and Frick, 1999) and introduced in 2005-2006 to meet the needs of the Instructional Technologies program at SF State to include online students in courses being taught in on-campus classrooms. In HyFlex courses, a mix of face-to-face and online students learn together as they use a course website to share files, access course information, review past class discussions in various formats, and engage in occasional topical discussions. (See table 1.) In addition, online students may have the option to participate in live online sessions using a synchronous web conferencing tool. All students are invited to participate either in face-to-face sessions or through online activities in any given week of the semester, depending on their needs and desires.

The Learning Management System (LMS) in use at this university, iLearn (a Moodle derivative), enables a dynamic teaching and learning setting where the artifacts from the learning activities of face-to-face students (such as audio recordings) can become "learning objects" for online students, and the artifacts of online students (such as

discussion forum posts and chat transcripts) can likewise become learning objects for face-to-face students. (See figure 1.) Because of the seamless nature of this sharing of course content, resources, and even some activities, there is the potential for students to cross over from one participation mode to the other (and even back again) without a major disruption in the "flow" of their learning processes during the semester. (*Note: The HyFlex courses used in this study were developed for in-class teaching setting, but are under constant evolution as the instructor learns more about hybrid teaching and learning modes.*) Since this way of teaching requires extra instructor preparation and involvement throughout a teaching week, an important question is, (how) do students benefit from this flexible approach to participation?

Table 1. Comparison of in-class and online participation for a sample week in ITEC 801 course

ITEC 801 Week 2: Needs and Performance Analysis	
Agenda for in-class participation: 1. History of ISD – Where did it come from? (30 min) Whole class discussion of Reiser article 2. A Brief Overview of Instructional Systems Design – the process perspective (30 min) Review of Chapter 1, recap of Week 1 discussion **Break** – peruse sample final projects from archives 3. Needs Analysis Theory (Chapter 2) (45 min) Performance Analysis Needs Assessment Job Analysis Instructional Goals 4. Choosing a design project topics – discussion (30 min) EXTRA: Try the quiz! "Assessing Performance" Remember, the quiz is designed to help you decide how well you are learning and remembering some of the main concepts your text and our class discussions have been covering. (quizzes are optional, not graded, and can be taken as many times as you like)	**Agenda for online participation:** 1. Read chapter 1 in text - A Brief Overview of Instructional Systems Design 2. Read chapter 2 in text on Needs Analysis Theory. As you read, consider the context for your design project. (Review Week 2 presentation slides/notes posted to site.) A. Post to the "Needs Analysis Components" discussion B. Post to the "Instructional Goals" discussion 3. Review sample design project reports - posted online in the "Sample Design Reports" folder. (These samples are located in the Week 3 space in iLearn.) 4. Post your ideas for a design project to the "Project Topics" forum. (This forum is located in the Week 3 space in iLearn.) 5. Post your weekly reflection. EXTRA: Try the quiz! "Assessing Performance" Remember, the quiz is designed to help you decide how well you are learning and remembering some of the main concepts your text and our class discussions have been covering. (quizzes are optional, not graded, and can be taken as many times as you like)
For next week (this is the same for all students): Read Textbook: Chapter 5 – Learner and Context Analysis Assignment Due: Reflection post (iLearn)	

Figure 1. Screenshot from SF State's iLearn LMS of a sample week in ITEC 801 course

HyFlex Course Design Principles

The HyFlex course design is built around four fundamental principles: Learner Choice, Equivalency, Reusability, and Accessibility. I believe that these principles are important in all instances of effective HyFlex course implementations, and may be considered "universal" principles (Reigeluth, 1999).

Learner Choice: Provide meaningful alternative participation modes and *enable students to choose* between participation modes weekly (or topically). The primary reason a HyFlex course design should be considered is to give students a choice in how they complete course activities in any given week (or topic). Without meaningful choice, there is no flexibility … and therefore no HyFlex. This requires that an instructor value providing participation choice to students more than s/he values forcing everyone into the "best" way of learning a set of content.

Equivalency: Provide *equivalent learning activities* in all participation modes. All alternative participation modes should lead to equivalent learning. Providing an alternative approach to students which leads to inferior learning "by design" is poor instructional practice and is probably unethical. Equivalency does not imply equality, however. An online learning experience (i.e., asynchronous discussion) may turn out to be much less socially interactive than a classroom based discussion activity. In each case, however, students should be challenged to reflect upon learning content, contribute their developing ideas to the discussion, and interact with the ideas of their peers.

Reusability: Utilize **artifacts** from learning activities in each participation mode as "learning objects" for all students. Many class activities which take place in classrooms can be captured and represented in an online-delivered form for online students. Podcasts, video recordings, discussion transcripts or notes, presentation files and handouts, and other forms of representation of in-class activities can be very useful – both for online students and for classroom students wishing to review after the class session is finished. In a similar way, the activities completed

by online students, such as chats, asynchronous discussions, file posting and peer review, etc. can become meaningful learning supports for in-class students as well as provide useful review materials for online students. And indeed, artifacts from some learning activities, such as, glossary entries, bibliographic resource collections, and topical research papers, could become perpetual learning resources for all students in future courses as well.

Accessibility: Equip students with technology skills and access to all participation modes. Clearly, alternative participation modes are not valid alternatives if students cannot effectively participate in class activities in one or more modes. If a student is not physically capable of attending class, then in-class participation is not an option for that student. If a student does not have convenient and reliable Internet access, then online participation may not be a realistic option for that student. Students need the technologies (hardware, software, networks) and skills in using technology in order to make legitimate choices about participation modes. It may be incumbent upon an instructor or academic program to provide resources and extra training to students (and instructors) so that flexible participation is a real option.

Another key aspect of accessibility is the need to make all course materials and activities accessible to and usable for all students. For example, audio or video recordings should include text transcripts or be closed captioned, web pages and learning management systems must be "screen reader friendly", and all forms of online discussion should meet universal design guidelines for accessibility. As more students with varied learning-mode abilities enter graduate programs and public, regulatory and legal pressures for universal design for accessibility increase, this aspect becomes increasingly important.

Study Questions

The questions this study attempts to answer for the HyFlex course delivery context are, When given the option to choose between online and face-to-face participation modes, which method do students choose? Why do they choose one method over another? When do they change their participation pattern, and why? Do their participation mode preferences change over the course of a semester? Are students satisfied with their interactions and learning in a HyFlex course? Answering these questions will help faculty choose a more effective mix of instructional options (overall class participation modes, online and face-to-face activities) to meet the needs and desires of their students.

Method

Course participation data was gathered during the Spring 2007 semester in four Instructional Technologies courses taught by the author. This data is either typical attendance information (who came to class, who did not, etc.), or evidence of online participation captured through the iLearn Learning Management System, usually measured by discussion forum participation. Online participation data includes participation frequency and quantity. One end-of-semester survey was used to assess student participation intentions and perceptions. Completing the survey was voluntary. The survey was available for one week after the last in-class meeting of the semester. Thirty four of 44 students (four students were enrolled in at least two of these classes) completed the survey, including 13 of the 15 students registered in the "online-only" section of ITEC 801, 801.02. Table 2 lists the questions asked in the survey.

For the participation part of this study, the analysis consisted of counting the frequency and amount of student participation online, and counting the frequency of class attendance. This data was entered into a spreadsheet for comparison and graphical analysis. Table 3 (in Results section) summarizes course participation for all four courses.

For the student satisfaction part of this study, survey results were tabulated and entered into a spreadsheet for comparison and graphical analysis. This analysis produced general answers to questions about student rationale for participation choices, changes in participation mode or amount, and student satisfaction with various components used in each course. (Note: Rigorous statistical analysis of survey results was not attempted, but is planned for future surveys. The survey instrument with tabulated aggregate data can be accessed at the HyFlex Course Design website: http://itec.sfsu.edu/hyflex/hyflex_home.htm)

Table 2. End-of semester survey questions *(Note: answer format has been changed to conserve space)*

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1. Please select which course(s) you were enrolled in during Spring 2007.
ITEC 801.01 (face-to-face: Monday night); ITEC 801.02 (online section: Wednesday night); ITEC 850; ITEC 865

2. Which mode of participation did you plan on using during the semester?
face-to-face only; online only; a mix of online and face-to-face

3. How far is your commute to SF State? 0-5 miles; 6-20 miles; 21-50 miles; greater than 50 miles; Other:

4. On a typical class day, how long does your commute to class take? Please include time to find parking and walk to class.
0-30 minutes; 31-60 minutes (one hour); 61-90 minutes; 91-120 minutes (two hours); more than two hours; Other:

5. How many OTHER HyFlex courses have you taken in the ITEC program? Do not include classes completed this semester.
0 (none); 1 (one); 2 (two); 3 (three); 4 (four)

6. Please rate the value of each type of learning resource used in this class to your learning experience. What was valuable to you? What was of little or no value? (*Note: each element is rated from Very High to Very Low*)
Face-to-face discussions; Face-to-face presentations; Online asynchronous discussions; Archived discussions from class meetings; Online synchronous sessions; Archived Eluminate Live! Sessions; Website links; Linked readings

7. Please indicate how "connected" you felt to the following during class this semester. Compare this class experience to other recent class experiences. (*Note: each element is rated from Very Strong to Very Weak*)
Peers; Instructor; ITEC Program; SF State

8. I feel that I learned as much or more than I expected to in this class.
Strongly Disagree; Disagree; Undecided; Agree; Strongly Agree

9. I wish all of my courses were available (pick one):
fully online; complete in-person; blended (instructor decides what is online and what is face-to-face); HyFlex (hybrid with flexible participation); on CD-ROM for independent study; Other:

10. Please comment on your participation throughout the semester. Did you vary your mode from face-to-face to online or vice versa? If so, why? Did you prefer one mode over the other? If so, why?

Results

Part A of the Results section reports student participation patterns: aggregate for all courses, broken out by course and by individual student. Part B of the Results section reports selected findings from the end-of-semester student survey of participation and satisfaction with their HyFlex experience.

Part A: Student Participation Patterns

In Spring 2007, the author taught four courses, ITEC 801.01 and 801.02 (two sections of the same course, Instructional Systems Design), ITEC 850.01 (Design and Management of Training Projects), and ITEC 865.01 (E-Learning Development). Of the four courses, ITEC 801.01 and 801.02 were identical except that 801.02 was listed in the course catalog as an online course. Students were alerted ahead of time that even if they registered for ITEC

801.02, they would still be welcome to attend 801.01 in person if they desired. Table 3 shows summary data for overall average weekly participation mode for each of the four courses.

Table 3. Spring 2007 Student Participation Mode Summary

Course	Enrollment (N)	Attendance (weekly ave | STD over the semester)		
		in-class	online	absent
801.01 (in-class)	15	**7.20 | 4.69**	**5.07 | 4.01**	2.67 | 1.50
801.02 (online)	13	1.13 | 1.41	8.93 | 1.98	2.87 | 1.68
850.01	10	2.38 | 1.98	1.93 | 2.46	0.21 | 0.43
865.01	10	7.85 | 2.85	1.15 | 2.03	1.00 | 1.35

Looking at the summary data, it is clear that in all courses, students took advantage of the HyFlex flexible participation option, with several students in each course using an alternative option (online for an in-class course, or in-class for an online course) each week. Not surprisingly, the greatest variation in participation mode was for the 801.01 course since there were both in-class and online course sections for 801. In 850 and 865, participating online often meant being the only online student, or being one of only two or three students interacting online in any particular week.

Individual Student Participation

In 801.01, the in-class section of the ISD course, there was at least one student participating online each week. Two class sessions were conducted only online, in part to ensure students had the basic skills to survive in the online participation mode. All but one student chose to participate online at least one more time during the semester.

In 801.02, six of 13 students never came to class in person during the semester. More than half of the students (seven of 13) exercised the option of coming to class to participate in-person at least once, but none more than 5 times (one student came to class 5 times, one came 4 times, one came 3 times, one came 2 times, and 3 came only once).

In 850.01, one week of the course was conducted completely online. All but two students (80%) chose at least one more week to participate online during the semester. Three students (30%) chose online three additional times (beyond the required one online week), three (30%) chose online two additional times, and two (20%) chose online one additional time.

In 865.01, students were never required to participate online during the semester, and three students (30%) came to class every week. Two students (20%) chose online three times, three (30%) chose online twice, and one chose online once.

Part B: Student Survey of Participation and Satisfaction

The end-of-semester survey asked students about their participation preferences, details about their commuting time and distance from campus, satisfaction with their learning, with the HyFlex course design, and their feelings of "connectedness" to various components of the learning community, and their valuing of various instructional resources used in the course. In this paper, I summarize the findings related to instructional resources, feelings of connectedness, satisfaction with learning, preference for course design, and overall satisfaction with their HyFlex participation experience.

Item 6 of the survey asked students to evaluate eight types of instructional resources provided in each class. (See table 4.) The four elements valued the most (ranked very high or high) from students were face-to-face discussions (23 of 34), presentations (26 of 34), website links (26 of 34), and linked readings (30 of 34). Essentially, these are in-class resources and online "expert" non-interactive resources. The interactive online resources were valued by less than 50% of the students, in comparison.

Table 4. Selected Student Survey Results

6. Please rate the value of each type of learning resource used in this class to your learning experience. What was valuable to you? What was of little or no value?

	Number of Responses				
	Very High	High	Neutral (so-so)	Low	Very Low (or did not access)
Face-to-face discussions	**17**	**6**	5	0	6
Face-to-face presentations	**16**	**10**	3	0	5
Online asynchronous discussions	8	9	14	3	0
Archived discussions from class meetings	5	10	11	4	4
Online synchronous sessions	6	16	6	2	2
Archived Elluminate Live! Sessions	4	4	10	3	12
Website links	**15**	**11**	7	1	0
Linked readings	**14**	**16**	4	0	0
Totals	*85*	*82*	*60*	*13*	*29*

7. Please indicate how "connected" you felt to the following during class this semester. Compare this class experience to other recent class experiences.

	very strong	strong	neutral	weak	very weak
Peers	**6**	**14**	8	6	0
Instructor	**10**	**19**	5	0	0
ITEC Program	3	12	11	4	4
SF State	1	10	10	8	5
Totals	*20*	*55*	*34*	*18*	*9*

8. I feel that I learned as much or more than I expected to in this class.

	Number of Responses	Response Ratio
Strongly Disagree	3	8.82%
Disagree	0	0.00%
Undecided	4	11.76%
Agree	**17**	**50.00%**
Strongly Agree	**10**	**29.41%**

9. I wish all of my courses were available (pick one):

	Number of Responses	Response Ratio
fully online	1	2.94%
complete in-person	4	11.76%
blended (instructor decides what is online and what is face-to-face)	8	23.53%
HyFlex (hybrid with flexible participation)	**20**	**58.82%**
on CD-ROM for independent study	0	0.00%
Other**	1	2.94%

** UNDECIDED

Item 7 asked students to evaluate their feelings of connectedness to their peers, the instructor, the ITEC program, and SF State University. (See table 4.) Connecting to others is often a particular challenge in online courses, and a lack of feeling connected contributes to attrition in online courses and programs (Kemp, 2002; Rovai, 2002). Blended courses which implement a mix of in-class and online instruction may improve the sense of community (Rovai and Jordan, 2004), leading to feelings of greater connectedness. In the end-of-semester survey, students reported feeling strongly (marking "very strong" or "strong") connected to the instructor (29 of 34) and to peers (20 of 34), but did not report feeling strongly connected to either the ITEC program or SF State in general.

Item 8 asked students whether or not they agreed with a statement about learning as much as they expected, and 80% (27 of 34) reported that they agreed or strongly agreed.

Item 9 asked students what type of course delivery they preferred. A majority of students (59%) preferred the HyFlex course, many preferred another form of hybrid course, instructor-controlled blended (24%), and most of the rest preferred traditional classroom instruction (12%). Only one student preferred online-only course delivery. This result indicates that these students value the face-to-face components of traditional classroom instruction, perhaps the social connection they experience with peers and the instructor, and the immediacy of rich interaction that is enabled in the classroom but is difficult to achieve online. But what did they say about the HyFlex course experience, when they were free to use their own words? Some of those comments are presented next.

Student Comments about HyFlex

The final survey question asked students to comment on their participation over the semester. Most comments expressed satisfaction with the flexible participation options; many students mentioned the aspects of each mode of class that they especially liked or disliked. A sample of students comments (as submitted in the survey) is presented here. (Full comments can be viewed at the HyFlex design website.)

> I did online mostly and caught the tail end of class when I could. I missed seeing and interacting with my peers face to face. online was a great deal of work and I found I needed to really manage my time. Office hour participation , listening to archived class, reading other student forums, posting my own forums, responding with coherence, spelling grammar... wow. office hours time was made to seem optional. I felt it was key and would have liked to see more people there and used more robustly to share projects, get feedback and have a class. It was good to get to know the program. Sharing papers with people online for feedback didn't work so much. people didn't know what to give for feedback. I can't believe how much I have learned.

> I enjoyed the hyflex mode of learning based on my very demanding schedule for work. As a consultant, I travel almost 4-5 days per week, and having the ability to attend or not attend class was very helpful.

> With a hectic work schedule, having the option to "attend" class online was ideal. The flexible structure kept me from dropping the course.

> I took two courses in this mode this semester, and my participation varied more in one than the other. Within a large class, the HyFlex approach is really useful because there is the sense that there will be a community to participate with in either modality. Therefore, I switched from online to face-to-face pretty regularly. Often, I made my choice based on what was going on for me that week (was I prepared for face-to-face session early in the week?) or the content of that week's lesson (am I going to fully understand this topic on my own?). I felt more comfortable participating online when I was confident about my knowledge for the week, and was just looking to peers to further develop that understanding. In contrast, in a small class, I was reluctant to participate online because I was unsure whether or not there would be someone to participate with, or enough of a dialogue to make the experience valuable. I only participated online once, outside of when the whole class was online, and it wasn't a dramatically different experience than if I had just skipped class for the week. I wouldn't recommend the HyFlex course for small classes, unless there is a more structured activity aside from discussion that one could do for the week.

> My participation has been about the same with online and in-class. This was my first time having (the option of) an online class. Being online gave me more flexibility with my work schedule, but I still needed to have some face-to-face peer work and discussions, especially regarding the materials we read and talked about. I don't think I think that i prefer being in class. I benefit more with being engaged, or even just listening to a discussion, but the availability of doing some of the work online really helped me.

Throughout most of the comments, students expressed an overall preference for traditional in-class meetings, especially the social nature of the seminar classroom. However, they also often expressed appreciation for the flexible nature of participation so that their studies could more easily integrate into the rest of their busy lives.

Conclusions

If you build it (the online options for traditional classroom-based courses) they *will* come! At least many of these students did. Approximately 15% of the student participation instances (96 of 642 opportunities to choose) took place in alternative modes, primarily in-class students participating online.

Students who register for an online course may not be able to attend class in-person, even if that is an option. If they have chosen an online course section instead of an in-class section, it is probably for as good reason, such as, work conflict, family duties, tie conflicts with other classes, or travel conflicts. Based on the participation patterns in the ITEC program at SF State, it doesn't make sense to prepare in-class options for students if a course is being offered online-only already. In this situation, if you build it, they probably *won't* come!

HyFlex options may be more effective for students choosing online participation if there is a large group of students who are likely to also be online in a given week. If online participation is considered to be a "second choice" option (perhaps because it can be a lonely virtual space when every one else is in class), online discussions may be sparse and relatively ineffective as interactive discussions.

Even when students did not choose alternative participation modes often, many report being very satisfied and pleased that they had the choice to participate in a different mode if they had to (or wanted to). Almost all of the students surveyed preferred a mix of online and classroom participation modes, and most of these students report that they would prefer all of their courses adopt a student-controlled flexible approach to participation.

Looking Ahead (with Plenty of Questions!)

As with any complex learning setting, initial development and research leads to many more questions than a simple study can answer. The end-of-semester survey is being revised and will be used with Fall 2007 and Spring 2008 courses using the HyFlex course model in the ITEC program. There are other areas to pursue, many more questions to ask (and eventually answer, one would hope.) Here are a few under consideration:

Student learning: Do students who choose to participate predominantly online achieve learning objectives? How do their final performance products (design plans, instructional packages, etc.) compare to those of their peers who participate in-class

Online learning environment: Is it possible create a rich, interactive online environment when only a few students are participating online in a given week? Would requiring all students, regardless of participation mode, to participate in online forums make the online participation richer? Could that be accomplished without increasing the workload for in-class students unfairly?

Faculty workload: It isn't fair to the faculty teaching a HyFlex course to require traditional in-class teaching and add on the load of facilitating online students as well. How much additional work is required to conduct a HyFlex course? How can the faculty load for facilitating online learners be lessened? Should faculty be assigned fewer students for HyFlex courses or fewer courses to teach? Can teaching assistants provide the additional instructional support needed?

Student outcomes: All of the students in this study are enrolled in the Instructional Technologies (ITEC) graduate program at SF State. Since these students are learning how to design instruction for a wide variety of education and training settings using technology, their experiences using online technologies in the HyFlex course may affect the way they think about teaching and learning in the various instructional contexts they move into. Does the HyFlex experience lead them to consider the impact of learner control and designing for flexible alternative approaches to learning the same content? Ultimately, do they become more effective designers and educators?

The results of continuing studies and development of HyFlex courses at SF State will try to answer these questions over the next few years. At SF State, especially in the ITEC program, we intend to determine how to select additional existing courses for hybridization with the HyFlex model, develop new courses in hybrid formats to meet the emerging needs of student populations, and help instructors and students better understand how new technologies can support a different approach to course delivery; creating a context for full and flexible participation in a learning community that may be more effective that traditional single-mode course designs.

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The Connection Log: Scaffolding the Development of Middle School Students' Evidence-Based Arguments

Brian R. Belland
Department of Curriculum and Instruction

William White
Department of Computer Science

Krista D. Glazewski
Jennifer C. Richardson
Department of Curriculum and Instruction

Abstract

Students engaged in Problem-based learning (PBL) units solve ill-structured problems in small groups, and then present arguments in support of their solution. However, middle school students often struggle developing evidence-based arguments (Krajcik et al., 1998). Using a mixed method design, we investigated (1) the impact of the Connection Log–a computer-based argumentation scaffold system–on middle school students' construction of evidence-based arguments during a PBL unit, and (2) scaffold use among members of two small groups purposefully chosen for case studies. Data sources included a test of argumentation, debate rating scores, videotaped class sessions, and retrospective interviews. Findings included a significant impact on individual argumentation skill, and use of the scaffolds by the small groups to communicate and keep organized.

Introduction

Recently, science educators have called for the use of inquiry-based instructional frameworks such as problem-based learning (PBL) to help secondary students to learn the process of science (i.e., the inquiry process), and move beyond instruction focused on declarative knowledge (e.g., Keys & Bryan, 2001; Sandoval & Reiser, 2004). In PBL, students center their learning on ill-structured problems, or problems for which (1) the initial statement does not indicate how to represent the problem, and (2) there are multiple paths to a solution and multiple solutions to the problem (Hmelo-Silver, 2004; Jonassen, 2003).

Within ill-structured problems, developing evidence-based arguments (EBAs) is essential to producing a viable solution (Cho & Jonassen, 2002). EBAs consist of discussions that provide support for claims with evidence and premises (Perelman & Olbrechts-Tyteca, 1958). However, secondary students often struggle creating EBAs (Krajcik et al., 1998; Sandoval & Reiser, 2004). Middle school students' inability to construct EBAs during PBL could be attributed to three challenges: (1) adequately representing the central problem of the unit (Ge & Land, 2004; Liu & Bera, 2005), (2) determining the most relevant evidence they must gather and gathering it (Pedersen & Liu, 2002-2003), and (3) synthesizing gathered information to construct a sound argument (Cho & Jonassen).

Possible Solutions

While some authors advocate direct instruction to help K-12 students improve argumentation skills (Knudson, 1991; Voss & Means, 1991), such interventions are not always successful (Knudson; Marttunen & Laurinen, 2001). Also, while direct instruction may help secondary students engaged in PBL units learn the components of EBAs, such students may continue to struggle representing the problem, determining relevant information to gather and gathering it, and synthesizing the gathered information to construct a strong argument.

Scaffolding is support (from a teacher or computer tool) provided to students participating in a task they cannot complete without assistance (Hannafin, Land, & Oliver, 1999; Wood, Bruner, & Ross, 1978). Computer-based argumentation scaffolding has helped college (Cho & Jonassen, 2002) and middle school students (Bell, 1997) produce coherent arguments. However, many available computer-based science-inquiry scaffolds are linked to specific PBL problems (Quintana et al., 2004), and transfer to other problems or domains has not been shown.

We designed and developed a computer-based scaffolding system, the Connection Log, to support middle school students' development of EBAs during a variety of PBL units. The purpose of this paper is to describe the Connection Log and to address how and why middle school science students use computer-based argumentation

scaffolding to construct an argument while participating in a PBL unit, and the Connection Log's impact on (a) individual student argumentation skills and (b) group argument quality.

Method

Design and Development of the Connection Log

The first author designed the Connection Log based on guidelines that emerged from a review of the literature and detailed observations of middle school students engaging in PBL: (1) embed scaffolds within a system, (2) make students articulate their thoughts, (3) constrain the problem space, (4) consider motivation, (5) make scaffolds explicit for students with less prior knowledge, and (6) focus on the development of conceptual, procedural, and strategic computer-based scaffolds (Belland, Glazewski, & Richardson, in press). The third author reviewed the instructional analysis once and the storyboard twice. After revising the storyboard, the first author reviewed scaffold readability with a seventh-grade science teacher and several seventh-grade students. We simplified the language where possible, and implemented rollover definitions where necessary.

Resources Used

We used Macromedia Fireworks version 8 to storyboard. The html shell was created using Macromedia Dreamweaver version 8. The php code was written using vi (text editor for UNIX). Database architecture was modeled using Toad™ Data Modeler. A Sun server running php 5.1.4 and mysql 5.0.22 hosts the Connection Log.

Evaluation

Setting and Participants

This setting was a laptop initiative middle school in a small, rural Midwestern community. The school had 38 teachers and 543 students, 44% of whom received free or reduced lunches. The sample included eighty-six seventh-grade science students in four class sections. The teacher had four years experience facilitating PBL units.

Data were gathered during a 2-week PBL unit on the Human Genome Project (HGP), which followed a teacher-led instructional unit on genetics and its role in human development. Each student team chose a unique stakeholder group such as doctors or religious leaders. Students needed to assume a position on the HGP based on their stakeholder's perspective, outline a plan for promoting their position, and argue their position during a debate at the end of the unit in fictitious competition for a grant to further their position.

Design

We used a mixed methods approach to address our research questions.
Qualitative method. We presented an in-depth description of how the members of two small groups worked together and used the scaffolds during the unit.

We (1) videotaped each group during the unit, and transcribed verbatim all dialogue, (2) retrieved each group member's response to prompts, (3) observed students from all class sections during the unit, and (4) conducted prompted, retrospective interviews of approximately 30 minutes each with each group. In each interview a unique, approximately 20-minute video containing scenes from the videotaped class sessions prompted participants' recollection of how they used the Connection Log and why.

We (1) coded the video and interview transcripts, (2) triangulated coding with observation and database information, (3) identified common themes, and (4) interpreted themes from the symbolic interactionism framework, according to which people interact with things based on the meaning they assign to the latter (Blumer, 1969).
Quantitative method. We used a two-factor nested experiment with factor B (classroom) nested in factor A (scaffold or no scaffold) (Kerlinger & Lee, 2000). The teacher identified two classes as high-achieving and two as low-achieving. The low-achieving class means were significantly lower than those of the high-achieving classes, $F(1, 81) = 6.93$, p < .05, on a pretest of argumentation ability. Pretest scores did not differ significantly between the low-achieving, $F(1, 81)=.38$, p=.54, or the high-achieving, $F(1, 81) = .62$, p=.43, classes. We assigned one high-achieving and one low-achieving science class to each condition: scaffold and no scaffold.

An argumentation measure was adapted with permission from the test used by Glassner et al. (2005). Students read four scenarios in which a claim was made about a particular topic and two supporting statements were

advanced. Students needed to indicate how well each statement supported the original claim. The pretest (Cronbach's alpha=.71) was similar to the posttest (Cronbach's alpha=.77).

To address the impact of the Connection Log on individual argumentation skill, we used nested ANOVA. If nested effects were significant and ordinal, we calculated simple effects (Keppel, 1982).

We videotaped all groups during the debate. The video was transcribed, and two raters blind to treatment condition assigned numerical scores for claim, evidence, and connection of claim to evidence quality for each team in all four periods. After raters came to consensus, agreement, measured by Cohen's Kappa, was 0.99.

To address the impact of the Connection Log on group argumentation quality, we used nested MANOVA. If effects were significant, we ran follow-up ANOVAs. If nested effects were significant and ordinal, we calculated simple effects (Keppel, 1982).

<div align="center">Results</div>

<div align="center">*Connection Log Description*</div>

General Description

The scaffolds are organized as six stages:
1. *Define problem*, in which students define the problem in their own words
2. *Determine needed information*, in which students decide on evidence and information about the problem they need to find, and strategies for finding it
3. *Find needed information*, in which students find and record the information they need to know
4. *Organize information*, in which students organize the information they found to make it more useful when developing their claims and building their argument
5. *Develop claim*, in which students actually develop their claims
6. *Link evidence to claim,* in which students link evidence to their claims and build an argument

Each stage is divided into 2-4 steps. See Figure 1 for a screenshot of step 1 of stage 1. Most steps have text boxes in which students type responses. Upon logout, all work is saved. Students start where they left off when logging back in.

Figure 1. *The Connection Log.*

Unique features. The Connection Log was developed for use with any PBL unit and guides students to articulate their thoughts. Because of group registration, students read what their group mates articulate at each stage. At each stage in the argument construction process (e.g., organize evidence, develop claim) students (1) articulate their own thoughts individually, and (2) discuss all group members' articulated thoughts to form a group consensus.

How Do Students Use Computer-based Argumentation Scaffolding?

Group 1

Robert, Erin, and Alejandra (note: all names were changed) faced different challenges during the unit. Robert was a leader who found the unit difficult due to his lack of prior knowledge about the unit content. He was also confused about the debate structure.

Erin was often unsure of herself. On many occasions when either Alejandra or we asked Erin a question about the group's strategy or how the HGP could help their stakeholder, she replied, "I don't know, ask Robert." She appeared to accept Robert's lead, but complained that sometimes it seemed like "Robert doesn't care." She also was confused about the overall task.

Alejandra had limited English proficiency. She struggled expressing herself and understanding what her teammates said, but was able to stay aware of her group mates' thoughts by reading what they wrote in the Connection Log. In this quote she reflected on her silence: "I was listening. I always listen. I was listening to what she was saying. Because I was trying to help, but they always talk, and I was trying to listen, but Erin talks too fast."

The group used the Connection Log to (1) get and stay organized, (2) aid communication, and (3) think of ideas. The Connection Log appeared to help the group to counter (1) confusion about the debate structure and required presentation parts, and (2) communication problems by allowing them to read what each other wrote.

Group 2

Daniel, Megan, and Claudia faced different challenges during the unit. Daniel was a soft-spoken leader who tended to take over tasks when required to explain them too much. He was challenged by the ill-structured nature of the unit. Though he understood them from the beginning, he found it challenging to apply the Connection Log's prompts to his project early in the unit. However, as we explained them more, Daniel found the prompts easier to apply.

Claudia was an English language learner who joined the group with three days left in the unit, and was assigned the task of finding pictures and information to complete the group's poster. She found the unit more difficult than previous inquiry units due to difficulty finding information. Because of her late addition, she did not use the Connection Log extensively.

Megan was a quiet student who also found the unit difficult because of its ill-structured nature. She often asked Daniel how to accomplish tasks. She noted difficulty getting started with the Connection Log, but once she got going, "it was pretty easy."

The group used the Connection Log to (1) get and stay organized, (2) serve as a reference, and (3) ensure inclusion of all required parts of the presentation. The Connection Log appeared to help the group counter their challenges by (1) structuring the unit to aid organization and strategy, (2) storing ideas for later reference, (3) indicating required parts of the presentation.

What is the Impact on Individual Students' Argumentation Skills?

The Connection Log had a significant main effect on individual argumentation ability ($F(1, 82)=2.99$, $p=.09$, $ES=0.35$) and a significant simple effect on the individual argumentation ability of low-achieving students ($F(1, 82)=6.07$, $p=.01$, $ES=0.61$). In other words, the Connection Log significantly affected the individual argumentation ability of all students, but had an effect of greater magnitude on the individual argumentation ability of low-achieving students.

What is the Impact on Group Argumentation Quality?

The Connection Log did not have a significant main effect ($\Lambda=0.88$, $F(3, 25)=1.16$, $p=.34$), but a significant nested effect ($\Lambda=0.66$, $F(6, 50)=1.95$, $p=.09$) on claim, evidence, and connection of claim to evidence quality. Follow-up ANOVAs indicated significant nested effects of the Connection Log on claim ($F(2, 27)=4.77$, $p=.02$) and connection ($F(2, 27)=4.52$, $p=.02$) scores, but simple effects were not significant. In other words, when considering all scores and student types, not all means were determined to be the same. When considering only claim or connection scores, scaffolding's effect appeared to differ according to student type, but further tests did not provide evidence of a significant difference.

Discussion

How do Small Groups of Middle School Science Students Use Computer-based Argumentation Scaffolding to Construct an Argument while Participating in a Problem-based Learning Unit?

When considered in context of what is currently known about how secondary students use scaffolding, the results related to how students used the Connection Log are interesting in that they add to the research base on how middle school students use hard scaffolds.

The capacity of hard scaffolds to facilitate organization. As Daniel noted, the Connection Log "helped us put it [the presentation] together so it didn't look confused and sloppy." Most articles in which the coherence of arguments was examined indicate that college (Cho & Jonassen, 2003; Ge & Land, 2003) and secondary (Bell, 1997; Kyza & Edelson, 2005) students who used evidence-based argumentation scaffolds produced more coherent arguments than students in control conditions (who did not use scaffolds). However, very few seemed to indicate why. Some authors noted that students using scaffolds more evidential support for claims (Cho & Jonassen) than

students who did not use scaffolds, but it is left to the reader to imagine what specifically about using the scaffolds led to the more coherent argumentation.

A closer look at what leads to argumentation coherence may reveal a possible impetus for greater argument coherence. Coherence of argumentation depends on three things: a clear claim, adequate supporting evidence, and an established link between the evidence and the claim (Perelman & Olbrechts-Tyteca, 1958). Essential to successfully linking evidence and claim and delivering an argument is organization (van Eemeren et al., 2002). In past studies in which secondary students who used scaffolds created more coherent arguments (Bell, 1997; Kyza & Edelson, 2005), students in the experimental condition may have been more organized than students in the control conditions, and that the increased organization contributed to more coherent argumentation. However, given that the authors did not present data to that effect, one cannot know.

The finding that the Connection Log helped Groups 1 and 2 stay more organized makes sense when one considers the poor organization of many groups in the control condition, many of whom jumped from one topic to another during the debate, and who did not appear to coordinate their efforts well during the unit. In my (first author) observations of all classes during the unit, I noticed that some groups in the control condition experienced difficulty staying organized. Often such groups researched a topic, researched the topic again later during the unit, and then researched it yet again. However, they were not looking for new or deeper information about the same topic, they were looking for the same type of information. For example, a group with the stakeholder perspective of adopted children in one of the control classes continually researched how many adopted children there were in Indiana and in the U.S. They asked me to help them find information on Day 3, and I provided them two links that they could use as well as strategies for finding further information. They continued to search for information about the number of adopted children in the US and in Indiana for much of the rest of the unit, usually finding the same sites. Part of the reason that they were stuck in a cycle of continually searching for the information may have been a lack of organization. They clearly did not keep track of search histories or strategies.

That the groups that used the Connection Log appeared to be more organized than students who did not use the Connection Log is in line with the findings of Simons and Klein (2007), who found that students who were required to use scaffolds were more organized than those who were in the scaffolding optional and no scaffolding conditions. Greater organization as supported by scaffolds benefits not only argumentation, but also ill-structured problem-solving success (Jonassen, 2003).

The capacity of hard scaffolds to promote inclusion of all required project parts. Daniel noted that the Connection Log helped his group ensure that they included all required parts of the presentation. This is consistent with the findings in the literature that students who are exposed to evidence-based argumentation scaffolds in the form of question prompts or video modeling determined more relevant information to gather than students in control groups (Pedersen & Liu, 2002-2003).

Many articles we reviewed that did not employ control groups also indicated that scaffolds promote the inclusion of all required project parts (e.g., Kyza & Edelson, 2005). Daniel's group's efforts to find evidence to support their claims mirrored that of groups who were prompted by empty evidence boxes in Progress Portfolio to include more evidential support for their hypotheses (Kyza & Edelson). This could be because the Connection Log fulfilled the group's conceptual scaffolding needs by guiding its members on what to consider (Hannafin et al., 1999). However, few authors articulate what about the scaffolds promotes the inclusion of all required project parts. Especially when scaffolding was not designed expressly for use with a particular unit, what about the scaffolding makes students add more information in order to meet project requirements? In Daniel's group's case, it appeared to be the act of looking back at what his group had entered into the scaffolds alongside the prompts that guided his group as to what to find. Members of Group 2 thus appeared to be scaffolded not only by what we had written a priori in the scaffolds, but what they wrote in the text boxes of the scaffolds as they went through the unit.

The Connection Log as reference and communication aid. A very interesting finding was that the Connection Log helped the members of Group 1 to communicate. Our literature review indicated that students might benefit from being required to input their responses to question prompts into a database that could be accessed later (Blumenfeld et al., 1996; Kyza & Edelson, 2005). We thought that in the process of articulating their thoughts, students would think about what they were thinking, and that by writing what they thought, the exact rendering of their thought would be available for their group mates to read and analyze. This effect appeared to be manifest in Erin's experience with the Connection Log, as she noted benefiting from having to create a textual representation of what was in her head.

However, the nature of the communication aid that the Connection Log appeared to provide to the group–facilitation of communication between the native-English-speaking members of the group and the ENL member and

continuity of the group's functioning when a group member was temporarily absent–was of a nature that we had not envisioned or encountered during our literature review. First, the question of what scaffolding needs ENL students have and how computer-based scaffolds can be designed to fulfill those needs has to our knowledge not been addressed in the scaffolding literature. That Alejandra felt that she could stay aware of what her group mates were thinking and doing by reading what they wrote in response to the Connection Log's prompts is interesting in that it suggests new areas of scaffolding that should be investigated. Though Alejandra is only one ENL student, the fact that she felt involved in the group as a result of reading what her group mates wrote rather than what they said suggests a possible new line of research into scaffolding in K-12 settings: what features of computer-based scaffolds best support ENL student's efforts during PBL units.

Second, Erin and Alejandra contended that the Connection Log helped the group function when Robert went to another part of the room. We found no literature in which cases of small groups working in PBL units are described in which one group member goes off to be alone, and the other group members describe what helped them continue during his/her absence. However, communication problems normally ensue when one of two people who are talking leaves in mid-conversation. That the Connection Log countered some of those difficulties by allowing Erin and Alejandra to read what Robert had written is interesting and merits further investigation.

Group 1's members also noted that they appreciated being able to compare each other's ideas. As Robert noted, many times group members would write one thing and say another. When this happened, the group members could hold a discussion about what they really meant in order to come to consensus. We found no articles in which the capacity of hard scaffolds to promote the process of comparing ideas was explored. However, Robert's comment makes sense because often during the unit Erin found herself saying one thing and writing yet another. As she noted, "everything always sounds better in my head." By being forced to commit her idea to writing, Erin also made her idea available to her group mates. Alejandra also committed ideas to group discussion through the use of the Connection Log. While we found that Robert was the group leader, not all group ideas originated with him. This finding is consistent with findings in the literature that computer-based scaffolds can provoke the discussion and explanation of ideas among group members, and that this interaction in turn can lead to better ideas.

Another interesting finding is that the members of Group 2 used what they typed into the Connection Log as a reference. Though members of Group 1 did not specify that they used what they wrote in the Connection Log as a reference, they did note using what they wrote for the presentation, which indicates that they did consult their notes when coming up with their presentation. This finding is consistent with the finding that students in control conditions did not consult notes when coming up with a solution, while students using Progress Portfolio (in which they could record thoughts) did (Kyza & Edelson, 2005). However, often students engaged in inquiry units did not consult their paper-based notes when determining a solution (Blumenfeld et al., 1996) or evaluating why a solution was not ideal (Puntambekar & Kolodner, 2005). That the members of Groups 1 and 2 referred to their notes when determining a solution is promising and warrants further research. If the Connection Log can lead students to consider their research when arriving at a solution, it could help students engaged in PBL be more efficient and successful. Few would argue that research done during a PBL unit should be forgotten after it is performed, or that students should research the same topic multiple times to find the same information.

What is the Impact of the Connection Log on Individual Argumentation Skills?

Main Effect of the Connection Log on Argumentation Scores

The main effect of the Connection Log on the individual argumentation scores is interesting for several reasons. First, articles examining the impact of hard argumentation scaffolds to tend to not employ the use of transfer tests of content knowledge or skills as response measures. To our knowledge none that involve middle school students use such tests. So our finding of a significant effect of the Connection Log on individual argumentation adds to the literature base on argumentation scaffolding for that reason.

Second, the overall effect size of 0.35 indicated that the magnitude of the effect of the Connection Log on individual argumentation skill was medium-small (Cohen, 1969). It is important to note that the effect was achieved through use of the scaffolds during a PBL unit during an eight-day span. Students only started using the scaffolds, and then only for about ten minutes, on the third day of the unit. Though an effect size of 0.35 is not enormous, it does appear to suggest that the Connection Log can positively impact student achievement in a substantial way.

Direct instruction has not produced consistent results in raising middle school and other students' argumentation skills (Knudson, 1991; Martunnen & Laurinen, 2001). Thus, the Connection Log's significant effect on individual argumentation skills is important in that it suggests that scaffolds such as the Connection Log may fill an important gap in helping middle school students raise their argumentation skills. One characteristic of successful

middle school "graduates" is that they are intellectually reflective people who can "analyze problems and issues, examine the component parts, and reintegrate them into either a solution or into a new way of stating the problem or issue" (Carnegie Council on Adolescent Development, 1989, p. 15). Another characteristic is that they "have learned to learn, a critically important capacity because of the rapidly changing nature of occupations and jobs" (CCAD, p. 15). In short they should be able to solve problems and build effective arguments.

Nested Effect of the Connection Log on Argumentation Scores

The finding of a simple main effect of greater magnitude than the main effect of the Connection Log on the individual argumentation skills of lower-achieving students may indicate that certain aspects of the Connection Log supported greater improvement in lower-achieving students' ability to recognize the extent to which a statement supports a claim. It is not clear why this may be the case as there is little literature that examines the differential impact of evidence-based argumentation scaffolding on different types of students. However, it may be that differences in the magnitude of the effect of the Connection Log resulted from students in the lower-achieving sections using the Connection Log in a different way than students in the higher-achieving sections. Insight into the different ways higher-achieving and lower-achieving students used the connection log may be gained from looking at the ways Group 1 and Group 2 used the Connection Log. Like Daniel's group, Robert, Alejandra, and Erin used the Connection Log to get and stay organized. But they also used the Connection Log to aid communication and to compare ideas, while Daniel's group did not.

The interesting finding to discuss in terms of the impact of the Connection Log on individual argumentation skill is its use to compare ideas. The process of comparing ideas, especially when the ideas are about evidence and claims could potentially raise one's skill in evaluating the evidential support for a claim because it is essentially practice performing the task. That is, as Robert, Alejandra, and Erin were comparing ideas and trying to come to consensus, they had to explain to each other why they thought that a particular piece of evidence supported or not their claim, or if their claim was valid. Daniel's group did not claim to do this and did not appear to do this as much from the video evidence. Practice performing a task can vastly improve one's ability to perform it. Observations indicated that many groups in the higher-achieving section of the experimental condition did not appear to engage in as many types of conversations of this type, but that other groups in the lower-achieving section of the experimental group did.

The effect size for the treatment among lower-achieving students of .61 was medium (Cohen, 1969). Given the initial difficulties that the students experienced using it and the relatively short treatment length, the impact of the Connection Log on individual argumentation skill appears to be substantial, and should be investigated further.

What is the Impact of the Scaffolding on Group Argumentation Quality?

The finding of no significant effect of Connection Log on claim, evidence, or connection scores was disappointing, and may be due to low power to detect significant differences. The power to detect significant effect of the Connection Log was 0.19, and the power to detect significant nested effect of the Connection Log was 0.35. Such low power makes it less likely that a researcher will detect significant differences.

The finding could also be due to a ceiling effect. Sixteen out of 30 groups attained the maximum score of six on claim, nine out of 30 groups attained the maximum score of six on evidence, and 13 out of 30 groups attained the maximum score of six on connection. This large number of maximum scores leaves one to wonder whether some of those groups would have scored higher than six if the scale had been wider.

There is a relative lack of studies in which transfer of scaffolded skills is measured. The lack of a significant effect of the Connection Log on group argumentation quality is consistent with the findings of Cho and Jonassen (2002), who did not find a significant transfer of argumentation scaffolds on problem-solving tasks. The finding is also partially consistent with a study in which scaffolds' transfer to a problem-solving task, as compared to didactic and help conditions, was inconsistent (Pedersen & Liu, 2002-2003).

Limitations and Suggestions for Future Studies

In this section we discuss suggestions for future research using (1) the Connection Log with a similar unit, (2) the Connection Log with a different unit, and (3) other systems developed using the guidelines for the development of computer-based scaffolds to support evidence-based argumentation.

Using the Connection Log with a similar unit. Future researchers should investigate how other small groups use the Connection Log and other scaffolding systems like the Connection Log in similar and different units. Also important is determining if students from similar and different student populations use the Connection Log in a similar manner as Groups 1 and 2 on a similar unit. We specifically chose to focus on how two small groups used the Connection Log so that we could gain in-depth information. However, such a strategy limits the potential generalizability of findings (Stake, 1978). It is likely that members of other groups would use the Connection Log in different ways. Would other groups use the Connection Log to compare ideas and/or to aid communication? Would they use it to get and stay organized, or to ensure inclusion of all required project parts?

Future researchers should also use a wider rubric to assess students' debate performances. The potential ceiling effect may have contributed to the lack of significant results in this study. A rubric that allows for a greater number of possible scores may allow more substantial differences in scores to emerge between groups.

Using the Connection Log with a different unit. We designed the Connection Log such that it could be used in a variety of PBL units. As such, it would be important to determine if similar impacts on individual argumentation skill and group argumentation quality can be ascertained when the Connection Log is used in conjunction with units of differing content, length, and depth. For example, if the unit topic were global warming, and students needed to write a letter to Congress expressing their opinion about global warming and what should be done about it, would students use the Connection Log in a similar manner to Group 1, Group 2, or neither? Would lower-achieving students tend to use it in a similar manner to Group 1, and higher-achieving students in a similar manner to Group 2? Or would they use the Connection Log in a different manner?

Using the Connection Log with a different unit and with a similar unit, it would be interesting to determine the extent to which the system helps ENL students with limited English proficiency be involved in their group. It is possible that Alejandra was an isolated case and that other students with similar difficulties speaking and understanding spoken English would not benefit from reading what their group mates wrote in the Connection Log.

Used with a unit of different topic or length, the Connection Log may have an impact on group argumentation quality. This can only be learned with further research.

Using other systems. An interesting study would examine how students use other scaffolds developed using our guidelines for the development of computer-based scaffolds to support the creation of evidence-based argumentation. Would features inspired by the guidelines (e.g., networked connectivity), and exhibited by other scaffolding systems, be helpful to middle school students? Would such a scaffolding system show positive impact on individual argumentation skill or on group argumentation quality?

Last, future research should examine when and how the Connection Log or other systems like it could be faded, as the literature base currently does not describe well the fading of hard scaffolds (Pea, 2004; Puntambekar & Hübscher, 2005). The guidelines for the development of argumentation scaffolds that recommended that all scaffolds be part of a system and that students articulate their thoughts caused me (first author) to design the Connection Log in such a way that fading it would have been difficult. Each student needed to type their answers to

prompts in order for group mates to be able to read each other's input. One of the only existing models for the fading of hard scaffolds involves students individually deciding when they do not need the former any more (Puntambekar & Hübscher). But if a group using the Connection Log were made up of Students A, B, and C, and Student A decided she did not need the scaffolds any more, but Students B and C deemed that they did, that would be a problem. We do not know how the Connection Log could be individually faded. However, that does not mean that it cannot be done.

Conclusion

Students will face unique challenges in the 21st century, and to help them prepare, schools need to incorporate inquiry-based instructional activities such as PBL so that students engage in authentic inquiry in school (Brush & Saye, 2001; Gallagher, 1997; Keys & Bryan, 2001; Sandoval & Reiser, 2004). Creating evidence-based arguments is central to student success during a problem-based learning unit (Jonassen, 2003). Doing so is particularly difficult for middle school students due to challenges (a) adequately representing the problem that is the focus of the unit (Ge & Land, 2004; Liu & Bera, 2005), (b) determining the most relevant evidence that they must gather and the process of gathering it (Pedersen & Liu, 2002-2003), and (c) synthesizing the information that they gathered to construct a sound argument (Cho & Jonassen, 2002).

Scaffolding has been advocated as one way to help college (Cho & Jonassen, 2002) and secondary (Bell, 1997) students build evidence-based arguments while participating in PBL unit. We designed and developed the Connection Log to support the creation of evidence-based arguments among middle school students engaged in a variety of PBL units, and implemented it in two out of four class sections participating in a PBL unit on the HGP. We detected no significant differences on claim, evidence, or the connection of claim to evidence ratings of debate performances. However, students used the Connection Log in different ways, and we found a significant main effect of the Connection Log on individual student argumentation ability, as well as a significant simple main effect of the Connection Log on the individual argumentation ability of lower-achieving students. Results of this study show the potential of the Connection Log to help middle school students overcome the challenges of creating evidence-based arguments.

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One Laptop for Each Middle Schooler: Practical Findings from a Recent Study

Ward Mitchell Cates, Lehigh University

Ubiquitous computer access has long been touted as making a difference in the educational endeavor (see Gayeski, 1989; Kay, 1984; Ravitz, 1999; Rogers, 2001). One version of such access takes the form of using individual wireless laptop computers (Hill, Reeves, & Heidemeier, 2004; Rockman et al., 2004; Russell, Bebell, & Higgins, 2004). Such computers provide each student in a class with anytime/anywhere access to instructional programs, the World Wide Web, and productivity tools that may be employed for instructional purposes. In recent years, a number of such "one-to-one" laptop initiatives have been implemented for individual schools, entire school districts, and entire states (Ubiquitous Computing Evaluation Consortium. 2005). As Zucker (2004) and Ross., Lowther, and Morrison (2001) noted, however, not all implementations have been rigorously evaluated.

This paper reports findings from a recent study of a one-laptop-per-student initiative in grades six and seven of a four middle schools in a single school district in the Northeastern United States. The study was conducted over 9 months (October through June). During this period, students had the same "personal" computer to use every day, although they were not able to take their computers home at night. Students used Apple iBook[TM] laptop computers to take notes, to explore a variety of Websites, to prepare word-processed documents for their various content subjects, to prepare presentations, to conduct research online, and for other similar group and individual computer activities. This study used data triangulation across multiple points in time and multiple respondents, including observational data to assess how the studied laptop implementation affected teachers and students, with a particular focus on changes in teaching/learning practices in the classroom. While not unique (see for example, Burns & Polman, 2006; Metiri Group, 2006; Sargent, 2003; Silvernail & Lane, 2004, Windschitl & Sahl, 2002), this study was rigorous in deriving its data sources and in seeking to correlate related data sources to produce a clearer picture of the impact of the implementation on teacher and student attitudes and teaching/learning skills.

Data Collection

In mid-October, I interviewed the principals of the four middle schools, as well as the assistant principals for curriculum (sixth grade). Each interview took approximately one hour and used the same interview protocol instrument. During the four weeks from mid-October to mid-November, all sixth and seventh-grade teachers, as well as affiliated special education teachers, were surveyed. The response rate for teachers was quite high; all but a handful completed the survey and returned it. All sixth-grade students were also surveyed during this period. In addition, all sixth-grade teachers were observed teaching one class. These measures were intended to supply baseline data. At this point not all laptops had been distributed, nor were they in frequent use in schools.

The first week of February, I interviewed all four principals and all four assistant principals for curriculum once again, this time using a slightly modified version of the initial interview protocol. While at each middle school, I left surveys for all sixth and seventh-grade teachers, as well as affiliated special education teachers, to complete. Within a week, I had received the vast majority of teacher surveys. Once again, the response rate was high, although a slightly higher percentage of blank or partially blank surveys were returned.

In late April and early May, all 42 sixth-grade teachers were observed teaching one class. In May and early June, all sixth and seventh-grade teachers, as well as affiliated special education teachers, were surveyed a final time. In this same time period, all sixth-grade students were also surveyed. In mid-June, I interviewed the principal and assistant principal for curriculum at each of the four middle schools. Once again, the same protocol was used for all interviews, although this protocol was once again slightly modified from the midpoint version, in this case to focus more on summative assessments and reflections.

This study employed classroom observations. Clearly not all instructional activities are suited to the use of technology and one takes the luck-of-the-draw in whether one will see technology in use during a single 50-minute observation. We did not ask teachers to modify their plans and use technology so that we could observe its use. We figured instead that observing classes, regardless of whether they were using technology during that period, would produce a more representative picture of how often and in what ways technology was being used in the schools. Of course, this decision may account for the percentage of teachers who were not using computers during each observation period.

All surveys reported herein constitute self-report data. A caution is in order: It is important not to mistake self-report data for factual evidence. That is, what someone reports on a survey may or may not be accurate. Self-report data may be affected by respondent awareness, experience, perceptions, and divergent intentions.

Findings

This section is divided into four subsections: *Student Findings, Teacher Observational Findings, Teacher Survey Findings*, and *Principal Interview Findings*. Under each subheading, I discuss relevant data from that data source.

Student Findings

A total of 817 sixth-grade students responded to the baseline student survey in October, while 795 sixth-grade students responded to the final student survey in May. The survey consisted of 59 items across 6 scales. Table 1 details these scales.

Table 1. Distribution of Teacher Survey Items across Scales (with Reliabilities)

Focus of Scale	Number of Items	Reliability
Student technology skills	18	.871*
Student comparison to "typical" students on technology skills	3	
Student feelings about school and learning	10	.625
Student opinions about technology	9	.630
Student ratings of how technology makes them feel	11	.772
Student preferences for classroom technology uses	8	.778
TOTAL ITEMS:	59	

* NOTE: For purposes of reliability calculations, the first pair of scales was combined.

Table 2 summarizes student responses to items in the six scales used in the survey. Student responses to each scale are discussed beneath the table.

Table 2. Mean Response Data for Baseline and Final Student Survey (by Scale)

Focus of Scale (highest possible rating)	Baseline Mean Rating	Final Mean Rating	Net Change	% Change
Student technology skills (5)	2.43	2.61	+.18	+3.5%
Student comparison to "typical" students on technology skills (3)	2.32	2.38	+.06	+1.9%
Student feelings about school and learning (4)	3.14	3.14	0	0%
Student opinions about technology (4)	3.22	3.26	+.04	+1.1%
Student ratings of how technology makes them feel (5)	3.98	3.95	-.03	-0.4%
Student preferences for classroom technology uses (5)	3.76	3.77	+.01	+0.3%

Note: Highest possible rating for each scale indicated in parentheses after scale focus description. Higher ratings are better.

As Table 2 illustrates, responses to the first scale went up dramatically, while two other scales went up moderately, and three stayed largely the same. Although Table 2 shows percentage of change for each scale baseline to final, rather than cite results solely by percentages, from this point on differences will be discussed in terms of **effect size (ES)**. The effect size describes how great an effect a significant change between measurements suggests has taken place. That is, it goes further than a simple significance rating to identify effects in terms of their magnitude. An effect size of **.2** is considered *small*, while an effect size of **.5** is considered *medium*, and effect sizes of **.8 or greater** are considered *large*.

The increase in ratings on the first scale across 18 separate technology skills is statistically significant (ES = **+.32**). This scale employs five points, with *one* representing **technology skills** students report they do not have and *five* representing self-reported skills at a level where the student usually helps other students complete a task involving technology. On the baseline, students reported they often needed help to perform almost all of the technology tasks listed. Only four items were rated above 3.0 *(often do alone),* and these included *using word*

processing (3.37), *turning the computer on and off* (3.29), *searching the Web* (3.28), and *using a printer* (3.27). Thus, sixth graders apparently did not feel they had much skill in completing most technology tasks.

In contrast, on the final survey seven items were above 3.0 and eight items had increases that were significantly higher (Effect sizes ranging from **+.27** to **+.46**). The final survey results suggest students now viewed themselves as able to handle many technology tasks independently (*often do alone* or *help others*). The technology tasks they see themselves needing help on or not doing include *using databases* (2.49), *making graphics and editing pictures* (2.42), *using CD-ROMS* (2.24), *making videos* (1.83), *taking digital photos* (1.73), *editing videos* (1.70), *doing email* (1.60), and *using a scanner* (1.51). A number of these were technology tasks not currently completed in these schools and thus may have received lower values because many respondents answered *don't do*.

Ironically, when asked to compare their skills to those of "typical" students, the surveyed sixth graders described themselves on the baseline as about one-third of the way between *about the same* and *better* (mean = **2.32** out of 3.0). Thus, although they did not rate themselves as strong in completing these technology tasks, they appeared to believe that other students were not much stronger. Despite the significant increases in students' assessments of their independence in completing technology tasks by the end of the study, students did not raise their assessment of comparison to "typical" students much (mean = **2.38** out of 3.0).

Students were asked to rate how they feel about **school and learning**. On a four-point scale, they rated themselves on the baseline at a mean of **3.14**, the same mean rating as on the final survey. This means that they rated most statements in this section of the instrument as being *usually true* of them. The statements in this section with which students agreed most strongly included *School prepares me well for the future* (means = **3.53**, baseline; **3.59**, final) and *When I do well in school, it is because I have tried hard* (means = **3.53**, baseline; **3.51**, final). The two items with which they most disagreed were *When I do badly in school, it is the teacher's fault* (**2.30** baseline, **2.34** final) and *How I do in school is completely out of my control* (**2.43** baseline and **2.41** final).

The next section of the instrument asked students their **opinions about technology**. On a four-point scale (*not true!* to *always true!*) the mean for items in this section was **3.22** on the baseline and **3.26** on the final survey. This means student respondents on average rated the statements on this scale as about one-quarter of the way between *usually true* and *always true!* Two items in this scale had effect sizes were equal to or greater than .2: Students assigned a mean rating of **3.42** to *I can do assignments when I have to use the computer*, up **.17** from the baseline (ES = **+.20**) and *The teachers in my school know how to use technology* went down .15 from the baseline to **3.13** on the final survey (ES = **-.20**). One of the highest rated items in this section on both baseline and final survey was *I want to use a computer more* (means = **3.60** and **3.57**, respectively). The items on this scale with which they disagreed most on both baseline and final survey were *Computers are a waste of time* (means = **2.17** and **2.11**) and *Technology makes it harder for me to get my work done* (means = **2.35** and **2.27**).

Students were asked next to respond to statements about **how technology makes them feel**. On a five-point scale from *never* (1) to *all of the time* (5), students assigned a mean rating of **3.98** to statements in this section on the baseline and **3.95** on the final survey. This suggests they felt the statements were true *most of the time*. The highest rated items on both baseline and final was *I like using computers in class* (means = **4.51** and **4.48** respectively). The items with which students expressed the greatest disagreement were *When we use computers, I feel left out* (means = **1.17** baseline and **1.15** final), *I get nervous when we will be using technology* (means = **1.28** and **1.21**), and *I have trouble with the software we use in class* (means = **1.65** and **1.58**). Only one item on this scale had a baseline-to-final effect size of .2 or greater: *I'm excited when I get to use a new computer program*. This item went from **3.92** (baseline) to **3.66** (final), producing an effect size of **-.20,** suggesting a faded novelty effect.

The final section of the student baseline survey asks students to tell how much they like particular **uses of technology in the classroom**. They were asked to rate such uses on a five-point scale from *I don't like it!* (1) to *It's great!* (5). Across the eight items in this section, students assigned a mean baseline preference of **3.76**, about three-quarters of the way from *It's OK* to *It's good*. This mean rating went up slightly to **3.77** on the final survey. The uses they rated most highly included *going online to look for facts or materials* (**4.06** and **4.11,** respectively) and *doing research on the computer to complete an assignment* (**4.01** and **4.08,** respectively). Only one item on the scale showed a baseline-to-final change that met the .2 effect size threshold: *My group uses a computer to prepare a report or presentation*. The mean for that item went from **3.79** on the baseline to **4.08** on the final, making it one of the best liked activities (ES = **+.25**). It is interesting to note that these top three uses are ones facilitated by having individual laptops.

Teacher Observational Findings

As noted earlier, all sixth grade teachers were observed by the same classroom observer, using a standardized observation protocol. The focus of the observation was the extent to which technology was

incorporated into the observed lesson. Table 3 presents the proportion of time in which computers were used in the classroom during the observation. Table 4 shows observer ratings of teacher apparent comfort on the final observation in using technology, while Tables 5 and 6 show ratings for instructional effectiveness and holistic assessments on final observations.

Table 3. Observed Computer Use by 42 6th Grade Teachers (in minutes, divided by observation period/activity)

Activity	School 1		School 2		School 3		School 4		TOTAL	
	Baseline (n=1)	Final (n=5)	Baseline (n=3)	Final (n=4)	Baseline (n=0)	Final (n=6)	Baseline (n=1)	Final (n=8)	Baseline (n=5)	Final (n=23)
Whole-class Use	1.5	31.5	87.5	11.0	0	85.0	27.5	0	116.5	127.5
Student Team Use	0	44.0	0	62.5	0	0	0	73.0	0	179.5
Individual Student Use	0	19.0	0	26.0	0	73.5	0	138.5	0	257.0
Students Learning Tech	0	0	20.0	0	0	0	0	0	20.0	0
Teacher Administrative Use	0	6.5	0	0	0	0	0	18.0	0	24.5
Handling Tech Problem/Setup	0	5.0	2.5	3.5	0	0	0	19.0	2.5	27.5
No Computer Use	48.5	144.0	40.0	97.0	0	141.5	22.5	151.5	111.0	534.0
Total	50.0	250.0	150.0	200.0	0	300.0	50.0	400.0	250.0	1150.0

Table 4. Final Observation Mean Ratings of Teacher Apparent Comfort with Technology (divided by task)

Observation Item Task	Applicable # of Teachers Observed	Mean Rating (of a possible 4)
Setting up equipment.	9	3.00
Handling minor technical problems.	12	3.00
Maintaining lesson flow while changing from one technology to another.	14	3.57
Helping students use technology.	13	3.38
Using traditional technologies (overhead, slide projector, tape recorder)	6	3.67

Table 5. Final Observation Mean Ratings of Apparent Instructional Effectiveness of Computer Uses

Observed Computer Use	Applicable # of Teachers Observed	Mean Rating (of a possible 5)
Word processing	9	3.89
Using teaching/learning programs	9	4.00
Searching the Internet/Web	9	4.44

Table 6. Final Observation Mean Holistic Assessments of Instructional Use of Technology

Observation Item Task	Applicable # of Teachers Observed	Mean Assessment (of a possible 5)
Students appeared comfortable using technology.	20	4.85
Technology used seemed well matched to instructional tasks to be accomplished.	20	4.80
There was enough technology available to accomplish intended tasks.	21	4.76
When working with technology, students seemed self-directed.	20	4.70
Students appeared engaged by the lesson.	21	4.62
Instructional pacing felt smooth with technology causing few interruptions.	20	4.60
Technology not used for its own sake, but to enhance lesson.	21	4.48
Use of technology did not cause discipline or classroom management problems.	21	4.43
Teacher appeared well focused on lesson and little distracted by technology.	20	4.25
Students appeared excited about using technology.	20	3.75

As Table 3 shows, while only one school had more than one teacher observed using technology at baseline, all four schools had multiple technology-using teachers at final. In fact, there were 4.6 times as many teachers observed using technology at final than at baseline and these teachers were observed using technology for 4.4 times as long. Perhaps equally important, the pattern of technology use observed was very different at final, with more individual student and team use as opposed to the whole-class used observed on the baseline. Tables 4 through 6 demonstrate that final observations revealed teachers who were more comfortable using technology and who used technology in ways well matched to instructional goals without disrupting pacing or creating classroom management problems. The observer holistically concluded that students were engaged by these technology-using lessons and

technology enriched the lessons (as opposed to simply being an add-on for technology's sake). The observer was asked to assess equity of access and use and concluded opportunity was about the same for student regardless of gender or race. The observer did conclude, however, that in terms of perceived academic level, students at lower perceived levels of academic ability actually had slightly more opportunity to use technology than other students. Teacher Survey Findings

The teacher survey was made up of 10 scales, ranging in reliability from +.746 to +.903 (Cronbach's alpha). Table 7 shows the change baseline to final for these 10 scales.

Table 7. Baseline and Final Teacher Survey Mean Response Data by Respondent Groups (Aggregated by Scale, Sorted by All Respondents Effect Size)

Scale	All Respondents (n=103)			6th Grade (n=42)			7th Grade (n=43)			Special Education (n=18)		
	Baseline Mean	Final Mean	Effect Size	Baseline Mean	Final Mean	Effect Size	Baseline Mean	Final Mean	Effect Size	Baseline Mean	Final Mean	Effect Size
Student Independence Using Tech / Comparison to "Typical" Students	57.93	68.79	0.83	59.61	70.00	0.84	60.76	70.21	0.81	47.67	65.08	1.28
Teacher Role in Student Success / How Much Difference Teacher Makes	92.39	85.58	-0.74	92.27	84.64	-0.91	93.17	86.65	-0.72	90.78	86.86	-0.36
Previous Training's Value in Preparing for Tech Use/ Value of Types of Future Training	70.16	63.77	-0.53	69.31	67.23	-0.20	70.77	60.93	-0.76	70.50	61.25	-0.76
Quality of Tech Support	10.10	11.06	0.38	10.02	11.18	0.42	10.17	11.00	0.35	10.11	11.07	0.42
Integration of Computers in the Classroom	37.32	40.33	0.33	39.00	40.88	0.23	37.26	38.53	0.13	33.83	42.71	1.00
General School Support for Technology Use	32.63	34.36	0.31	33.27	35.67	0.47	33.14	34.36	0.20	29.82	32.71	0.68
Student Use of Types of Software	35.70	37.50	0.20	37.35	38.25	0.10	34.79	34.65	-0.02	33.77	42.07	0.87
Beliefs about Technology's Value in Education	81.04	79.71	-0.16	82.29	80.13	-0.26	80.76	81.13	0.05	79.00	76.38	-0.37
Teacher Confidence and Comfort with Technology	49.81	50.18	0.05	49.90	50.69	0.12	51.29	51.32	0.00	45.81	47.57	0.25
Teacher Use of Types of Software	38.31	38.38	0.01	39.62	38.13	-0.17	37.92	37.47	-0.05	35.69	39.67	0.47

As the left column in that table illustrates, 7 of 10 scales had significant changes baseline-to-final. Highest among these was enhanced student technology competence and independence, as well as their comparison to typical students. Teachers were asked to compare the technology skills of their students to "typical" students. Teachers rated students on a three-point scale (*worse, about the same, better*). As Table 8 shows, teacher ratings came up significantly.

Table 8. Baseline and Final Mean Teacher Response for *Comparison to "Typical"* Scale (with Effect Size)

Item	Baseline Mean Rating	Final Mean Rating	Net Change	Effect Size
In using computers, my students are…	2.21	2.40	+.19	.31
In using software, my students are…	2.09	2.27	+.18	.32
In learning new technology, my students are…	2.18	2.35	+.17	.29

Two scales went down significantly, *Teacher's role in student success / How much difference the teacher makes* and *Previous training's value in preparing for technology use / Value of future training*. All but one of the 15 items on the *Teacher role / Difference* scale went down. This seems to suggest that teachers perceived themselves as being less effective or making less of a difference as the year went on. Some teachers call this the "wear-down"

factor: As the year goes on, they become less optimistic and feel less effective. Over the summer many teachers then recharge and come back optimistic again in fall. The fact that this scale was significantly lower at final should not surprise us. It suggests instead that technology does not enhance the teachers' sense of impact. As further evidence that this scale may be measuring a technology-independent variable, it is worth noting that –in the depths of snowy and cold February—teachers actually rated this scale lower than at final. The *Previous training/ Future training* scale lists seven possible sources of previous preparation to use technology and asks the respondent to rate the extent to which he or she acquired skills from that source. The scale next lists 17 different types of training and asks the respondent to rate the potential benefit of each on a five-point scale. Of the 7 sources listed, only one source showed a significant increase in teachers attributing their computer skills to its role. That source was *in-service courses and workshops* and showed a mean change from **2.85** on the baseline to **3.23** on the final (ES = **+.51**, *medium*). Of the 17 different types of training listed, all showed marked drops in perceived benefit baseline-to-final. The mean differences ranged from **-.22** to **-.57**. There were still five types of training that are at or above the middle position (*moderate* benefit) and that these five are ones that were among the top rated types on the baseline as well. While all 17 types rated at (or within .02 of) at least *small* benefit on the baseline, two types of training –*introductory computer basics* and *word processing basics*—were now below that level, suggesting a sizable portion of teachers rated them as of *no* benefit. In general, all "basic" training now seemed of lower perceived benefit.

Teachers rated quality of tech support significantly higher on final than on baseline and, as Table 9 shows, two of the scale's three items had notable effect sizes.

Table 9. Baseline and Final Mean Teacher Response for *Quality of Tech Support* Scale (with Effect Size)

Item	Baseline Mean Rating	Final Mean Rating	Net Change	Effect Size
I have enough access to tech support to resolve hardware, software, and tech use problems.	**3.01**	**3.48**	+.47	**.46**
I [do not] have to contact our tech-support person several times before I get assistance.*	**3.29**	**3.62**	+.33	**.31**
The on-site tech-support person is committed to getting the technology running and keeping it running well.	**3.81**	**3.96**	+.16	.17

* Note: Words in brackets indicate item was reversed on the survey.

The *Classroom Computer Integration* scale lists a variety of ways to use technology and asks the teacher to rate frequency of use on a five-point scale from *not at all* (1) to *every day* (5). Table 10 shows the baseline and final means, net change, and effect sizes for all 12 items. It lists items in descending order, based on final reported frequency of use.

Table 10. Baseline and Final Mean Teacher Ratings for *Classroom Computer Integration* Scale (with Effect Size)

Item (Uses)	Baseline Mean	Final Mean	Net Change	Effect Size
Independent learning (students working alone on individual computers)	**3.93**	**4.05**	+.12	0.12
As a **research and class preparation tool for you**	**3.84**	**4.01**	+.17	0.15
Individual instruction (one student on one computer)	**3.67**	**3.96**	+.29	**0.27**
As an **instructional resource for students** (Websites, online files)	**3.38**	**3.65**	+.28	**0.26**
As a **research tool for students**	**3.11**	**3.45**	+.35	**0.33**
As a **productivity tool for students** (create charts, reports, other products/artifacts)	**3.28**	**3.37**	+.09	0.09
As a **communication tool for you and your students** (email, electronic discussion)	**2.97**	**3.33**	+.35	**0.21**
As a **problem-solving tool for students**	**3.11**	**3.28**	+.17	0.16
Cooperative groups (teams working on computers)	**3.05**	**2.92**	-.13	-0.11
As a **classroom presentation tool for you and/or your students**	**2.56**	**2.79**	+.22	0.19
Whole class instruction (one computer as central focus)	**2.37**	**2.69**	+.31	**0.25**
Small group instruction (teaching subgroup of students using a single computer)	**2.08**	**2.61**	+.54	**0.43**

Only one of 12 uses has lower reported frequency on the final than on the baseline: *use by cooperative groups*, and that effect size is less than .2 (as well as the reported final frequency still hovering close to the *once a week* point on the scale). In fact, it appears to be a verified common use of computers by sixth-grade teachers, since *use of computers by a team of students* made up 15.6% of observed computer use during the final set of observations

(see Table 3). The two most frequent reported uses are for *independent learning by students* and as a *teacher research and class preparation tool*. On the five-point scale, these equate to *several times a week*. These were the two most frequent uses reported on the baseline as well. Although both final frequency means are higher than on the baseline, the change does not meet the .2 threshold. The next use is *individual instruction* and teachers reported it was also used close to *several times a week*. The increase from baseline to final was significant, with an effect size of **+.27**. This seems to confirm what the observer found in final observations, where *individual student use of computers* constituted 22.3% of observed computer use. The next five uses were reportedly used more than once a week, but less than several times a week. Of these five, four had effect sizes larger than +.2. Of the final four uses in the list that were reportedly used less frequently than once a week, two had effect sizes greater than +.2. These two, *whole class instruction* and *small group instruction*, are the least frequently reported uses of computers, but both increased notably from baseline. In particular, *small group instruction* showed the greatest change, moving from *once a month or less* to almost two-thirds of the way to *once a week*.

Going back to Table 7, we find the next largest scale effect size is for *general school support for technology use* (ES = **+.31**). This ten-item scale addresses time, access, nature of training, and administrative encouragement. Respondents were asked to rate their agreement with a series of statements, using a five-point scale from *strongly disagree* (1) to *strongly agree* (5). Six of the 10 items met the .2 effect size threshold, all positive (see Table 11). While these six statements showed significant baseline-to-final increases, it is perhaps useful to examine the final means as a way of gauging teacher end-of-year sentiment. Respondents moved substantially closer to *agree* in terms of their rating of administrative support for training. This suggests an enhanced perception of such support. The next three statements, however, were ones where respondents are only one-third or so higher than *neutral* in their final mean responses. This suggests either that many respondents were undecided on these statements or perhaps that some group of teachers was in greater agreement, while another was in lesser. The final two statements in Table 11 are ones that have moved from halfway between *disagree* and *neutral* to two-thirds of the way. While this is desirable, once again, it suggests at least some sizeable portion of respondents still disagreed with these statements. Thus, it appears that there may have been room for improvement in teacher perception of general school support.

Table 11. Baseline and Final Mean Teacher Ratings for Key Items from *General School Support* Scale (with Effect Size, Ordered by Final Mean)

Item	Baseline Mean	Final Mean	Net Change	Effect Size
The administration supports technology-related training.	3.70	3.87	+.17	.22
My school gives me enough tech-related support.	3.09	3.39	+.31	.32
I have had adequate training in using computers.	3.12	3.36	+.24	.22
Training is offered often enough to meet my needs.	2.97	3.29	+.32	.34
Teachers [do] have enough time to develop good instruction using technology. *	2.46	2.71	+.26	.26
I have enough time to learn computer skills	2.45	2.68	+.23	.23

* Note: Words in brackets indicate item was reversed on the survey.

On the *student use of types of software* scale teachers were asked to tell the frequency with which their students used 15 types of software. The scale offered five points, from *not at all* (1) to *every day* (5). Eight of these items showed significant changes in reported frequency baseline-to-final. Table 12 lists all 15 uses, ordered by final survey reported frequency of use. The top four student uses remain the same baseline-to-final, although all show a marked and significant increase in reported use. Reported student use of drill-and-practice software jumped ahead of educational games (whose reported use was unchanged). The single greatest change was in reported use of presentation software, which is now used approximately *once a month*. Graphics software exhibited a similar rise in frequency of use and is also now reportedly used about once a month. The three types of software reported as having the lowest frequency of use were simulations, movie-making, and collaborative writing. These same types of software were rated as three of the least frequently used pieces of software on the baseline (and on the midpoint). While simulations showed lower reported student use on the final than on the baseline, that difference had an effect size less than .2. Only one use showed lower reported frequency of use at that level on the final survey: *collaborative writing* software. Based on teacher comments, it appears this software was little used during the study.

Table 12. Baseline and Final Mean Teacher Ratings for *Student Software Use*
(with Effect Size, Ordered by Reported Frequency)

Item (Type of Software)	Baseline Mean	Final Mean	Net Change	Effect Size
Word processor (AppleWorks, Open Office, etc.)	3.81	4.02	+.21	.23
Web browser (Internet Explorer, Netscape, etc.)	3.67	3.91	+.25	.26
Online search engines (Google, Yahoo, MSN, etc.)	3.35	3.70	+.34	.31
Websites with downloadable images or files.	2.96	3.24	+.28	.22
Drill and practice (quiz programs, self-test and practice programs, multiplication drills, etc.)	2.58	2.89	+.31	.25
Educational games (Tom Snyder products, History Concentration, Alien Rescue, etc.)	2.89	2.89	+.01	0
Presentation software (Keynote, PowerPoint, etc.)	1.88	2.36	+.48	.58
Graphics (iPhoto, PhotoShop, GraphicsConverter, etc.)	1.91	2.22	+.30	.31
Teaching and learning programs (Geometer's Sketchpad, MasterKey, etc.)	2.00	2.09	+.09	.08
Spreadsheet (AppleWorks, Open Office, etc.)	1.93	2.07	+.15	.15
Database (AppleWorks, Open Office, etc.)	1.73	1.78	+.05	.05
Audio capture / editing (Audio Recorder, Finale Notepad, QuickTime, etc.)	1.54	1.67	+.13	.15
Simulations (Sim City, Sim Ant, etc.)	1.66	1.54	-.12	-.12
Movie-making (iMovie)	1.50	1.52	+.02	.03
Collaborative writing (SubEthaEdit)	1.74	1.52	-.21	-.21

Principal Interview Findings

Although principal interviews used a structured form and this same form was used with both principals and assistant principals, the data gathered tend to be more divergent. That is, because of the interactive interview process, respondents sometimes headed in directions that differed slightly from those initially intended by a question. At the same time, such divergence tends to produce a richer data set. While some questions were common to all three interview forms, each interview also used different questions focused on identifying changes occurring as the year progressed. This section summarizes the three interviews holistically, emphasizing changes as appropriate.

When asked in October, principals said one would see little technology use in classrooms in the building, but this changed progressively to the point at final that they felt technology was widely used and widely integrated into the classroom ethos. This matches what student and teacher surveys and classroom observations suggested. As might be expected, principals noted technological issues as serious problems as the beginning but these became less a concern as the year went on. Many principals noted teacher anxiety as a "technology-related problem" in the early stages, but not at final. This suggests the teachers were indeed becoming more comfortable working with technology and more confident in their abilities and the abilities of their students.

Principals noted that the laptop initiative appeared to be leading to better teacher planning for classes and a change from teacher-centered, more authoritative models of teaching to more student-centered, distributed-knowledge models. Principals noted that the availability of online resources and content seemed to have enriched the instructional environment considerably, reducing reliance on the textbook. Better time management was also cited, since the use of online resources like *First in Math*[TM] and other similar activities made it possible to use even small time segments for instruction, as well as offering the chance to keep all members of the class engaged at their own instructional level while addressing the needs of subgroups of students in the classroom. Principals suggested this led to more hands-on time and more time-on-task than was previously possible. Principals also noted that students were beginning to move toward seeing a need for communication: They read and write to persuade, with technology helping them present their arguments. This seems to confirm the dramatic increase in use of presentation software revealed in both survey and observation.

In disagreement with teacher surveys, principals felt there was insufficient support for technology use. They appeared, however, less focused on nuts-and-bolts tech support and more focused on support for curricular integration of technology and enhanced teaching/learning practice. They saw the beginnings of use of technology to differentiate instruction and were anxious to see this use enhanced. One principal noted that the greatest benefit of the initiative was staff development: Teachers were being exposed to new instructional techniques and technology was being used to facilitate the implementation of these techniques. All principals wanted more such in-service training, feeling that it did much to enhance the effectiveness of the teaching staff, regardless of technology use.

Principals were asked to put a dollar amount on the value to each individual student of having a laptop computer for the entire year. This question was a challenge for them. Three of the five classified its value differently according to the user or use, suggesting a range of value. The responses of the five respondents who were able to assign a dollar figure ranged between $250 per student and $3333 per student (mean range: $1300 to $1500 per student). They felt the value depended on the nature of the student and the use, suggesting students who lacked access outside school or who were more challenged academically perhaps benefited more than other students. As one principal said, "It's the equalizer; it puts every kid on the same level." They noted that the initiative had equalized access and instructional practice across the schools, eliminating what some perceived as pre-existing inequalities among the four middle schools.

Principals suggested the laptop initiative produced more engaged teachers and learners and more enthusiasm among students for learning. Principals suggested this was not based on the technology itself, but rather on the access to resources it provided and the changes in teaching practice that had accompanied the use of technology. Principals also noted that students seemed better equipped with real-world skills than they had been before the initiative was implemented. Principals universally praised the school board for its courage in supporting the laptop initiative, suggesting the initiative should be continued.

Discussion and Interpretation

The final survey data support the conclusion that tech support currently meets teachers' perceived needs. Although principals cited a variety of minor glitches and logistic problems in all three sets of interviews, the teachers almost universally seemed pleased with both the level of support they received and the responsiveness of those who supply it. Given the size of this initiative and the demands it places on a school district, this is certainly something to which the district may point with pride. That teachers and principals now wanted to move further and get deeper into curricular applications and integration is a favorable sign.

Special education teachers appear to have embraced this initiative. They showed significantly more favorable reactions across a wide range of items on both midpoint and final survey and rated their students as working more independently on the midpoint than the baseline and on the final than on the midpoint. Analysis of baseline-to-final changes show the greatest changes among all teachers surveyed, changes that suggest special education teachers were using technology, their students were using technology, and both special education teachers and students were growing in confidence and independence. There is much discussion in the literature about how technology can help special populations, in many cases such help is limited by the amount of technology available to them. If special education teachers were correct in their assessment that students were able to perform more tasks independently without teacher help, this offers the possibility of providing a kind of 'intellectual robotics' that enables special education teachers to do more with technology than they would be able to do without it.

Anecdotal reports from the principals indicated students may be more engaged by laptop-enriched learning experiences. Several principals also suggested each student having a laptop may enable teachers to do some basic differentiated instruction, mostly through pacing and individualized materials. Principal comments implied support for curricular integration continued to be the most pressing need in the school district. They indicated the greatest potential of the technology may be in differentiating instruction to address the needs of a much wider range of students than most teachers were currently able to address. In fact, in final interviews, some principals even suggested the district might consider moving from individual laptops to class sets, freeing previously committed funds for use in enhancing professional development for curricular integration and differentiated instruction.

In any school district, at least some portion of the population will likely leave school prior to graduation from high school. Student ratings of their own technology abilities went up significantly on the posttest measure and students viewed themselves as even more capable than "typical" students. If teacher and student assessments of student independence using technology are accurate, this initiative appeared to be producing at least some of what are termed *21st Century Technology Skills* in middle school students. This should enhance their real-world employment opportunities, regardless of how much farther they go in the system.

Clearly, an initiative like this one is expensive. Most principals suggested having a laptop was of greater value to some students, for some subjects, and when used by certain kinds of teachers. Should the district have to reduce the scope of the laptop initiative in future, this may offer a starting point for hard decisions. For instance, exactly which students benefit the most and why? Which subjects lend themselves most to academic enhancement through use of laptops? And what are the characteristics of teachers who make the most effective use of laptops with their students?

When principals were specifically asked to judge whether the laptop initiative was a success or not, they unanimously rated it as a success, although they noted ways in which its implementation might be improved in

future. As one of the principals noted in the midpoint interviews, it is not technology that makes the difference; it is solid pedagogy. Thus, while having laptops may enhance instructional opportunity, it cannot, in and of itself, enhance academic achievement. The principals suggested, however, that discontinuing the initiative would have negative effects on instructional practice and morale, as well as act to reinstate some of the educational inequities that apparently existed before the initiative was implemented. Several principals also suggested at least some segment of the parent population would be disturbed, perhaps because of lost opportunities for their children, perhaps because a school laptop represents almost the only way their children can gain access to such technology.

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Chinese Students' Perceptions of
Cooperative Online Distance Education Interaction

Yu-ching Chen
University of Central Florida

Background Information

Interaction is considered to be a necessary and important ingredient for a successful learning experience so distance learning practitioners and researchers have concerned with how much interaction a distance learning environment could provide for students (McIsaac & Gunawardena, 1996). Vygotsky (1978, 1986) asserts that a great deal of learning occurs in a social context and is brought out by interactions with other people. The process of interactivity among learners brings in the benefits including analyzing, synthesizing, and evaluating course content (Lave, 1991), increases in learning achievement (Bates, 1993), applying higher levels of cognitive processing (Garrison, 1993), and development of collaborative and cooperative learning skills (Berge, 1995). Computers can potentially contribute to a sense of community within the group and create a social bond which offers important motivational and cognitive benefits in learning (Harasim, 1992).

Western culture values individualism; pedagogical practices are designed for developing individualism and individuated skills while Chinese culture is highly collectivist and pedagogical practices tend to reflect the importance of the group (Carson, 1992). As a result of culture differences, online interaction practices in distance learning within Western culture may not be beneficial to Chinese students.

The purpose of this study was to find out Chinese students' attitude toward their interactions with peers, instructors, course material, and interface in a cooperative online distance education environment. The kinds of interaction facilitating Chinese students' learning, the barriers encountered, and suggestions to overcome these barriers were investigated in the study.

Activity theory was applied in analyzing Chinese students' interactions in a cooperative distance learning environment. Activity theory (Leont'ev, 1978; Vygotsky, 1978) is increasingly being used to explain social aspects of technology-supported learning (Jonassen, 2002). Activity theory can contribute to computer-supported collaborative learning by "[understanding] learning not as the internalization of discrete information or skills by individuals, but rather as expanding involvement over time—social as well as intellectual—with other people and the tools available in their culture" (Russell, 2002, p. 65).

Activity theory has its origins in the social-historical approaches around 70 years ago and can be characterized in (a) objective, (b) ecological, and (c) socio-cultural perspectives on human activity (Kaptelinin, 1996). The key elements of activity theory related to computer-supported cooperative learning are shown in Figure 1:
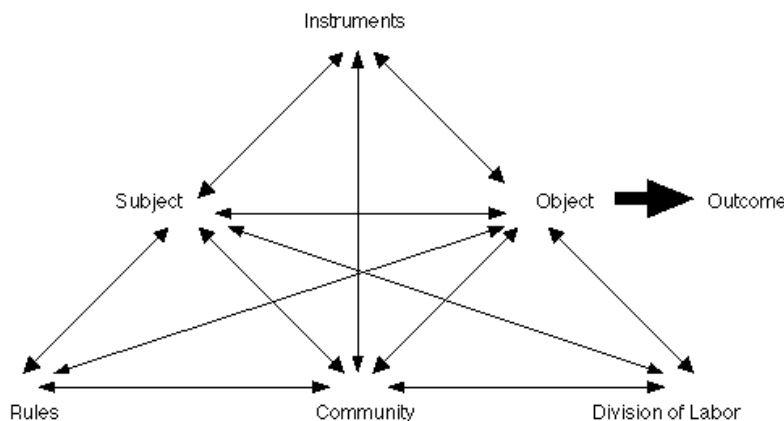
Figure 1. *Engestrom's classic model of Activity Theory*. The model shows the relationship between the subject, the object and the community, as well as how rules, instruments, and the division of labor are used in transforming the object into the desired outcome (Engestroem, 1987).

There are seven elements in the model and the definition of each element as follows (Jonassen, 2002; Jonassen & Rohrer-Murphy, 1999; Collis & Margaryan, 2004):

1. Subject: The individuals such as leaner, peers, facilitator, supervisor, instructor, and mentor who participated in the activity.
2. Instruments: Methods, resources, supports, online tools and environments that facilitate the activity such as technological tools, networks, and learning resources.
3. Object: Products created by the subjects during the activity such as learning tasks, assignments, and projects.
4. Community: Socio-cultural environment in which interactivity takes place such as virtual classroom and organization.
5. Rules: Standards and norms of the community that rule the activity such as frameworks, culture and other standards that influence the learning environment.
6. Division of Labor: Roles and relationships within the community that affect task division and responsibilities. For example, roles and relationships within cooperative teams and courses.
7. Outcome: The overall results achieved by the activity system such as final products and learning outcome.

From the prospective of Activity theory, the process of cognition is no longer studied based on certain aspects individually but on the interaction between learners, tools, resources, and context that influence learning in a socio-cultural setting.

Methodology

A purposeful sampling was used to select participants in University of Central Florida who: (1) have taken at least 2 online or mixed mode courses; (2) have used the function of discussion board or chat room; and (3) must be over 18 years old. Four in-depth interviews were conducted to give an in-depth portrait of their participation. In order to completely understanding the feelings of the participants, the qualitative research was conducted for researcher to go deep into the interviews. The whole interview was recorded. The audio-tape was then transcribed by the researcher and a Grounded Theory Analysis based on Activity theory was done on the transcripts.

Data was gathered in the fall 2006 semester and consisted of: (1) Four face-to-face audio-taped semi-structured interviews lasted for 30 to 50 minutes; and (2) Four field notes, 5 analytic memos and more than 20 journal entries. Recordings were transcribed and compared with field notes, analytic memos and researcher's journal for details. The data was analyzed using Grounded Theory methods.

Results and discussion

The results that organized according to Activity Theory indicate:

Subject—Subject

A number of participants said that course mail was commonly used in Chinese students' cooperative online interaction and it was helpful to their learning. They felt that they were comfortable to interact with others by this asynchronous communication tool because they were allowed to have more time understanding what others said and have sufficient time to respond to others. The participants expressed that:

"I like email, I usually ask questions and if we had teamwork, I discussed with my teammates and asked professor questions using emails."

"we usually used email to contact with others. We used email to exchange word documents, draft, something like that…. I like email because I can have more time to think about what I want to say and I have more time to check their feedback and response."

Asynchronous online discussion boards were also commonly used and they were regarded to be a helpful tool in Chinese students' cooperative online interaction. A participant said that:

> "…the discussion board is useful for me to post our reflection for the class and our projects. For me and for that class, the discussion board most of the time is to post something but sometimes we can get feedback from classmates."

Rules—Instruments

However, synchronous online discussion tools such as chat room were not regarded to be useful to Chinese students according to their cooperative learning experience. All participants expressed the similar experience that they didn't like to use chat room due to flaws in technology and language barrier.

> "I don't like chat room is that I think the design of the program is not good at all. I mean if there are more than three or four [people participated], if more people talk at the same time, the screen will refresh very quickly and it's hard to track what was said."

> "I can not type English very fast so sometimes I felt that I can't catch up [with] their speed. Sometimes when I finish my typing, they already jump to the next topic or next issue. So let me feel like kind of, you know…embarrassed or upset."

Subject—Community

As for Chinese students' attitude toward cooperative online interaction, in general, most of them had passive attitudes toward cooperative online discussions. They basically didn't actively take part in discussions unless they were required to do so. However, compared to face-to-face discussions, they felt more comfortable and were more willing to express themselves in online environments.

> "I don't feel stressed in posting discussions. The professors set up due dates and I posted when required. If I don't post it I won't get grade."

> "For me, if you don't ask me to [express my ideas] I won't do it but I think for somebody, if you ask them to do, I think Asian students will express themselves more freely if they are required to in the online environment than in face-to-face class."

Division of Labor—Instrument

To improve cooperative online interaction and make Chinese students' learning experience a successful one, most of them agreed that instructors' skills in designing activities and facilitating interactions were essential abilities in promoting successful cooperative online distance education interaction.

> "I believe that [a comfortable online discussion environment] depends on how the professor designed the courses. The way the professor designed that could make me comfortable to express my ideas. I think it's the feeling to make you feel comfortable and you will be more willing to talk."

> "I think the professor's ability to use chat room was important. If the professor could keep an eye on all students in the chat room and facilitate some students. I think that'll be better."

Subject—Instrument

To facilitate Chinese students' cooperative online distance education interaction, participants recommended integrating more technology features such as video and audio into cooperative online learning environment to help them correctly interpret others' ideas and efficiently communicate with others.

"I think maybe they can use some kind of video chat so I can see others' faces to feel more reality not just see words."

"I would like to say to integrate video and audio communication tools there, I think that'll be much better and much efficient and effective to communicate."

Conclusion

According to Chinese students' cooperative online learning experience, interacting with other peers and instructor was frequently taken place and asynchronous communication tools such as email, course mail, and discussion boards contributed to their interactivity and learning. However, due to barriers such as language and cultural difference, Chinese students were not fully comfortable in interacting with others using synchronous communication tools. They needed more time to organize their ideas, as well as understand others' and needed time to compose their feedback. The interface of these tools and instructors' facilitation skills were considered to be an important role in successful cooperative online learning interaction. Because of culture difference, Chinese students would not actively participate in cooperative online learning interactions unless they were asked to do so. Besides instructor's facilitation skills, integrating technological communication features such as video and audio into chat room was recommended to improve cooperative online learning interaction. To better serve Chinese students' learning needs and help improve their learning outcomes, instructional designers and instructors should be aware of Chinese students' experience of interaction in cooperative online distance education.

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Do flashy interfaces help? Comparing learning efficiency of different interface types based on cognitive load theory

JongPil Cheon, Michael Grant
University of Memphis
jpcheon@memphis.edu
mgrant2@memphis.edu

Abstract

The purpose of this study was to examine the efficiency of three different interface types on Web-based instruction: a text-based interface, a graphical interface and a metaphorical interface. In order to determine which interface type reduces cognitive load, learning efficiency scores formulated with performance scores and mental effort levels from 50 undergraduate students were compared. Results indicated there was no difference among the groups in terms of learning efficiency. Based on the results, implications for instructional designers are presented.

Introduction

In Web-based instruction, the user interface is a communication point between an instructional unit and a learner. While instructional designers are making efforts to develop effective and aesthetically pleasing interfaces, designing a usable and appealing interface, in fact, is still challenging for instructional designers (Metros & Hedberg, 2002; Chalmers, 2003). The importance of the user interface in Web-based instruction has been emphasized by many researchers: attracting learners' attention (Hron, 1998; Szabo & Kanuka, 1998), facilitating communication between a learning domain and learners (Metros & Hedberg, 2002; Parizotto-Ribeiro & Hammond, 2005), and reducing cognitive load (Chalmers, 2003; Haag & Snetsigner, 1993; Hannafin & Hooper, 1989).

Cognitive load has been measured by a learner's difficulty level or time to completion. In addition, a learning efficiency metric has been used to quantify the efficiency of instruction (e.g., Clark, Nguyen & Sweller, 2005; Tuovine & Paas, 2004). The efficiency score is calculated by performance and mental effort, meaning a high efficiency condition occurs when performance is higher and effort is less (Tuovinen & Paas, 2004). Based on cognitive load theory, researchers and practitioners have proposed interface design guidelines (e.g., Norman, 1998; Shneiderman & Plaisant, 2005; Swan, 2001). The following guidelines have been proposed to reduce cognitive load; (a) provide informative system feedback (Norman, 1998; Shneiderman & Plaisant, 2005); (b) use intuitive elements (Norman, 1998); (c) provide directions (Swan, 2004); (d) avoid extraneous objects (Beriswill, 1998; Swan, 2004); (e) use organizational strategies (Chalmers, 2003; Norman, 1998); (f) provide visual elements (Swan, 2004); and (g) enhance learner's autonomy (Shneiderman & Plaisant, 2005; Swan, 2004).

A cognitive load perspective is used to evaluate how well the user interface supports the cognitive processes involved in the task (Plass, 1998), and the goal of the approach is the interface should impose as minimal as possible a cognitive load on the learner (Stoney & Wild, 1998). In a graphical user interface, graphical elements have been used to make Web pages pleasing in order to get users' attention. In addition, the elements use metaphors to assist users to intuitively navigate through a system (Lang, 2003). While menu buttons or images employ different metaphors to reflect each function in a graphical interface, metaphorical interface design has been proposed to connect whole-screen or system-environment to the instructional content (Haag & Snetsigner, 1993). A metaphorical interface design focuses on creating an interactive environment that reflects the learning content in order to provide learners with instructional cues. Metaphor plays a significant role in scaffolding the learner to intuitively interact with multimedia resources (Hron, 1998; Lang, 2003), because it helps the learner structure links between theme and content (Cates, 1996; Hron, 1998). Like graphical user interfaces, metaphorical interfaces can also decrease cognitive load and disorientation (Hron, 1998). However, there is little empirical evidence for the benefits of graphical or metaphorical interface regarding learning outcomes and cognitive load. Therefore, the purpose of this study was to examine if the interface of Web-based instruction affects learners' performance and cognitive load with three different interface types: a text-based interface, a graphical interface and a metaphorical interface.

Methodology

   Three different types of user interface were implemented with the same content on Cognitive Information Processing theory. The process of developing these three instructional units consisted of two layers: content layer and interface layer (Beriswill, 1998). First, in the content layer, learning materials, which were presented in the form of various media types, such as images and interactive sample experiments, were developed to provide the learners with cohesive learning. The same learning materials, including informational graphics and interactions, were used in all three instructional units. Next, in the interface layer, design guidelines based on various studies were applied to implement three different user interfaces as shown in Figures 1, 2 and 3. These instructional units provided different navigation designs, but the basic mechanism was same in that the units had both linear and user-controlled navigation.
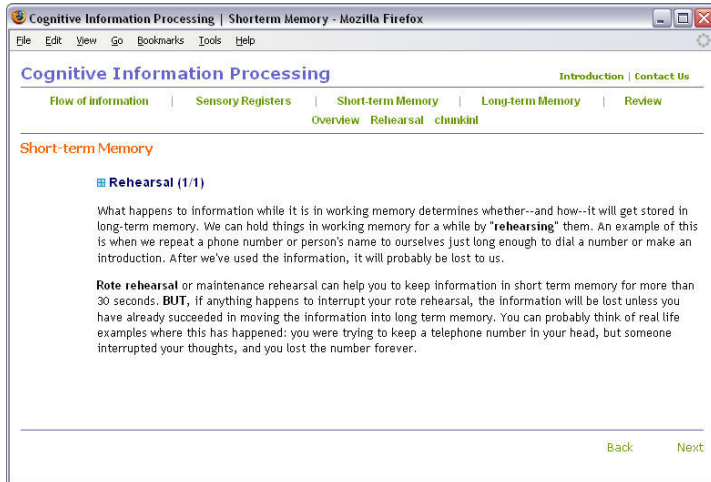
Figure 1. Text-based interface implemented with typography and basic design guideline (Lee & Boling, 1999)
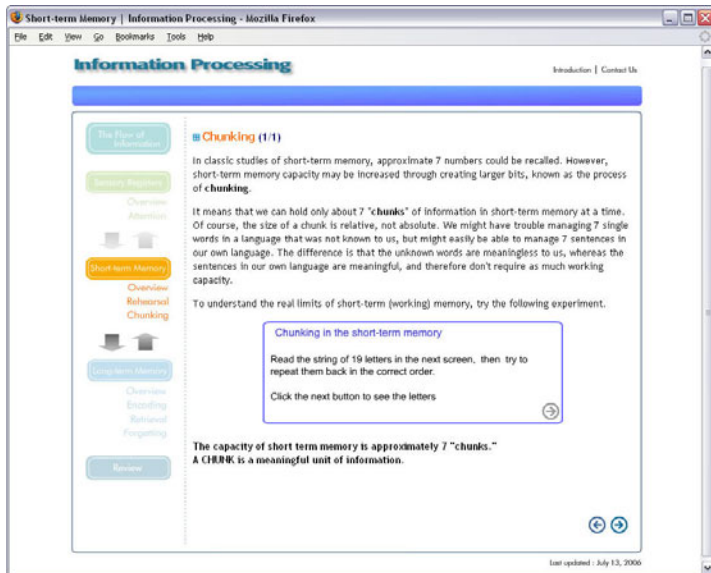
Figure 2. Graphical interface using five guidelines: unity, proportion, homogeneity, balance, rhythm (Parizotto-Ribeiro, Hammond, Mansano & Cziulik, 2004)
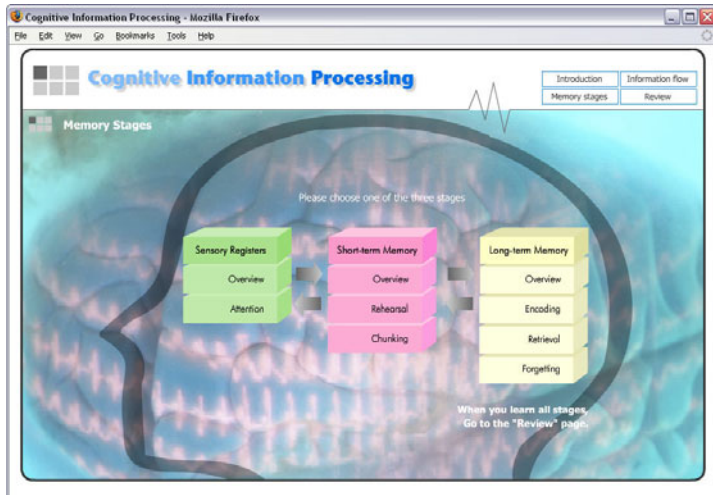
Figure 3. Metaphorical interface with primary and secondary metaphor (e.g., Cates, 1994; Lang, 2003; Hron, 1998)

Various data were collected from fifty undergraduate students: a pretest score, time to complete the instruction, a difficulty level of the instruction, a posttest score and responses for the attitude survey adapted from the studies of Ciavarelli (2003) and Moreno and Valdez (2005). The difficulty level, which can be called mental effort rating, was rated by the question adapted from Kalyuga and Sweller (2005): "Please indicate how difficult the test you just took was by clicking on the appropriate degree of difficulty." The participants had to select one of the nine degrees ranging from extremely easy to extremely difficult. Cognitive load was measured with the time to completion, the mental effort for instruction, and the responses to the questions in the attitude survey. The mental effort and score difference between pretest and posttest were used to quantify learning efficiency.

Results

First, pretest scores and post test scores were analyzed with one-between, one-within mixed analysis of variance (ANOVA). There was no difference of learning performance regarding interface types while all instructions were effective in increasing test scores (F=2.356, p=.109).

Second, three variables were used to compare cognitive load in the three interface groups: (a) mental effort for the instruction, (b) time to completion for the instruction and (c) attitude survey data. The mental effort scores were obtained when students rated the degree of difficulty on a scale of 1 to 9. The analysis of variable (ANOVA) revealed that there was no difference among groups in terms of mental efforts and time to completion (Time to completion: F=.123, p=.884; mental efforts: F=.609, p=.549).

Third, the performance score and mental effort for the instruction were used to quantify learning efficiency. This analysis followed Paas, Tuovinen, van Merrienboer and Darabi (2005) process for measuring efficiency. Regarding the performance score, differences between the pretest and posttest scores were used in the learning efficiency formula because the pretest scores among groups were different. The two data were standardized since they were scored with different scale, and learning efficiency score was computed by the formula as follows:

$$E = \frac{P - M_E}{\sqrt{2}}$$ (E = efficiency, P = performance, M_E= mental effort)

The graphical interface had the highest efficiency score (E=.1240) as compared to the text-based interface (E=-.0882) and the metaphorical interface (E=-.0052, but the analysis of variance (ANOVA) revealed that there was no difference among groups in terms of efficiency scores (F =.101, p=.904).

Finally, the answers to the six questions in the attitude survey regarding cognitive load showed that there was no difference other than the question number 4 asking if the interface captured learners' attention (F=8.400, p=.001). The mean scores and standard deviations presented in Table 1.

Table 1
The mean scores of the attitude survey questions

Questions	Text-based	Graphical	Metaphorical
1. It took too long to complete.	3.62 (1.12)*	3.38 (1.39)*	3.63 (0.60)*
2. There is too much information on the pages.	3.69 (1.03)*	3.00 (1.41)*	3.42 (0.90)*
3. Graphics or other elements on the pages are distracting.	4.54 (0.52)*	4.38 (0.51)*	4.26 (0.45)*
4. Elements on the page, such as heading and graphics, focused my attention.	2.77 (1.01)	3.15 (0.90)	4.00 (0.75)
5. The information layout and locations are consistent throughout the instruction.	4.08 (0.95)	3.69 (0.75)	4.05 (0.78)
6. The menu is consistent throughout the instruction.	4.15 (0.99)	3.77 (0.84)	4.16 (0.38)

[a] Standard deviations are given in parentheses
* The three values of the question 1, 2 and 3 were recoded so that higher number represents positive perception.

Discussion and conclusion

This study was designed to explore the effects of interface on Web-based instruction. It should be noted that all interface types applied design guidelines based on the previous research and convention. The hypothesis was that a metaphorical interface would be the most effective and efficient interface, but the results revealed that there was no significant difference among groups in terms of performance or cognitive load. The implications of this research are informative to instructional designers as they develop Web-based instruction. First, this study revealed that interface did not exert any influence on learning performance, so instructional designers and developers should focus on creating meaningful instruction with interactions because the learners depend on more these elements than on the interface. Second, interface did not affect learners' cognitive load and learning efficiency. An aesthetically pleasing interface did not make any difference in cognitive load. It implies that time-consuming works of making attractive interface may not be worth the investment.

Even though the results indicated that both graphical interface and metaphorical interface were not beneficial to learning, the study requires further investigation with different assessment, domain and learning materials. For example, the assessment in this study was focused more on declarative knowledge, so a different assessment which includes more procedural or application knowledge might produce different results. A concrete domain instead of the abstract domain that was used in this study could be examined with different interface types. In addition, one type of interface with different types of learning materials could investigate to determine which combination of interface type and learning material is more effective.

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Analyzing Learners' Collaborative Behaviors
Using Activity Theory

Hyungshin Choi
Ewha Womans University

Myunghee Ju Kang
Ewha Womans University

Abstract

The primary goal of the study is to analyze learner behaviors during collaborative group work in a digital learning community. A qualitative data analysis program, NVivo 2, was used to code the vast amount of online transcripts and written interviews based on the grounded theory. Resulting codes were aligned in the four subsystems of activity theory and the activation of subsystems by group work phases was investigated. Conflicting factors and facilitating factors while college students achieve a common learning goal were identified. At the same time, whether the high performing groups show patterns of learner behaviors, conflicting factors, and facilitating factors that differ from those of the low performing groups was examined.

Introduction

A digital learning community (DLC) is an emerging instructional approach that embraces the characteristics of collaborative learning and computer-mediated communication in networked environments. A DLC draws attention because it provides students with opportunities to extend their learning experiences by sharing their new ideas with, and receiving critical and constructive feedback from, community members (Palloff & Pratt, 2005). Also, learning together in a DLC provides chances for students to improve collaboration and communication skills that are required on the job (Bennett, 2005). Furthermore, teamwork is another generic skill developed in higher education (Candy, Crebert, & O'Leary, 1994). In recognizing the benefits of a DLC, the questions that come to mind are "How do learners in a DLC collaborate to achieve a common learning goal?" and "How do we need to design and support such nontraditional pedagogies of learning?"

Despite the promising benefits of collaborative learning, learners experience tensions from mixed feelings of wanting to learn independently and a fear of being isolated from the community. Dirkx and Smith (2005) argued that these negative experiences are derived from "ambivalence." A major focus of Computer-Supported Collaborative Learning (CSCL) has been providing better ways of understanding learners in communication and collaboration to achieve learning goals. Group synergy created by collaboration, however, is not fully explained by CSCL theory and still remains as abstraction (Stahl, 2006).

The direction of research has been geared toward two aspects of CSCL, that is, outcomes and processes. Research examined the effectiveness of different tools, techniques, and learner outcomes in collaborative learning. On the other hand, the process-oriented research examined socio-cultural factors and learners' language acts (Treleaven, 2004). Activity theory has been used to understand human behaviors in a social context and is one of the major theories on which CSCL is based.

This study attempted to shed light on the process of online collaboration with activity theory. The investigation revealed different patterns of learner behaviors during collaborative group work which is aligned with the framework of activity theory. In particular, both facilitating and conflicting factors were identified after analyzing the data from online transcripts and semi-structured interviews. This study also sought to determine if any differences exist between high and low performing groups for both factors in their collaboration activities.

Theoretical Background

Activity theory is a philosophical and multi-disciplinary framework to research various forms of human behaviors. It has been used as a socio-cultural analytical framework in social contexts with humans and mediators (Kuutti, 1996; Jonassen & Rohrer-Murphy, 1999). The applications of activity theory are found in learning (Hung & Wong, 2000; Barab, Barnett, Yamagata-Lynch, Squire, & Keating, 2002; Johri, 2005; Barab, Schatz, & Scheckler,

2004), human-computer interaction (Kuutti, 1991; Nardi, 1995), instructional design (Jonassen & Rhorer-Murphy, 1999) and work practices (Engeström & Middleton, 1996).

The root of activity theory stems from three historical origins: classical German philosophy from Kant to Hegel, the writings of Marx and Engels, and the Soviet Russian cultural-historical psychology of Vygotsky, Leont'ev, and Luria (Engeström, 1987). Activity theory has evolved and reached the third generation. The first generation of activity theory stems from the idea of mediation by Vygotsky. The second generation of activity theory was derived from Leont'ev's work. He made distinctions between an automatic operation, an individual action, and a collective activity. The third generation of activity theory has expanded to include the activity system by Engeström (1987).

Activity theory has been further developed as a practical model of human activity, an activity system. An activity system contains six interacting components: subjects, objects, tools, rules, division of labor, and community. Activity systems are organized to achieve the goals of activities of the activity subsystems (production, exchange, distribution, and consumption subsystems) that describe functions, interactions, and relationships between the six components. The production subsystem explains how subjects transform the object of the activity system into the outcome. The exchange subsystem shows how subjects are constrained by rules and interact with the community in accordance with the rules. The distribution subsystem describes how the community defines a division of labor for the subject to accomplish the object of the activity system. Lastly, the consumption subsystem shows how the subject and the community around the subject collaborate, and also how the community consumes effort from the subject (Engeström, 1987; Jonassen, 2000).

Research Questions

The study intended to answer the following questions:

1. What are the different patterns of learner behaviors in a digital learning community?
2. What are the emerging conflicting factors in a digital learning community?
3. What are the emerging facilitating factors in a digital learning community?
4. How do the high performing groups differ from the low performing groups in learner behaviors, conflicting factors, and facilitating factors?

Method

Participants and Setting

In order to examine collaborators' behaviors in an online environment, we chose six groups who enrolled in a college-level class, titled 'Information Society and Education,' in the fall semester of 2006 at a large university in Seoul, Korea. Though the class met offline every week, each group of four members also worked independently online on the group project. Ranking each group according to performance, we selected three groups to form the upper half and the other three to form the lower half. Each group selected an instructional design method, submitted a project plan, and implemented an online course. At the end of the semester, each group presented the website they implemented to the class. This research used online transcripts of 24 students and semi-structured interviews of seven participants.

Procedures

The constant comparison method was used to capture real phenomena. As a result, the codes were created from the raw data. The qualitative data analysis program, NVivo 2, was used to code consistently the online transcripts from six groups for fifteen weeks. The coding scheme was divided into three main categories. The first category was learner behaviors that represented the specific behaviors performed by participants. The second category was conflicting factors and the third was facilitating factors. The codes in the learner behaviors category was then further categorized into the related subsystems (production, distribution, exchange, consumption subsystems) defined in activity theory. Upon completion of the coding scheme, the codes and the frequencies of the codes found in both the upper and lower halves were compared.

Results

First, the analysis identified 29 different types of learner behaviors. These 29 open codes generated by the grounded theory revealed seven themes of learner behaviors in a digital learning community, as shown in Figure 1. The seven themes were information seeking (i.e., share material), extraction of relevant information (i.e., summarize material), idea generation (i.e., suggest an idea, request an idea, collect ideas, ask questions), co-construction (i.e., outline tasks, suggest a meeting, suggest group work, request to do work, etc.), division of tasks (i.e., divide tasks, redistribute tasks), making or conforming to rules (i.e., suggest a rule, share template, remind of schedule, raise an issue, etc.), and evaluation (i.e., evaluate material, evaluate self or peer work). The two most frequently observed categories were information seeking and co-construction.
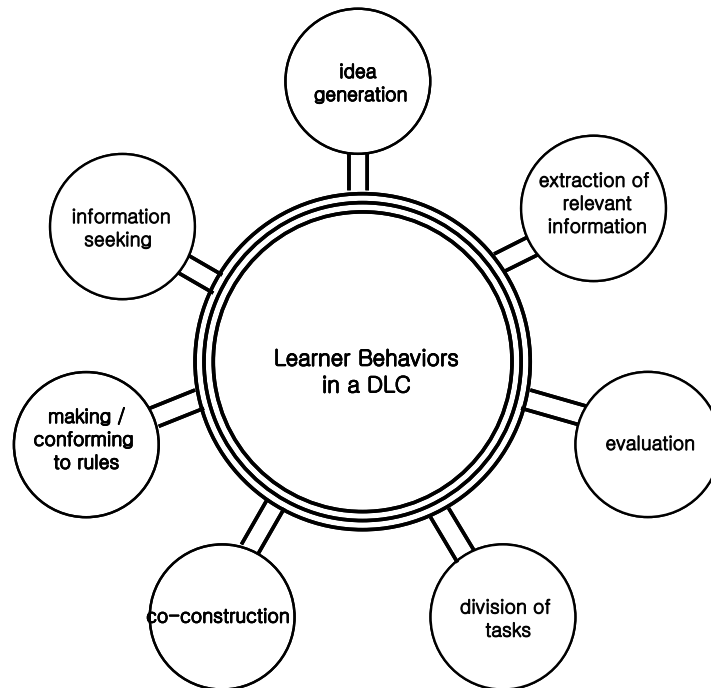
Figure 1. Emerging themes of learner behaviors in a DLC

Those 29 different learner behaviors were aligned with the four subsystems of the activity system based on activity theory. Among the four subsystems (production, consumption, distribution, and exchange subsystems) in the activity system, the consumption subsystem had eleven different behaviors (i.e., share material, suggest an idea, ask questions, etc.) and the highest frequencies of observations. The exchange subsystem had eight different behaviors (i.e., suggest a rule, remind of schedule, evaluate peer work, etc.) and the production subsystem showed five different behaviors (i.e., modifying material, submitting reports, writing meeting minutes, etc.). The production subsystem had more incidents than the exchange subsystem even if it had fewer types of behaviors. Lastly, the distribution subsystem showed one type of behavior, dividing tasks, and showed the least number of incidents. Figure 2 shows how active each subsystem is according to the project phase.
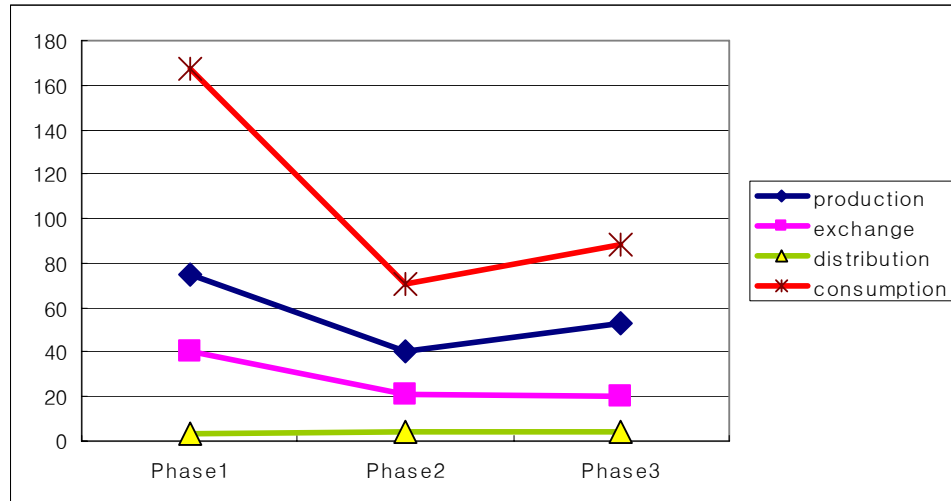
Figure 2. *Activated subsystems by group work phases*

Second, six different categories of conflicting factors emerged: inefficiency of work, unfamiliarity, difficulty in communication, issues of roles, conflicting schedules, and technical difficulties (Table 2). The factor most frequently appeared was inefficiency of work. The reasons of inefficiency included lack of skills, lack of group rules, applying inefficient methods, and lack of necessary resources. The next most frequently mentioned factor was difficulties of communication in online environment. This factor included uncertainty, nonparticipation, difficulty with relationships, and delayed feedback. Other conflicting factors included role-related issues, unfamiliarity, schedule conflicts, technical difficulties, etc. When the observed conflicting factors were matched with the components in the activity system, the most frequently observed conflicting factors resided between subjects and tools components.

Table 2
Emerged conflicting factors

Categories	Open codes	CODE	Definitions
Inefficiency of work	Lack of skills	IW_LS	Work is not performed efficiently due to a team member's lack of skills regarding tools (e.g., Photoshop, Flash) required to complete the group project
	Applying inefficient methods	IW_AI	Work is not performed efficiently due to the fact that a team member used inefficient methods to complete the group project
	Lack of resources	IW_LR	Work is not performed efficiently due to lack of resources to complete the group project
	Lack of group rules	IW_LG	Work is not performed efficiently due to the absence of rules defined by team members to complete the group project
	Difficulty with finding the relevant info	IW_DF	Work is not performed efficiently due to the fact that team members do not know how to find relevant information
Unfamiliarity	Unfamiliarity with processes or methods	UF_UP	Frustrations due to unfamiliarity with how to proceed with the group project and with what methods to use
	Unfamiliarity with topics or material	UF_TP	Frustrations due to unfamiliarity regarding the project topic or the relevant material

Difficulty in Communi-cation	Uncertainty	DC_UN	Difficulty in communication caused by not understanding what other team members meant exactly
	Nonparticipation	DC_NO	Difficulty in communication due to the fact that a team member did not participate in a decision making process
	Difficulty with relationships	DC_DR	Difficulty in communication due to discomfort among other team members especially when there are age differences
	Delayed feedback	DC_DF	Difficulty in communication caused by the nature of asynchronicity of online communication
Issues of roles	Work delays	IR_WD	Issues of roles due to the fact that a team member does not complete one's assigned work on time
	Varying levels of contribution	IR_VC	Issues of roles due to the fact that a team member recognizes inequality of efforts made by each team member
	Issues of role assignment	IR_RA	Issues of roles due to the fact that roles were not assigned equally.
Conflicting schedules	Conflicts with other personal commitments	CS_PC	Conflicting schedules among team members due to jobs, part-time work, or other personal commitments.
	Conflicts with other subjects/exams	CS_EX	Conflicting schedules among team members due to other subjects or exams
Technical difficulties	System issues	TD_SY	Issues with sharing files due to the learning management system
	Corrupted or incompatible files	TD_FL	Issues with sharing files due to corrupted files, or incompatibilities between different versions of software, etc.

Third, the analysis revealed five facilitating factors: efficiency of work, effective communication, the competence of team members, group cohesiveness, and goal orientation (Table 3). The most frequently observed factor was group cohesiveness. This category was composed of intimacy, a sense of community, and encouraging others. When the observed facilitating factors were placed in relevant components in the activity system, the most frequently observed facilitating factors were located between subjects and community components.

Lastly, comparing the high performing groups with the low performing groups, no difference was found in terms of types of learner behaviors. One evident difference was that the high performing groups revealed about 40% more of such incidents. When the learner behavior codes were aligned in the activity system, the consumption subsystem was the most highly activated subsystem, followed by the production, exchange, and distribution subsystems, in that order. A salient difference between the high and low performing groups was that the frequency of the behaviors in the consumption subsystem was in decline at the project completion phase for the high performing groups, whereas that of the low performing groups was increasing. As for facilitating and conflicting factors, the high performing groups revealed more incidents of conflicting factors and fewer incidents of facilitating factors.

Table 3
Emerged facilitating factors

Categories	Open codes	CODE	Definitions
Efficiency of work	Applying efficient methods	EW_AE	Work is performed efficiently because team members use efficient methods to do the group project
	Conforming to rules	EW_CR	Work is performed efficiently because team members follow the rules defined by the team to do the group project
	Efficient role assignment	EW_FR	Work is performed efficiently due to efficient role assignment based on team members' strengths
Effective communication	Timely decision making	EC_DM	Team members make a decision through responsive communication
	Honesty	EC_HO	Team members talk straight regarding the way or the quality of peer work
	Proactiveness	EC_PR	Team members show eagerness or take an initiative in communication.
Competency of team members	Responsibility	CT_RE	Team members are responsible for the assigned task or the project overall
	Competency of tools	CT_CT	Team members are competent in using tools required to complete the group project
	Previous experience	CT_PE	Team members have previous experience or prior knowledge to do the group project
Group cohesiveness	Intimacy	GC_IN	Team members feel close to each other
	Sense of community	GC_SC	Team members have a sense of community, referring to the group as 'we', 'us', or 'our'
	Encouraging others	GC_EO	Team members encourage each other to keep up the good work
Goal oriented	Sense of competition	GO_SC	Team members feel a sense of competition with other teams (performance goal)
	Excellent outcomes	GO_EX	Team members strive to create excellent outcomes (mastery goal)

Discussion and Implications

This study produced a coding scheme that can be used to analyze learners' collaborative behaviors. To generate a coding scheme we have used a mixed approach that is grounded in empirical data and theory based (activity theory). The results of this study showed how production, exchange, distribution, and consumption subsystems were activated during collaborative work. Each subsystem can be considered as a learning space in a digital learning community. This study revealed that the consumption subsystem was the most highly activated subsystem throughout the project phases. DLC design should be able to support learner behaviors identified in the consumption subsystem. Likewise, when learners engage in the production subsystem, necessary tools or artifacts should be available in the DLC environment. In addition, rules govern the learner behaviors during group work. DLC designers should take into account rules that facilitate effective and productive learning. Lastly, division of labor should be designed to ensure both individual accountability and optimal interdependency among team members.

Based on the conflicting factors found in this study, some implications can be made. First, there is a need for different implementation strategies depending on the nature of conflicting factors. It was evident that some of the conflicting factors are not as harmful but can serve as an alert for interventions. The fact that the high performing groups revealed higher incidents of conflicting factors supports Engestrőm's point (2002) that development occurs when contradictions are overcome. Apparently, other types of conflicting factors are harmful and can lead to negative learning experiences or deficient learning outcomes. These include work delays, varying levels of contribution, issues of role assignments, and nonparticipation. An instructor or a facilitator should proactively monitor and intervene by using them as indicators.

Recommendations for Future Research

Based on the results of this study, the following future research is suggested. First, the findings of the study have drawn a few implications in providing an effective DLC learning environment. Those DLC design implications are required to be validated and refined through design-based research. Second, the study implied two different kinds of conflicting factors. This interpretation requires in-depth research regarding specific conflicting factors and how these factors can affect student achievement or learning processes in a DLC. Third, group cohesiveness was the most frequently observed category of facilitating factors. In this study, group cohesiveness is not directly related to group performance. Further research on group cohesiveness and performance would be beneficial. Lastly, the digital learning community in this study was formed rather involuntarily due to the nature of higher education. Future research could replicate this study in an autonomously formed learning community to determine if it reveals different patterns of learner behaviors, conflicting factors, and facilitating factors during group work.

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Instructional Strategies to Influence Self-Efficacy for Technology Integration: A Study of Middle-School Preservice Teachers

Liesl M. Combs
Michael A. Evans
Virginia Tech

Introduction

Middle schools are increasingly confronted with a broad mix of new and legacy digital technologies and personal media devices – handheld computers in classrooms, cell phones in break rooms, and portable gaming devices on playgrounds. The anticipated ubiquity of technological resources in schools, as evidenced by more and more multifunctional, multipurpose wireless and mobile devices (take the iPhone for example) coming to market, is driving teacher educators to re-examine preservice preparedness in light of such trends. In response, teacher preparation educators have come to realize a significant need to shift purpose toward providing properly trained teachers who are prepared for the influx of new digital technologies and media. A noticeable conundrum is that tech savvy students outside the classroom become befuddled when asked to use same technologies for instructional purposes. Thus, a noted issue in this area is the inconsistent level of technology integration among pre- and in-service teachers. As explained in the literature, the inconsistency can be partially attributed to trends in acceptance of technology within schools along with attitudes toward and competency in technology for classroom use (Brzycki & Dudt, 2005; Finley & Hartman, 2004; Pope, Hare & Howard, 2005). With pre-service teachers reporting low perceived competency levels, anxiety elevates as the demand to integrate through classroom practice becomes imminent. Anxiety therefore, remains a barrier to technology acceptance, most significantly in the early phases of technology adoption, when pre-service teachers receive training (Christiansen & Knezek, 2002).

To more thoroughly understand reasons behind this issue – low levels of perceived competency followed by high levels of anxiety, and thus poor integration performance, we focus on the need to research and develop instructional strategies for middle school teacher preparation programs. The perceptions of preservice teachers toward technology have been widely identified as a target area; instructional strategies to influence these perceptions being seen as a crucial area for further investigation (Delcourt & Kinzie, 1993; Glazewski & Brush, 2005; Hakkinen, 1995; Reed & Overbaugh, 1993). Research, in regards to teacher preparation, is primarily designed to make improvements and determine best practices for meeting standardized requirements. In response to the increasing importance of state and national standards, a general concern surrounds understanding how teacher preparation is changing to yield more teachers prepared for such responsibilities (Combs & Evans, 2007). As Topper (2004) indicates, "The current movement towards standards for technology in teacher education provides an opportunity to begin to study how teachers' changing technology competence also influences their plans for integrating technology into their classroom practices" (p. 303). Researchers have studied the effects of instructional strategies and program design to determine some of the most effective strategies being used to incorporate the fundamental technology component (Brzycki & Dudt, 2005; Collier, Weinburgh & Rivera, 2004). Combs & Evans (2006) argue that potential benefits from instructional strategies designed to increase self-efficacy include improved performance, increased confidence, excitement about future opportunities, and a heightened desire to uphold and increase knowledge gained through training. The pressing pedagogical question is when and how to instruct preservice teachers on effective, creative uses of instructional technologies and digital resources. Previous research has indicated that increased self-efficacy positively effects future technology integration into classroom practice.

Self-efficacy beliefs provide a strong source of motivation for and predictor of technology use (Hill, Smith, & Mann, 1987; Jorde-Bloom, 1988; McInerney, McInerney, & Sinclair, 1994; Milbrath & Kinzie, 2000). The attitude toward a given task can severely affect the amount of effort exerted and therefore affects the desirability of the outcome of the tasks and actions: learners must believe learning will influence and enhance their future and opportunities (Bandura, 1977; Driscoll, 2005, p. 317). This results in a change in self-perception and therefore influences a learners' desire to proceed in the learning process, practice, and apply skills. Instructional strategies developed for pre-service teachers to affect a learners' perceived self-efficacy and the effect on the transfer has been identified as a significant line of research to pursue (Ertmer, 2005). Consequently, our research question is this: What effects do instructional strategies designed specifically to influence self-efficacy have on preservice teacher perceptions of technology integration in the classroom?

Method

For this study, we employed a participatory action research method (Kemmis & McTaggart, 2000). The participants (n=14) were members of a cohort (n=22) of middle school pre-service teachers at a small university in southwest Virginia. The cohort members were involved in the final year of a teacher preparation program and actively participated in their school placements. Members of the cohort were also enrolled in an instructional technology methods course that was required for degree completion. Fourteen of the twenty-two students enrolled in the course gave written consent to participate in the research as directed through IRB procedures. Of the fourteen participants, 11 were female and three were male with a mix of graduate and undergraduate as traditional and non-traditional students.

In consideration of resources available within local school districts and needs expressed by practicing teachers, the first author (as instructor-of-record) designed the instructional technology course with several critical components in mind. First, it was important to display the realities of local classrooms (i.e. avoid sharing technology not available or entirely beyond school budget). Second, it was essential to set realistic goals and begin with simpler technologies. Third, participants needed just-in-time instruction, meaning it was important to help them develop skills that could be immediately applied to their current classroom experiences. In taking all of these points into consideration, the overall instructional strategy of the course was problem-based in nature; the instructor provided tools and equipment where participants were encouraged to investigate applications of the equipment into their current instructional planning. As an instructor, the focus was on providing opportunities for participants to become familiar with and share ideas on using equipment; the focus for the participants was to explore their content areas and grade levels and design instructional activities around their planning needs. The activities throughout the course were purposed to encourage participant discovery with the intent of increasing self-efficacy toward technology use for instruction. In addition, the activities involved using equipment, exploring web applications and general programs with the intent of increasing the probability of transfer to their instructional planning and classrooms.

For the purpose of analysis and discussion, we focus solely on one activity designed with a mental models approach to learning (Magliaro & Shambaugh, 2006). As Combs and Evans (2006; 2007) point out, when individuals lack relevant prior knowledge, they are less likely to assimilate or accommodate new knowledge. Mental models, which can be described as executable mental simulations (Mason-Mason & Tessmer, 2000), are significant in the formation of new knowledge that can lead to success and thus increased self-efficacy. In this activity, both participants and the instructor had a significant role in the execution of learning activities. The description of this activity, the role of participants, and the role of the instructor are described as follows:

Activity Description

For a class period of approximately two hours, the participants rotated through five stations, each having several pieces of instructional technology. The stations, as illustrated in Table 1, were completely disassembled and all cords and accessories were packed in cases. Participants were instructed to determine the purpose of the station and required to work to connect the equipment until they had an operable product (see Figure 1).

Figure 1: Participants beginning activity at Station 3

As an example, station one had an LCD projector and a visual data presenter. At this station, the participants needed to use all the equipment and cords in order to present items displayed on the visual presenter to a larger group. In order to complete the activity, participants were required to visit all five stations (see Table 1) with at least minimal success (for this activity, mastery was not a requirement).

Table 1: Activity stations and their purposes

	Station 1	Station 2	Station 3	Station 4	Station 5
Equipment list	LCD projector Visual data presenter	LCD projector Kodak EasyShare digital camera	LCD projector Dell laptop Intel QX5 Digital Blue microscope	LCD projector DVD/VCR combo Speakers	LCD projector Dell laptop Interwrite SchoolPad
Purposes	- To display items placed on the visual presenter to large groups - To learn basic operation of the visual presenter, explore usage potential	- To display photos/videos taken with the camera to large groups - To explore alternative forms of display in the absence of a computer	- To display images/videos captured through the microscope to large groups - To learn basic operation of the digital microscope	- To display videos to large groups - To explore alternative methods of video display in the absence of a television or computer	- To display contents of a computer to large groups - Optional: to learn basic operation of the SchoolPad

Role of the Participant

Participants were directed to collaborate with two or three other participants, thus forming groups of three or four, with which to rotate through each of the five stations. As part of the activity, one member from each group was responsible for writing complete instructions on how their group connected the equipment successfully (one set of instructions per station yielding three or four separate sets of instructions from each group). For their instructions, participants were encouraged to consider the perspective of a novice user and use language and vocabulary appropriate for such an audience. An example given was a new teacher who may have been in their second or third

career, thus being part of an older generation of learners not as readily exposed to the equipment found in the activity. Therefore, the language and vocabulary used in the written instructions should provide a sense of clarity and simplicity to avoid confusion and frustration for the user. As the groups rotated, they were video and audio recorded at stations one and three.

Role of the Instructor

For this specific activity within the course, the instructor was careful to take participant experiences and observed typical experiences of many teachers into consideration. For example, it was important to present equipment that is most readily available and/or most commonly found within school districts. The purpose here was to provide participants with a realistic perspective of what to expect in their future classrooms and provide practice with equipment they were most likely to encounter. At the beginning of the activity, the instructor introduced the equipment and explained the activity to the participants. Through this explanation, the participants were prompted to consider what they may already know about technology and more familiar equipment. An example provided was the consideration of setting up a television and a VCD/DVD player. In this description, the instructor explained the importance of taking into consideration factors such as signal direction, types of connectors (shape/size), and overall function of the equipment (i.e. what is the ultimate goal and what will happen if you successful).

Once participants were actively engaged in the learning activity, rotation through the stations, the instructor served to facilitate group interactions. By freely rotating through stations, it was important to pay close attention to group conversations and monitor their actions and progress. If groups showed signs of struggle, the instructor would intervene and provide prompts to assist the groups to continue moving forward. Some of these questions included:

- What is problem you are having? What doesn't appear to be working correctly?
- When you look at the labels on the equipment, are your "In" and "Out" connections correct?
- Are you sure all the equipment is getting power?
- If everything is connected correctly, what else could possibly be wrong?

These questions, and others, often prompted the participants to reconsider their connections, check their power connections, turn on all the equipment, etc. (see Figure 2 and Figure 3).
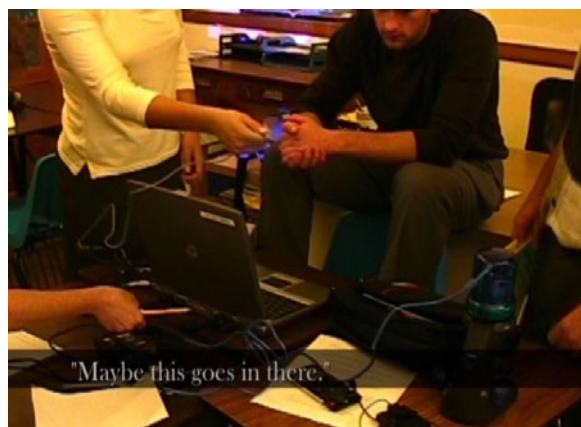
Figure 2 and *Figure 3*: Participants questioning their connections among equipment

This typically led the groups into additional discussion eventually resulting in successful completion of the task. Participants were eventually able to question themselves in a similar manner as they progressed through each station, resulting in less reliance on the instructor and more reliance on other group members.

Toward the end of the course, participants were given individual audio recorders to respond to a set of prompts regarding attitudes and reactions toward technology integration. The purpose was to capture possible changes in attitudes and reactions to things they had seen within their field placement classrooms and how that connected to prior experiences and what they had experienced throughout the technology methods course. A grounded analysis (Erlandson, Harris, Skipper, & Allen, 1993) was conducted by constantly comparing observations, audio recordings, and class deliverables. As a result, three prominent themes emerged as it became evident that a majority, if not all, participants voiced similar ideas and perceptions.

Data Analysis

A pattern-matching logic (Yin, 2003), where empirically based patterns from the descriptive case are compared with predicted ones from theoretical propositions, was used to analyze data. Initially, theoretical propositions were derived from mental model and self-efficacy theories. If empirical and predicted patterns coincide, opportunity exists to strengthen the internal validity of interpretations. The particular type of pattern-matching used proposed *rival explanations* (Yin, 1994, p. 108). The important characteristic here is that each explanation involves a pattern of independent variables that is mutually exclusive with the other two. Finally, there was also room for simpler patterns to be revealed by the case. The goal, in the end, is to determine the best ways of contrasting differences and to develop theoretically significant explanations for different outcomes (Yin, 1994, p. 110).

Results

Evidence exists to demonstrate not only growth regarding levels of confidence but also a deeper understanding of and appreciation for the educational possibilities of technology. Participants responded to open-ended questions regarding positive changes in attitudes, what they had discovered, and what they needed to become more confident. Most apparent were statements about realizing new possibilities, understanding how important it is to just use the equipment, and coming to realize what was needed in the future to enhance what was learned (see Table 2 for a summary of these findings). These results are interesting in light of previous work that identifies these concerns as prominent among first-year inservice teachers (Strudler, McKinney, Jones, & Quinn, 1999).

Increase in Attitudes and Level of Comfort

As participant change in confidence and self-efficacy was the primary motivation behind the design of instruction for this course, we carefully analyzed audio and video recordings for statements of perceived improvement or lack thereof. Five participants made it clear that they began the course with a high level of confidence in using technology for their teaching and were therefore unable to identify a major change. The remaining nine participants, however, were able to comfortably identify and admit that attitudes and level of comfort had increased as a result of instruction. Marcus, a traditional undergraduate, was particularly excited about describing what he had learned through his verbal response as follows:

> …these things [technology] were brought in; I had never used them myself actually, as far as hooking them up, and not had much use with them at all with display. I really got the feeling that – okay – I can look at these things. I can hook them up. And, you know, if it's not meant to go together, it's not going to go together so I'm not going to break anything.

Katherine, a traditional undergraduate, noted excitement about the major change in her comfort level. She stated that in order to learn and become more comfortable, instructional activities need to "involve using something you've never used – just give opportunities to explore…." Jamie, another female, undergraduate student who had shown major improvement in her levels of confidence, responded: "My comfort level towards using technology has definitely increased…we've done a lot of activities where we put together the technology and practiced using it." She further discussed the importance of having the opportunity to practice with technology, increasing confidence and desire to use technology in lesson plans. Christine, a traditional, undergraduate student, articulates her realization of the effects on her self-efficacy through written reflection as follows:

> After taking this Technology course I feel much more competent in the field of technology. Before taking this class, I thought knowing how to use Word and PowerPoint and being able to hook up equipment was all I needed to know. This class has shown me many different aspects of technology I never knew existed, which I can use in my classroom. I feel like I know a lot more about how to navigate different programs and even different computers. I now have many more resources to use to help bring technology into my classroom and feel comfortable using them. I no longer feel I am going to break the equipment. I know I can play around with equipment or programs until I figures out what I am attempting to do. Before, I never would have considered working with some of the technology we learned about in class. Now, I can't wait to add it to my classroom (as cited in Combs & Evans, 2007, p. 2523).

Figure 4: Participants completing the task, questioning their procedures

Importance of Technology Within Teaching

While activities for the course were designed to increase levels of self-efficacy, video and audio evidence showed effect on participant perceptions on realizing how limitless their teaching possibilities were with using technology for their lessons and how important it is to their teaching. Jayna, a traditional undergraduate, stated in her verbal reflection:

My level of comfort toward incorporating technology in the lessons has changed a little bit, not a whole lot because I feel like I was pretty comfortable coming in, with some technology like Power Point, Microsoft Word, things like that. But I believe that if I want to be a good teacher, I think that I need to incorporate more technology into my lessons so that I can be up to date so that the children can see that there is more than just the standard - what their parents learned by is not always the best, so we shouldn't try to limit our teaching by doing what was always done.

Theresa noticed: "…the practice throughout the entire semester has helped me really understand there's a lot more out there that I didn't know about…", but also pointed out, "…there's a challenge to make it meaningful…the students need to be taught how they can make it meaningful for themselves…" Kelly, a traditional undergraduate, recognized that the class was a safe environment in which to "explore things that I may not have seen elsewhere…the more I know, the better I feel." In reviewing participant responses, a majority responded with similar comments and clearly recognized the educational potential of the technology available in field placement schools and schools in which they plan to teach.

Reaching Their Full Potential

Even with careful planning and execution of lesson plans, participants were still able to identify they had not reached their full potential and their confidence levels could still improve. Many responses included a discussion of what students felt they needed in future lessons, courses or professional development activities. It was clear they had moved from thinking currently, regarding just what was necessary to get through the course, to thinking about their futures as educators. The main response from participants was that they felt more practice and opportunities were necessary to continue learning about technology integration. Jayna, a non-traditional graduate, summed up her reactions with the statement, "Practice makes perfect – just getting in there and doing what I can with technology will help to increase my confidence." She realized that her learning must go beyond the doors of the classroom and to maintain what she already learned, she will need more practice. Marcus also mentioned the need for practice. He stated, "…it's just a matter of doing it and practicing." It's obvious, from observation and listening to her responses that Becky, a traditional undergraduate, still feels nervous. However, she is confident in stating, "I'm still a little bit

nervous…you never know if it [technology] will work or not…the more you use it, the more comfortable you'll be with it and can create your own ideas when you are comfortable." She also noted an increase in confidence and understanding of the need for teachers to be more educated. To illustrate, she wrote the following in her final reflection:

> After this course I do feel more competent with technology. I have learned a great deal not only with using technology, but along with numerous resources. I do feel more comfortable as well. I feel I can try to use equipment and see how it works. I also know I could try and look it up on the Internet and could find something about it one there. I think teachers need to be more educated on the options with technology. Technology is growing and students love to use the web. They seem to want to learn more when a computer is involved. I think teachers are hesitant with using technology in the classroom because they are unsure of how to use it themselves. (as cited in Combs & Evans, 2007, p. 2524)

A summarizing comment from another student helps illustrate the overall impact of instructional strategies designed to encourage students in their practice and application along with supporting them in their personal attempts at learning and becoming more confident. Marcus, as highlighted earlier in the text, shares his personal insights regarding changes throughout the course and how the training he has received has affected his overall performance and attitudes. He states:

> I can tell you that honestly, I have always been uncomfortable with using technology in the classroom. It seems that while I am trying to teach a lesson it's hard for me to keep up with all of the gadgets or pushing buttons a lot…many times if I'm using a PowerPoint it's hard for me to stay on task with the PowerPoint to what part of the lesson I'm teaching. So this is something that, in going into the course of technology, that I was really hoping to benefit and improve on.

> I've gotten a lot better with keeping up with the slides and where I need to be, multitasking while using technology, keeping an eye on students, this is really actually kind of becoming a strength to me when it used to be something that was just weighing me down. So, yes, I feel much better about using technology in my lessons due to the chances that I've had to use it in classes and in teaching.

> The activities I feel were covered pretty well in my technology class because I've started using things and, to me, at this point, it's just a matter of doing it and practicing. The more I do it, the more comfortable I get and even my cooperating teacher has brought to my attention that he sees that I'm getting better with directing the class through the use of technology and – through direct use – me directing myself, I guess. And, it's just a matter of practice for me and I'm getting a lot more comfortable with it and I've created lesson plans and I feel like I'm very creative because I've gotten used to using technology a little more and I hope to get better at it the more time goes on and I feel that I will, and I feel that I am. (as cited in Combs & Evans, 2007, p. 2524)

As is evidenced through the reflections above, these students were affected in several different ways in regards to their views on technology use in the classroom and their perceived personal self-efficacy (see Table 2 for a summary). While some addressed technology as a whole, both through and outside of course activities, several addressed specific topics within the course as being an immediate factor in changes to both their confidence and competence. The themes noted throughout provide evidence that as self-efficacy increases, learners begin to assign a higher value to what they are learning and realize the impact and effectiveness of not only using technology in their classrooms, but also what it would mean to continue to learn and improve on their skills and knowledge.

Table 2: Instructional strategies and their influence on self-efficacy

Instructional Strategy	Influence on Perceived Self-Efficacy
Just-in-time training	Helped participants realize their potential for current instructional planning and increased motivation for immediate integration and transfer

Providing a realistic perspective; using simpler technologies most readily available	Gave participants chances to explore *familiar* equipment with opportunities to practice in a safe environment; slight mastery provided motivation for transfer and integration
Activate mental model	Allowed participants to place themselves in a familiar perspective and use what they already know; personal comparison introduced a perspective above the *novice* level providing an additional level of motivation and confidence
Prompts/questions from instructor	Helped participants activate existing mental models and reevaluate their position within the activity; prompted discussion and further questioning beyond scope of the activity which they answered confidently
Assignment: writing instructions	Participants were led to not only verbalize their understanding but compose their position in written form, allowing an extra level of processing and understanding; instructions can be used to provide self-assurance in future attempts and revised as experience increases

Discussion

This paper presents evidence to support a focus on the positive influences on self-efficacy through the design of sound instructional strategies. Pre-service teachers who participated in the research study provided verbal and visual evidence of potential as teachers when using technology for classroom instruction. Many participants concluded that without a course designed to demonstrate new techniques, given hands-on experiences, and increased self-efficacy, they would not have felt comfortable using technology in the classroom. The course and activities throughout allowed students to practice skills and find new ways to use common technologies. A majority of participants were confident in their reactions to sharing what they had learned about technology, its role in the classroom and how their attitudes had changed. In addition, students were much more able to verbalize their need for future training, the importance of practice and what they understand will need to happen for confidence to increase. These changes in attitude bode well for the formation of "collaborative, subject specific technology inquiry groups" that Hughes (2005, p.277) proposes for future teacher professional development.

Admittedly, limitations of the current study exist. The reporting of perceptions cannot guarantee implementation in the classroom. Consequently, our plan is to follow-up with additional research participants and monitor them throughout their field placements to identify additional themes and help determine the actual degree of action on words. Pope, Hare, and Howard (2005) have noted the positive effects appropriate modeling has on pre-service self-efficacy toward technology integration. Finally, we recognize that data collection in the field is fraught with unexpected outcomes – one of them being that participants may become frustrated or misunderstand the purpose of research; an obligation as qualitative researchers is to ensure that participants are treated ethically and with due respect. We recognize this issue and explain how we dealt with it in separate work (Evans & Combs, 2007).

Conclusion

In summary, instructional designers and technologists are at the forefront of promoting a culture of ubiquity when it comes to technological resources in the classroom (cf. Evans & Powell, 2007). Consequently, we have an inescapable duty to ensure that pre-service teachers are prepared in knowledge, skills, and affect to effectively and creatively adopt and use these technologies – be they computers, projectors, digital video recorders or the like. The question is this: "What instructional strategies are most effective to promote technology integration in the middle school classrooms of tomorrow?" Researchers will continue to propose similar questions and conduct additional research to help answer this question. At this point, the continuation of research can only encourage those in practice to continue or discontinue their current approaches to preparing teachers to integrate and teach with technology. With this research we call for theory- and evidence-based decisions to guide teacher preparation.

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How Instructional Design Experts Use Knowledge and Experience to Solve Ill-Structured Problems

Peggy A. Ertmer[1]
[1]Purdue University, West Lafayette, IN

Donald A. Stepich[2]
[2]Boise State University, Boise, ID

Cindy S. York[1]
Ann Stickman[1]
Xuemei (Lily) Wu[1]
Stacey Zurek[1]
[1]Purdue University, West Lafayette, IN

Yuksel Goktas[3]
[3]Ataturk University, Erzurum, Turkey

Abstract

This study examined how instructional design (ID) experts used their prior knowledge and previous experiences to solve an ill-structured instructional design problem. Seven experienced designers used a think-aloud procedure to articulate their problem-solving processes while reading a case narrative. Results, presented in the form of four assertions, showed that experts 1) narrowed the problem space by identifying key design challenges, 2) used an amalgamation of knowledge and experience to interpret the problem situation, 3) incorporated a mental model of the ID process in their problem analyses, and 4) came to similar conclusions about how to respond to the situation, despite differences in their initial conceptualizations. Implications for the education of novice instructional designers are discussed.

Experts in any field tend to be better problem solvers than novices. Faced with a problem situation, experts quickly form solutions that are more likely to be effective than solutions formed by novices. This characteristic of expertise has been documented in diverse domains: playing bridge (Charness, 1979), solving physics problems (Chi, Feltovich, & Glaser, 1981), repairing electrical generators (Jacobson, 1988), driving a taxi (Chase, 1983), and revising instructional text (LeMaistre, 1998). Experts are able to achieve this superior problem-solving performance, in large part, because they have at their disposals vast, well-organized stores of domain-specific knowledge, gained through extensive experience (Bruer, 1993; Glaser & Chi, 1988). Expertise is comprised of two major components: abstract knowledge and practical experiences (Bonner, 2007; Laurillard, 2002). While expert knowledge may arise from only one of these sources, both may be necessary to develop the kind of "fluid expertise" (Bereiter & Scardamalia, 1993) that allows individuals to adapt and apply their knowledge to novel situations. According to Bereiter and Scardamalia, practical experience by itself may lead to a kind of "crystallized expertise" that results in individuals who may not be particularly good problem solvers because they simply implement well-practiced procedures. In contrast, individuals with fluid expertise use both abstract knowledge and practical experience to think through a problem in a more dynamic and constructive way. While crystallized expertise would include the acquisition of automaticity after extensive practice in a relatively stable and constant system, fluid expertise would be characterized by flexibility that is responsive to changes in a dynamic world (Feltovich, Spiro, & Coulson, 1997).

Drawing on the expert-novice literature, Ertmer and Stepich (2005) outlined six dimensions that characterize the problem solving processes of expert instructional designers. Central among these dimensions is the expert's ability to "synthesize" a particular problem situation; that is, to formulate a clear, coherent representation in terms of one or two central issues. This kind of synthesizing has been a recognized aspect of expert practice for a

long time. For example, Larkin, McDermott, Simon, and Simon (1980) found that physics experts routinely generated a physical representation of the problem situation before attempting a computational solution. More specifically, when experts were given complex problems to solve, they frequently began by drawing a sketch of the central elements of the problem. This physical representation reduced the problem space, allowing the experts to identify relevant variables and test relevant qualitative hypotheses. Once these hypotheses were checked, the experts would fill in the details and solve the problem quantitatively. In the nursing field, Benner (1984) used the term "recognitional ability" to describe the ability of expert nurses to discriminate relevant from irrelevant information and to develop a context-dependent, holistic perceptual understanding of the patient situation. According to Benner, this ability is based on collected practical experiences that expert nurses use to continually refine their abstract knowledge. In both cases, the authors suggested that experts begin the problem solving process by developing a "big picture" understanding of the problem situation.

Similar results have been shown within the field of instructional design. For example, Perez and Emery (1995) asked expert and novice instructional designers to design a computer simulation on diesel engine mechanics. They found that experts were more likely to identify a central element of the problem (e.g., the characteristics of the target audience) and to return to this element as they began to work out the design details. Perez and Emery referred to this approach as a "breadth-first, top-down, progressive" design strategy. In another study involving the revision of instructional text (LeMaistre, 1998), the expert instructional designer initially identified the lack of overall structure of the text as the primary problem and continually referred to the importance of structure throughout the revision process. LeMaistre noted that the expert was explicit in the creation of the problem space and employed "strategies of constantly adjusting decisions and decomposing the problem into manageable parts" (p. 31) so that related aspects of the problem could be addressed collectively rather than in an isolated fashion.

While it seems clear that experts engage in the kind of synthesizing described above, it is less clear how this process is influenced by the experts' vast stores of knowledge. Building on the idea that expert knowledge is made up of abstract knowledge and practical experience, one view is that synthesizing is based, primarily, on the recall of abstract knowledge. In this view, experts define a problem in terms of conceptual principles drawn from their stores of domain knowledge (Ertmer & Stepich, 2005). For example, Chi et al. (1981) asked experts and novices to outline solutions to physics problems. While novices typically defined the problem in terms of literal objects and terminology used in the problem statement, experts were more likely to identify a "second order feature," referring to a feature that was not explicitly described in the problem statement, but that was derived from a small piece of given information that activated a relevant schema in the experts' existing knowledge. Glaser and Chi (1988) noted that, with experience, experts encode not only the procedures for solving relevant problems but also the conditions under which they are applied.

An alternative view is that synthesizing is based, primarily, on the recall of practical experiences. In this view, experts define a problem in terms of a similar situation drawn from prior experiences (i.e., a case). For example, Rowland (1992) found that instructional design experts typically associated a given situation with similar problems they had previously encountered and used those prior experiences to develop an initial picture of the current problem and how it might be solved. Similarly, Perez, Jacobson, and Emery (1995) observed that instructional design experts often reflected on past design problems and solutions and compared them with the problems at hand. Klein and Calderwood (1988) studied decision making among urban fire commanders, wild land incident commanders, and tank platoon commanders and found that these individuals based their decision making more on prior cases than abstract principles. This interpretation is supported further by research on case-based reasoning (Kolodner, 1997), which posits that experts have amassed rich libraries of case experiences that they apply, through a type of analogical reasoning, when solving new problems.

To elaborate, case-based reasoning is defined as "solving a new problem by remembering a previous similar situation and by reusing information and knowledge of that situation" (Aamodt & Plaza, 1996, p. 40). Theorists claim that human reasoning is case-based; that is, we all have different experiences that are stored in our memories and then reused when new problems trigger the recall of similar situations (Kolodner, 1993; Schank, 1999). Jonassen and Hernandez-Serrano (2002), after reviewing studies in multiple contexts, proposed that "experts relied more heavily on cases based on past experience than on abstract principles when making decisions with a high degree of uncertainty" (p. 68). They argued that cases and stories work more effectively than abstract rules or principles in knowledge construction because they "require less cognitive effort than exposition" (p. 66). Moreover, stories or cases facilitate vicarious learning by providing a substitute for first-hand experience (Jonassen, 1999).

Although these two explanations of synthesizing appear conflicting, they may not be mutually exclusive. For example, Genberg (1992) suggested that expertise might be viewed from two different lenses: 1) an information-processing lens and 2) an intuitive lens. While the former emphasizes the organization of knowledge and the progression of skill acquisition, the latter focuses on the relevance of past experiences in a particular context.

Kolodner and Guzdial (1999), while strong advocates of reasoning from cases, stressed that abstraction is necessary for organizing, or indexing, cases within one's library, as well as for efficient retrieval. In other words, experts seem to extract guidelines and principles from concrete experiences that they then apply to new problem solving situations. This idea is supported further by research by Didierjean and Cauzinille-Marmeche (1998) who demonstrated that individuals can develop, and even use simultaneously, these two types of reasoning processes.

Purpose

The purpose of this study was to determine *if* instructional design (ID) experts synthesized the issues presented in an ill-structured problem scenario (as described in the literature), and if so, *how* abstract knowledge and practical experience were used during the synthesizing process. Based on the six dimensions of expert thinking described by Ertmer and Stepich (2005), we selected synthesizing, a critical characteristic that distinguishes experts from novices, to further our understanding of how experts use their prior knowledge of rules and principles, and/or draw upon their previous experiences.

Method

Overview

This study was designed to examine the processes that experienced instructional designers use when solving ill-defined instructional design problems. Data consisted of a demographic survey, think-aloud protocols, and interviews with seven participants. The think-aloud protocols captured experts' verbalizations during the problem-solving process and the interviews gathered additional data about how experience and knowledge were used during the process.

Theoretical Framework

We used grounded theory, a method of qualitative inquiry designed to generate an explanatory theory of a specific process or phenomenon (Glaser & Strauss, 1967; Strauss & Corbin, 1997). Grounded theory is an inductive approach in which theory is derived from the data through a process of asking questions and making comparisons. The primary objective is to expand upon an explanation of a phenomenon by identifying the key elements and the relationships among them within the specific context of the research study (Davidson, 2002). Thus, in this study, a grounded theory approach enabled us to develop a theoretical account of the characteristics of expert problem solving while simultaneously grounding the account in empirical data (Strauss & Corbin, 1997).

Role of Researchers

This study was designed and implemented by a research team consisting of six doctoral students and one faculty member at a large mid-western university. A second faculty member, located at a large western university, acted as a consultant to the team during the design and implementation of the study. All but one student had previously completed an advanced instructional design course, which utilized ill-defined case problems. Students had a range of previous ID experiences in both educational and business contexts.

Prior to the start of the study, a pilot was conducted with one participant, during which the entire research team observed and/or participated in implementing the data collection procedures. Subsequently, the research team divided into two subgroups with each group taking primary responsibility for conducting the research with three of the six remaining participants. As a team, students worked to define the research protocol, to modify specific data collection procedures that were either problematic or unclear during the pilot, and to clarify each person's role in the subgroups. The researchers carefully checked and monitored each other during the entire research process, reviewing transcriptions for accuracy and requiring clear evidence of initial interpretations. For example, specific claims were linked to supporting data (using a line-numbering system for each transcription), thus enabling team members to challenge or support initial interpretations and to provide either additional or counter evidence.

Participants

Seven expert instructional designers (four women and three men) were purposefully selected. Each participant had eight or more years of instructional design experience, in a variety of settings. Demographic data

(e.g., years and types of experience; current positions and responsibilities) were collected via a short online survey. On average, participants had 20.5 years of instructional design experience, ranging from 8 to 32 years. Four participants were currently working in higher education (with two of these holding a Ph. D. degree), while three were employed in the business sector. All seven designers indicated that they regularly participated in all aspects of the instructional design process (analysis, design, development, implementation, evaluation). In addition, six of the seven participants indicated that they had previous experience with face-to-face, computer-based, online, self-instructional, and hybrid instructional delivery formats.

Data Collection

Following the completion of the demographic survey, participants met individually with one of the two research subgroups to participate in a think-aloud process in which they read and reflected on an ill-defined instructional design problem. The problem (Hooper & Doering, 2007) was presented via a 12 page, double-spaced, typed narrative and dealt with the topic of converting a face-to-face HIV/AIDS workshop to an online format — a topic for which none of the participants had previously developed instruction. Each data collection session lasted about two hours and included a warm-up exercise, the think-aloud procedure, and a retrospective interview. The warm-up exercise included a small problem that the participants used to practice the think-aloud approach (e.g., identify the number of windows in your house). Retrospective interviewing (Ericsson & Simon, 1980) occurred immediately after the think aloud as a way to help participants reflect on, and verbalize, their thought processes during the think aloud, drawing from both long- and short-term memory (e.g., Describe the method you used to determine the number of windows in your house.). In addition, interviews included questions to clarify comments participants made during the process and to explicate how knowledge and experiences were used. The interviews included questions such as, "What was the first thing you thought about as you read the case?" "What made you think of that?" or "Where did you learn that?" All sessions were videotaped and transcribed.

Data Analysis

Transcriptions were examined using a constant comparison method, with specific attention given to participants' references to prior knowledge and experiences. Initially, each researcher conducted an analysis of a single transcription, looking for evidence that related to our two research questions, but without establishing preconceived ideas about what might be discovered. This resulted in a set of tentative profiles that captured each participant's response to the case situation. Following this, two researchers applied a modified open-coding process using an electronic copy of each transcription, inserting comments and highlighting quotes that seemed particularly relevant to our questions. However, rather than create a set of categories and subcategories as is typical in open coding (Creswell, 2003), we created a set of themes that reflected each participant's responses. Themes for each participant were shared and discussed between the two researchers as they were developed. During these conversations, no attempts were made to come to consensus, but merely to note the similarities among the themes and to seek clarification and additional evidence if the interpretations were unique or unusual.

After creating themes for each participant, the researchers then looked for similarities across participants as the first step in creating a set of assertions that could be applied to the majority, if not all, of our participants. If the themes were not evident among at least four participants, they were not used in the final set of assertions. Finally, after the assertions were developed, they were presented to the rest of the research team (with evidence) for additional comment and final team verification. The team then worked together to find relevant supporting or contradictory evidence from the literature.

Validity/Reliability

Lincoln and Guba (1985) recommended that qualitative results be evaluated using the standard of "trustworthiness," as established by credibility and confirmability. In this study, *credibility* was gained though triangulation of multiple data sources including a demographic survey, think-aloud protocol, and retrospective interview. The use of multiple researchers led to *confirmability* of the data. Throughout the study, weekly meetings of the researchers helped to ensure understanding of our research questions, consistency of data collection, and interpretations of data. Data analysis involved both individual and collaborative efforts in order to develop and verify the emergent themes and overall assertions. A line numbering system was used to identify specific data supporting each finding, thus creating a traceable link between evidence and assertions. Finally, participants verified our interpretations, immediately during the interviews, and later through their responses to specific email queries.

Results and Discussion

In this study we asked questions about how experts used their knowledge and experience to solve ill-structured problems presented via a case study narrative. We present our findings in the form of four assertions that were developed through our analysis and interpretation of the data. Excerpts from the participants' think-aloud and interview protocols are integrated with interpretive commentary to support each assertion. Subsequently, we discuss how each assertion is, or is not, supported by the literature.

Assertion 1. In identifying the key design challenges, **experts narrowed the problem space**. For some, this seemed to occur either in place of, or prior to, making a synthesis statement. According to the literature, a major task of the problem-solving process involves "being able to articulate a clear and concise representation of the problem(s) in a particular situation" (Ertmer & Stepich, 2005, p. 39). Referring to this as the ability to "synthesize" the issues in a problem situation, the authors noted that this is a key characteristic of expert instructional designers.

In this study, all seven participants articulated specific design challenges related to converting a highly interactive face-to-face workshop to an online format. Specific aspects of the case situation were highlighted either because they were seen as particularly central to the effectiveness of the workshop and/or particularly difficult to translate to an online environment. For example, as Jacob read the sentence, "Experiences were extremely powerful" he stopped and added "which is going to be wonderfully fun to try to do with the Internet." Similarly, when Marlene read the sentence, "The face-to-face … workshop was presented to approximately 50-60 participants who traveled to a single location and met for approximately 16 hours over a two-day period," she noted, "That seems problematic to me, for something that's online." Additional challenges highlighted by the participants included, among others: the importance of interactions among the workshop participants, learning by doing, resolving access issues, facilitating and maintaining behavior change advocated by the workshop leaders, and "smoothing out" interpersonal relationships among the designers in the case (described in more detail in Assertion 4).

Among our seven participants, "highlighting" seemed to be more common than "synthesizing." Despite the fact that every participant articulated specific challenges related to converting the face-to-face workshop to an online format, not every participant synthesized these challenges into a clear concise statement, as hypothesized earlier. While Jacob, for example, stated the problem in a very straightforward manner ("I see the problem as determining what are the essential characteristics to changing behavior?"), others simply pointed out a number of different elements that would be difficult to transfer to the online environment without making a direct statement about how these elements contributed to, or comprised, the core problem. For example, as Jill engaged in the think-aloud process, she stopped periodically to comment on new challenges as they were introduced in the case narrative. These challenges related to a wide variety of issues: putting an interactive workshop online, moderating discussions, providing appropriate counseling services, securing online permissions, resolving access issues, and limiting the amount of time required. Jill noted that she usually begins the design process by "looking for some sort of initial analysis, starting with some kind of objectives" but because these were not immediately available, she described her approach as just "kind of reacting to things as we went through." This lack of a synthesis statement, then, may have been due to a stylistic difference among participants or to a variation in the way the researchers asked the participants to state the problem. Alternatively, it may suggest that synthesizing does not always result in a single concise statement of the problem. Instead, as Gredler (2004) suggested, experts may identify key information within a situation and use that information to create a mental map of the problem.

In almost all instances in which synthesizing occurred, it was preceded by highlighting. Most often, the synthesis statement captured one or two key design challenges that the participants had highlighted during the think-aloud process. For example, after highlighting a number of problem elements, Simone stated:

If that data is [sic] actually true and correct, I'd want to hone in on what elements of instruction itself—the format, the instruction, the affective aspect of it, group interaction [all problem elements noted earlier]—all of that and say, "What part of this made it the most successful?" and "Can this be duplicated?"

As another example, after mentioning a number of potential problem elements, Thad synthesized the issues with the following statement:

Soon you're going to have some kind of table [in which] you compare what they've done in the past, and if it worked then, are you going to be able to transfer that over into the online environment and help them to solve some problems they are having in the transfer? That's probably where they are having their most difficulty in creating this thing, is that transfer of some of these things.

The literature suggests that experts tend to translate ill-defined or unfamiliar problems into well-defined or more familiar problems as a way to narrow the problem space and search for a solution (Glaser & Chi, 1988;

LeMaistre, 1998; Perez et al., 1995). According to Rowland (1992), expert designers approach new problem situations using existing "frames of reference," built from their previous knowledge and experiences. Frames of reference, then, may be one way in which experts make this translation from an ill-defined problem to a more defined one. Similar to what Rowland (1992) and Perez and Niederman (1992) found, each participant in this study understood the case problem in terms of the personal experiences and perspectives s/he brought to the case as much as by the information provided by the case narrative. For example, based on her 22 years of experience as a designer in business and industry, Marlene brought a "training" frame of reference to the problem: "What is the problem? Will training address it? Who are we dealing with?" She elaborated on her specific perspective:

> I look at it from a training perspective and then I add all of the human baggage that goes with it, or that is going on there. I go to "what is the target audience" and get a clear definition of what that is. And then [I get] a clear definition of what the training issues are by defining the objectives.

Sean, who had a background in counseling psychology used a "consulting" perspective: "The problem is more about the interaction of the cultural differences between the organizations as much as it's about a lack of specificity of the goals." As he explained further:

> This is a very typical problem … it's a challenge for consultants who work with the military, for example. And I was sort of using that as one of my frames of reference. I have experience in that. I do my research with consultants as well and … there is always tension between research design and product design.

In contrast, Sammie used her communication background to frame the problem in terms of the type of topic that needed to be addressed and the kinds of conversations that needed to occur: "With such a … touchy topic, I would want to have control in the room so if something happened I would be there to handle it. … I have a background in communications and all of my teaching is done in very small groups where I can watch the faces of my students and especially their non-verbal behavior and make instant corrections in the instruction."

As a final example, Jacob, who was in charge of instructional computing on a large university campus, used an administrative perspective to consider whether the "real" problem could be addressed in an online environment: "I pull from components of projects and they are kind of reorganized into other types of situations. I'm primarily an administrator, so my categories right now are: project timelines, budgets, legal, those types of things."

In summary, participants in this study all identified multiple design challenges in the case scenario, with these challenges later being combined, by five of the seven participants, into the articulation of a synthesis statement during the interview process. As suggested by Schon (1983), the first step in the problem solving process is problem finding or problem setting: "The designer must make sense of an uncertain situation that initially makes no sense" (p. 74). As part of this process, expert designers identify the constraints, or problem elements, of the given situation. Goel and Pirolli (1992) suggested that during this process, expert designers may explicitly try to change the problem situation so it more closely matches their personal expertise and knowledge. Although we didn't observe our participants use their frames of reference to actually transform the case information, they were employed to filter through the details, facilitating a focus on those case details that were judged most critical.

Assertion 2. When analyzing ill-structured problems presented via a case narrative, instructional design ***experts used an amalgamation of knowledge and experience***. While all of our participants referred to specific prior experiences and six of seven referred to some specific piece of abstract, academic knowledge (e.g., ADDIE model, Gagne's types of learning, message design), their interpretations of the case details relied primarily on an amalgamation, or blend, of knowledge and experience. When asked, specifically, how they knew to use a particular strategy or to consider particular issues, our participants typically referred to previous experiences. For example, Marlene responded, ""How do I know that? I know that just from my experiences working in this company," while Simone reflected, "I'm thinking of my own experiences with taking online courses." Sean captured the general feeling of all of our participants when he stated, "I have been in that situation many times."

In general, the recollection of specific ID experiences or specific ID principles was rare. Furthermore, if participants recalled specific experiences, they didn't really use the information from that experience to narrow the problem space or solve the problem (at least not in any obvious way). If they recalled specific book knowledge, it was usually embedded within their recall of experiences. More typically, the participants recalled a "mix" or "blend" of experiences that were relevant to the current problem. Consider the following quotes from three participants:

- "I can't say, oh this really reminds me of this, but there is … all the little pieces remind me of something." (Jill)
- "I'm thinking it was background experiences but there isn't one specific one." (Thad)
- "I have a blend in my head that is from many different experiences … in my mind, it just all blends together … I pull from components of projects, and they are kind of re-categorized into other types of situations." (Jacob)

Rather than accessing a single specific prior experience (a case), participants extracted from their collected experiences one or more relevant rules, which they applied to the current situation. These rules were not ones that could be found in an ID textbook, but were much more idiosyncratic and were drawn from the unique collection of previous experiences that each participant brought to the current situation (Klein & Calderwood, 1988; Kolodner & Guzdial, 1999). According to Davenport and Prusak (2000), rules of thumb are "guides to action" that have developed over time through extensive experience and observation (p. 10). Schank (cited in Davenport & Prusak) referred to these internalized responses as "scripts," which, like play scripts or computer programming codes, act as efficient guides to complex situations, offering plausible routes through a maze of alternative solutions (p. 11).

As an example of how our participants applied rules of thumb during their analyses of the case narrative, Thad suggested that before you can decide what to translate to an online environment you need to know exactly what's making the current materials effective. This rule is captured in his comment: "You have to take it [the workshop] apart and make sure that the type of thing isn't going on where you think it is effective, but yet it really wasn't teaching what they needed." As another example, Sammie used a set of rules to guide her decision-making that related to her background in communication. These rules helped her decide how to handle sensitive topics in a workshop environment: "If [the workshop involves] interaction and the subject is controversial, the delivery should be face-to-face." For Sammie, the decision to keep the workshop face-to-face appeared to be based on what she viewed as a critical rule of thumb. Similarly, a related rule was captured when she stated, "If it's a run-of-the-mill topic, then it could be successfully converted to the Internet."

In summary, experts in this study used an amalgamation of knowledge and experience to analyze the problem situation presented in the case narrative. Similar to what Davenport and Prusak (2000) described as a "fluid mix of framed experience" (p. 5), our participants appeared to access domain-specific knowledge, which was built *of* experience. As noted by Kolodner (1988; 1997), expert problem solvers tend to access their case memories multiple times during a problem-solving episode, thus allowing them to recall several cases (previous experiences), rather than just one, to be used during the process. Results from this study support this contention.

Assertion 3. When recalling previous ID knowledge and experiences to solve an ill-structured problem, ID **experts accessed a mental model of the instructional design process** to guide their thinking. According to the literature, experts have a large store of organized domain-specific knowledge (Bransford, Brown, & Cocking, 2000; Bruer, 1993; Glaser & Chi, 1988), organized as schemas or deep knowledge structures (Bedard & Chi, 1992; Brophy, Hodge, & Bransford, 2004). Johnson (1988) suggested that expert knowledge is organized schematically as a mental model of the relevant system. Experts use this mental model, then, to create a large-scale, qualitative representation of the current problem (Larkin et. al., 1980) as a first step in solving the problem.

In this study, all seven of our participants made statements suggesting that they approached the case with some kind of instructional design process model in mind. The models varied, but everyone had one. Two types of models accounted for six of the seven experts in this study. For example, three of the participants used an "audience first" model:

- "The first thing I like to do is write down what the target audience is." (Marlene)
- "You need to know what the audience is and the more you know about the audience the better you can design something." (Sammie)
- "OK, so I'm honing in on the target audience because any time you design instruction you are designing it for a particular audience and it is helpful to know who that audience is and as much information as possible about that audience." (Simone)

Three of the remaining four participants used an "outcomes first" model. This shows up, specifically, in comments about what is missing in the case:

- "… a lot of the objectives are not clear to me. So, I'd really want to nail it down first of all." (Jill)
- "What are the objectives here? … These are goals, they're not objectives – they're way too broad." (Jacob)
- "As a designer, the challenge here is figuring out the complex combination of learning outcomes that they are after … thinking about a solution is way too far down the road because we don't know what the goal is." (Sean)

Finally, one participant used a "domains of learning first" model. A critical step in Thad's process was to "classify the type of learning that is occurring." In contrast to other experts, Thad did not refer to objectives or goals. Instead, he referred to the type of learning, specifically questioning whether the focus of the workshop was on verbal information or attitudes and noting that "we've got to go at it a little different" depending on the type of learning

involved. This idea of domain-specific instructional strategies is a central principle in Gagne's instructional design model, which suggests that Thad's mental model was based on Gagne's theory.

In general, our participants used these mental models to guide their thinking about the case. Typically, they did not follow their models on a 1 to 1 basis, like a recipe. Instead, they used their models in a broader, more heuristic way. While the nature of the think-aloud task may have limited their uses of the model to the beginning stages of the analysis task, our participants appeared to apply them in two explicit ways: 1) to structure their searches for information, as illustrated by Marlene and Simone, respectively ("I needed to look for information to fit into a model like the ADDIE model." "… The ADDIE Model is just sort of a nice little acronym that reminds me have you covered all of these bases. It may not be in that order necessarily in reality."), and 2) to focus their attention on initial information considered critical to the instructional design process. This isn't necessarily the first step in a particular textbook model, but rather the element of the ID process that the experts saw as particularly critical at the start of the process. For example:

- Sammie ("audience first") focused first on the needs of the target audience.
- Jacob ("objectives first") distinguished between objectives and goals and wanted to know what the objectives were. It's worth noting that objectives are not the first consideration in the Dick and Carey model (the textbook model that Jacob mentioned), which supports the idea that the mental models were individual heuristics rather than textbook-based recipes.
- Thad ("domains of learning first") based his thoughts about selecting the instructional media on the type of learning involved.

The fact that our designers all accessed a mental model of the ID process is not surprising, as it is supported by the literature. Recent research by Campbell, Schwier, and Kenny (2006) suggested that designers reference conventional ID processes in their conversations about design, although their practice varies significantly according to context. Perez and Neiderman (1992) also reported that the experts in their study used a design process that reflected a systems approach, yet varied in how they implemented the process. The authors argued that these differences were related to the frames of reference that the experts used when making their design decisions. Again, this may explain why our participants used the models that they did: that is, an "audience first" model was more compatible with a communications frame of reference, while an "outcomes first" model was more compatible with an administrator's frame of reference. After participating in a large number of relevant projects, the mental models of the ID process enabled our experts to reason, not from textbook principles or models, but rather from "first principles" (Merrill, 2002; Reigeluth, 1997; Winn, 1997). This is similar to what other researchers have described: Experts tend to look past the surface details in a problem to focus on the underlying principles or "big ideas" embedded in the situation (Bransford et al., 2000: Glaser & Chi, 1988; Larkin et al., 1980).

Mental models are one characteristic that have been used to distinguish between expert and novice designers. In general, novice designers have access, primarily, to textbook models, which don't necessarily apply to novel problem situations (Atherton, 2002; Reimann & Schult, 1996). In contrast, based on their many years of experience in a variety of contexts, experts are able to recognize patterns of practice and generate solutions based on those that have worked in similar situations (Hardre, Ge, & Thomas, 2006; Kirschner, Sweller, & Clark, 2006).

Assertion 4. The ***experts came to the same, or a very similar, conclusion*** about how to respond to the situation. Polya (cited in Wilson, 1997) stated that once we've figured out how to see a problem in a certain way, the solution becomes obvious (p. 23). Given that the frames of reference used by our participants all incorporated some variation of an ID process model, (Assertion 3) this may explain why (and how) the experts in our study all came to see the design problem in a similar way. As captured by Assertion 1, all seven participants articulated explicit design challenges related to converting the face-to-face workshop to an online format. Specifically, as illustrated by Table 1, the participants mainly focused on four related issues: the affective nature of the workshop, the use of diverse instructional strategies, achieving the goal of behavior change, and the interactive nature of the workshop.

Table 1.
Design Challenges Identified by Participants

Identified design challenges	Jacob	Jill	Marlene	Sammie	Simone	Sean	Thad
The affective nature of the workshop (e.g., powerful experiences, intense engagement)	x	x	x	x	x	x	x
Converting the instructional strategies that were effective in the F2F workshop to an online format	x		x	x	x		x

Achieving, measuring, and maintaining behavior change	x		x		x	x	x
The interactive nature of the workshop	x	x	x		x		
The length of the workshop	x	x	x				
The interactions between the designers involved				x		x	x
Ethical and legal issues	x		x				

All seven designers highlighted the difficulty in recreating the affective nature of the workshop in an online environment. For example, Simone commented, "There are some things that cannot be [translated online]. If it is [just] information and that changes behavior, then yes, there are ways to get at that. But if it's this closeness and a support group … if it's some other element; there are some things that just cannot be duplicated online." Similarly, Jacob noted, "The empathy — yeah, that's going to be a challenge … Their options are going to be very limited." In fact, due to the affective nature of the topic and the methods used in the face-to-face environment (hot cognitions, sexually explicit media, etc.), several designers expressed a healthy skepticism toward making this conversion. Simone and Sammie, in particular, challenged the decision to translate the workshop. Simone said, "The first question I would ask is: Does this really lend itself to e-learning? I am not sure. You know, you will have to convince me. Why are they even doing this? What is the overriding advantage over what they've got, which is already successful?" This led Simone to conclude "Maybe it shouldn't be an online course at all." Sammie echoed Simone's concerns and quickly came to the conclusion that this conversion should not be made: "If the previous workshop has been successful, I would not go with the Internet … it would open all sorts of cans of worms." With such a … touchy topic, I would want to have control in the room … I would stick with what's been working."

In addition to outlining the challenges of translating affective content and methods to an online environment, five of the seven designers identified specific challenges related to implementing the diverse range of strategies that had been effective in the face-to-face environment noting, "We'll have to think about ways for doing that" (Marlene). Simone commented specifically on the "learning by doing" approach favored in the face-to-face workshop, stating, "As an educational approach this is great, but how you do that online … that's something to think about." Five designers also identified challenges related to the goal of the workshop, that is, to create a change in behavior. For Jacob, particularly, this was the focal point of the case: "… [for] how long does that behavior change, and for which people … that's what this group has to deal with."

The identification of these key design challenges, then, shaped how our participants envisioned addressing those challenges. Although participants conceptualized the design challenges in slightly different ways, initial strategies for addressing the design issues were very similar. That is, six of the seven participants described the need to determine the specific characteristics of the current workshop that were essential to success. For example, Thad noted the need to identify and translate the strategies that were successful in the face-to-face workshop, while Jacob proposed determining the characteristics of the workshop that were essential to changing the behavior of the participants, describing these in terms of must-haves vs. nice-to-haves. Similarly, Marlene discussed the need to determine which workshop components provided "value added."

The results of this study suggest that expert designers, despite some variation in their conceptualizations of the issues in the problem situation, still reach similar conclusions about how to address those issues. This finding is similar to that of Spector and Koszalka (2004) who found that experts conceptualize complex problems in recognizably similar ways. As pointed out by Driscoll and Carliner (2005), this may relate to the nature of the problem-finding process in that early problem identification subsequently limits the number of solution paths that can be considered. It is conceivable that by initially highlighting similar elements, our designers had, in effect, constrained the number of possible solution paths. However, this finding contrasts with what Rowland (1992) reported in his study, in which the experts were described as demonstrating a "significant amount of variation" (p. 81), both in terms of their problem representations and proposed solutions. Rowland attributed this result to the different frames of reference used by his participants. While no two designers in our study appeared to use the same frame of reference when analyzing the problem, they all incorporated key elements of the design process within those frames, a similarity that was not described by Rowland. Perhaps, the "significant" variation in initial problem representation left more solution paths open for Rowland's participants to explore. Finally, we must also consider the simple explanation that the case narrative used in this study was not as complex as the problem that Rowland's experts encountered, thus allowing our experts to more readily represent and address the core issues in similar ways. As another point of contrast, the specific problem presented to the experts in this study required only that they "translate" existing instruction to a new format, rather than "design" something new from scratch. Additional research is needed to help clarify these seemingly conflicting results.

Implications for the Education of Designers

        The results of this study have implications for the education of instructional designers. First, the results support findings from previous research (LeMaistre, 1998; Perez & Emery, 1995) that suggest that ID experts construct a clear understanding of the issues in an ill-structured problem as the first step in the problem-solving process. While two of our experts did not specifically articulate a synthesis statement, they all narrowed the problem space by identifying key problem elements in the case narrative. It is possible that, with practice and support, novices also can learn to do this effectively. This idea is supported by findings from Dufresne, Gerace, Hardiman, and Mestre (1992) who taught students to solve physics problems using a computer-based "Hierarchical Analysis Tool" (HAT) that prompted them to analyze the problem in more expert-like ways. In subsequent problem-solving exercises, students who received the HAT instruction were noted to use the expert-like strategy more often than students who received other types of instruction. That is, by using a hierarchical analysis structure that integrated concepts, principles, and procedures, novices were able to increase their focus on the deep structure of the problem rather than on surface details. A similar approach may be used with ID novices who could be given analysis guidelines that compel them to consider "big picture" (as opposed to surface) issues when analyzing ill-structured problems. Preliminary results from a study by Author (in progress) suggest that the use of guidelines or scaffolds that remind novices to, among other things, 1) focus on the "big picture," 2) consider the core issues (i.e., those that are most central to understanding the case), and 3) consider the critical issues (i.e., those that are most likely to lead to a successful resolution), helped them analyze an ill-structured case scenario in more expert-like ways than novices who were not given these guidelines. Additional research is needed to verify these preliminary results.

        The experts in this study appeared to use personal frames of reference, based on accumulated sets of previous experiences, when conceptualizing the ID challenges embedded within a problem scenario. While it is unlikely that ID students will have amassed many personal experiences (related to ID practice) while still in school, there is some indication that students can benefit, vicariously, from the experiences of others (Jonassen, 1999; Schon, 1993). Fortunately, there are a variety of ways to incorporate both direct and vicarious learning experiences into our graduate programs including the use of case studies; internship and practicum experiences; guest speakers; as well as consulting with, and working for, real clients as part of a studio design approach. This is in line with Collins' (1991) recommendations for designing cognitive apprenticeships, which suggest that novices observe experts as they solve problems so they can witness the false starts and dead-ends that are typical of real-world problem solving. Furthermore, by hearing experts' reflections-in-action (Schon, 1993), novices may gain deeper understanding of the entire problem-solving process. So, for example, if students were to view videotapes of experts as they analyzed ill-structured case studies, they would not only see real-world examples of completed analyses, but also hear how the experts arrived at their final solutions. Furthermore, students could compare their ideas about the case with those of experts, providing rich fodder for meaningful reflection. Each of these strategies could provide opportunities for novices to hear and benefit from the experiences of more expert others.

        Still, it may be important to help students index these experiences in ways that are readily retrievable (Kolodner, Owensby, & Guzdial, 2004). According to Jonassen and Hernandez-Serrano (2002), the ability to recall prior experiences depends on how those experiences are stored in memory. Aamodt and Plaza (1994) noted that effective case-based reasoning requires a "well thought out set of methods" (p. 41) for indexing cases/experiences so they can be readily integrated into existing knowledge and then easily retrieved when needed to solve similar problems. Since only a subset of one's knowledge and/or experience will be relevant to any single problem, a practitioner needs to be able to select and retrieve only that which is relevant. Part of the job of the ID educator, then, becomes that of supporting novices as they observe, accumulate, and store (in memory) relevant experiences during their graduate programs.

        Providing appropriate learning experiences may be part of the answer, but it is also important to help students reflect on those experiences in ways that enable them to readily recall and use those experiences during future problem solving situations. For example, case study discussions can focus students' attention on specific problem elements and design challenges in the case, as well as possible solutions and their implications. Following this, Didierjean and Cauzinille-Marmeche (1998) recommended that we help students represent the knowledge gained at multiple levels of abstraction. At the lowest level, this would entail simply storing / indexing "unabstracted" knowledge in the form of specific case details (e.g., context, stakeholders, events). At the next level, case details would be represented in the form of themes or concepts underlying the specifics (e.g., communication issues, project management decisions). Further abstraction might result in the formation of a principle, or rule of thumb, that links the concepts or themes through causal, correlational, or chronological relationships (e.g., "If the subject is controversial, the delivery should be face-to-face; if it's a run-of-the-mill topic, it could be converted to the Internet."). As students' case knowledge becomes more abstract, it would have the potential to be more

generalizable. However, it also would lose the local and specific nuances that would enable it to address novelties, ambiguities, and exceptions to the generalities (Didierjean & Cauzinille-Marmeche, 1998; Reimann & Schult, 1996). Ideally, students would integrate their knowledge across all levels of abstraction to enable the most effective reasoning and recall. As students' mental models became more sophisticated through each subsequent experience, they would, over time, increase their ability to identify the underlying structure of the problem situation and thus reason from first principles (Reigeluth, 1997).

Limitations and Suggestions for Future Research

In addition to the small number of participants, a primary limitation of this study relates to the use of think-aloud protocols for data collection. While this is a common approach used in expert-novice studies (LeMaistre, 1998; Perez & Emery, 1995; Rowland, 1992), some participants are better at engaging in the concurrent tasks of problem solving and thinking aloud than others. In this study, this may have been complicated further by the manner in which the design problem was presented to the participants, that is, as a text-based case narrative. Asking participants to think-aloud as they read the case out loud may have interfered with their normal problem solving processes. Furthermore, according to Lloyd, Lawson, and Sean (1995), protocol analysis itself may interfere with designing and thus not accurately represent the design thinking we are trying to analyze. Additional research is needed to determine the extent of the influence of a think-aloud procedure on design thinking, as well as to evaluate other means for capturing the thought processes of experts. For example, it may be possible to videotape a team of designers as they discuss a novel case, capturing their conversations, and thus their thinking, as they analyze the situation. Another option might be to present the case situation via video rather than print, perhaps enabling a different type of thought process than that captured by reading and thinking-aloud. Finally, asking individuals to write a synopsis of a case situation might be able to capture important components of the problem-solving process, such as initial design decisions or elements deemed critical by the designer. While each of these methods has advantages and limitations, it also may be possible to combine approaches to adequately address critical shortcomings. This area appears ripe for additional research.

While this study focused primarily on experts' approaches to analysis (problem-finding), it will be important also to look at experts' approaches to designing solutions to the problems identified. Although all of the participants in this study made some suggestions about how to solve the problems described in the case, this was not pursued in depth due to time constraints. Future research should examine how experts use their previous knowledge and experiences to design solutions to ill-structured problems, including the extent to which they apply personal rules of thumb as they did during the problem finding process.

Conclusion

The results of this study suggest that experts tend to quickly filter through the layers of a problem situation to determine the key elements, by drawing on their previous knowledge and personal experiences, as a first step in conceptualizing the ill-defined issues in a case-based problem. Regardless of whether individual, multiple, or composites of previous experiences were recalled, these were used to create personal rules which were not gleaned from knowledge or experience alone, but from a combination of the two. Specifically, knowledge and experience appeared to facilitate the problem solving process by providing the individual with:
1. A personal perspective or frame of reference, incorporating a mental model of the ID process, that guided the individual's thinking about the problem and
2. A set of idiosyncratic rules of thumb that helped the individual reflect on specific ways to address the complex issues in the case.

According to Dufresne et al. (1992), "It is the organization and use of knowledge, not the knowledge itself, that play the pivotal role in successful problem solving' (p. 330). This suggests the need to rethink the way we scaffold student problem solving activities in order to more effectively enable them to organize their domain knowledge in ways that facilitate more expert problem solving. Based on the results of this study, we suggest three specific strategies for the education of designers: 1) helping students conceptualize the key issues in an ill-structured problem by scaffolding their analysis efforts to be more expert-like, 2) helping students accumulate a variety of ID experiences, either directly or vicariously, from which they can draw when faced with an unfamiliar design situation, and 3) enabling students to index these experiences in ways that facilitate efficient recall of relevant cases and/or principles when solving future ID problems. It is our hope that the use of these strategies will lead to more skillful problem-solvers who are able to strategically apply their knowledge, whether from textbooks or vicarious experiences, to articulate clear conceptualizations of ill-structured ID problems and, ultimately, to generate powerful and effective solutions.

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Through Singaporean Eyes: How Young Adults Learnt Online

Dr Linda Mei-Ling Fang

Abstract

As culture has been known to shape learning, it would invariably influence online learning as well. Learners bring along their culture to any learning environment. As they are influenced by multiple layers of culture, it is uncertain how these influence online learning. This qualitative descriptive case study investigates how a group of 20 young adult Singaporean Chinese in a Speakers' Program offered as blended learning, were learning online. It examined the influence of national, ethnic and cyber cultures on their online learning experience. The findings suggest that the learners' culture influenced how and what they wanted to learn, and with whom. While the influence of the different cultures predominated in certain areas, they often had a competitive or complementary effect on each other.

Introduction

The culture of the learner needs to be considered when explaining the individual's learning (Schunk, 2004). This is because culture shapes the mind by providing the toolkit by which individuals' worlds are constructed, as well as conceptions of themselves and their powers (Brunner, 1996). As cultural determinants such as gender, ethnicity, social class shape learners (Grenfell, 2004), they have been observed to learn differently (Brislin, Bochner & Lonner, 1995).

Culture is known to influence preference for learning and training (Marquardt & Kearsley, 1999). As behaviour is predetermined by mental programs or the software of the mind, culture can determine how students interact with their teachers (Hofstede, 1994). For instance, power distance influences how the students regard their teachers. Uncertainty avoidance differences will determine the level of expertise a teacher is expected to have. Students from collectivist cultures are more reluctant to speak up in class and instead try to preserve harmony and maintain 'face'. Masculinity and femininity also determine whether students present themselves as competitive or not. Hence, recognition of learner's personal epistemologies and conceptions of learning is important because learners' beliefs, significantly influence the approach they take to learning as well as what they ultimately learn (Pratt, 1998).

Culture influences online learning as well. For instance, Lim, (2004) found differences in online learning motivation between American and Korean learners. The American learners indicated significantly higher motivation scores for course relevancy, course interest, reinforcement and self-efficacy compared to the Koreans, who in turn scored significantly higher for learner control. For affect, the American students comparatively felt a greater sense of accomplishment when completing online lessons, preferred voicing personal opinions during class, enjoyed learning and enrolling in classes to obtain a sense of belonging. This shows that the Asian e-learner has a distinctive approach to learning online. Edmundson (2004), who studied the impact of cross-cultural dimensions in online learning, found that learners from two opposing cultures, namely USA and India, were able to achieve equitable learning outomes after taking a Western-designed online learning course. However, national cross-cultural differences were found to have affected learners' preferences and perceptions in educational contexts. Other studies have focused on the cultural aspects of user interface and understanding of a website involving international user groups (Evers, 2002), the relationship between national culture and usability in online learning (Adeoye, 2004), and differences between American and Chinese university students' design of personal web pages (Chu, 1999). Most studies used the quantitative approach. More qualitative studies like Chu's (1999) are needed to provide a balanced picture of online learner.

In Singapore, there is widespread use of technology in everyday life (Corbett & Wong, 1999) and in the schools (Hung, Tan, & Chen, 2003). Singaporean young adult learners belong to a cyber generation that has grown up with computers. As individuals are influence by different layers of culture (Hofstede, 1994), it can be expected that students in highly-networked, multi-cultural Singapore could be influenced by the national, ethnic and cyber cultures at the same time. While there have been studies on how Singaporean students interact online compared to their US counterparts (Tan, Wei, Watson, Clapper, & McLean, 1998), there are no studies that consider how online learning is influenced by three levels of culture.

This qualitative, descriptive case study focused on 20 young adult Singaporean Chinese enrolled in a two-month long Speakers' Program offered as blended learning. The research question was as follows: How were young adult Singaporean Chinese at a polytechnic in Singapore learning online? This study was part of a larger study which focused on the online learning experience of these learners (Fang, 2006). It surmised that the learners' culture would influence how they were learning. Hence, the conceptual framework was as follows (see Figure 1):
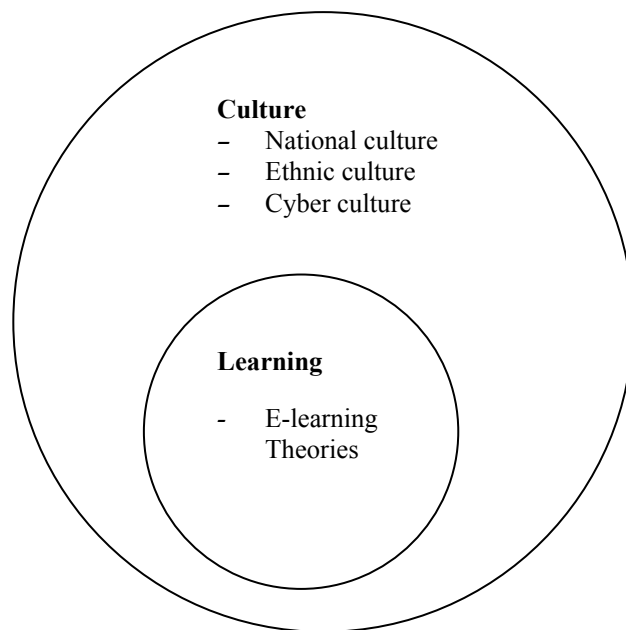
Figure 1. Conceptual Framework

Terms Used
i)   Singaporean Chinese: Those who have been born in Singapore, lived in Singapore and educated in the national schools are referred to as Singaporean Chinese in this study.
ii) Student Ambassadors Program: A specially-designed speakers' program to prepare student for public speaking events with the aim of promoting their institution, school or diploma; upon successful completion of the program, the Student Ambassadors would undertake a range of speaking assignments for both formal and informal events, addressing small groups of two to three persons to large audiences of 1000. They would have to be prepared for the unique demands of each event.
iii) Senior Student Ambassadors: Students who have successfully completed the program and have served well as Student Ambassadors.

Literature Review

How learning takes place online will be briefly reviewed. Culture at the national, ethnic and cyber levels would be reviewed.

Online learning
Online learning calls for an active approach to learning (Brooks, Nolan, & Gallagher, 2001; Dringus, 2000). It occurs where there is interaction with non-humans (i.e., content) as well as humans, namely tutors and other students (Garrison & Anderson, 2002; Moore, 1989). Each type of interaction has its role in ensuring that learning takes place. Moore (1989) explains that interaction with materials results in the change in learners' understanding, perspective, or the cognitive structures of the learners' mind. Interactions with the instructor (the expert) allows for the presentation of information, demonstration of skill or modeling of certain attitudes and values, and the shaping of learning. In huge classes, interactions with other learners at the group level can lead to learning.
Online learning applications could range from simple presentations to sophisticated online learning simulations with graphics, animation, video, and audio components (Hall, 1997). Interaction with others could take place in formal or informal learning communities via e-mail, list-serves, threaded discussion forums (Joliffe, Ritter,

& Stevens, 2001), live online chat sessions and discussions on whiteboard (Long, 2004; Welsh, Wanberg, Brown, & Simmerin, 2003) and video-audio conferencing (Duggleby, 2000). The interaction with other learners allows for collaborative work and discussions to take place online (Dillenbourg, 1999). Attention has to be paid to developing the sense of community within the group for the learning process to be successful (Pallof & Pratt, 1999). Learners receive feedback from humans or through electronically programmed means (Long, 2004) in a variety of ways: email messages, conference and announcement postings, automated feedback in the form of schedules, news, updates and personal feedback (Dringus, 2000). Guidance can be provided through e-moderation (Salmon, 2000), e-coaching (Bagshaw & Bagshaw, 2001; Dennen & Wang, 2002) and /or e-mentoring (Nuernberger, 2000).

Existing learning theories can be easily applied to computer-mediated technologies as the learning environment for drill and practice (Behaviorism), information transmission and processing (Cognitivism), personal discovery of knowledge (Constructivism), and the social construction of knowledge through mediated by different perspectives (Social constructivism) can be provided (Chen & Hung, 2003). However, Social Learning (Bandura, 1972) or Social Cognitive Theory (Bandura, 1985) which involves observational learning has yet to be explored fully.

Culture

Singaporeans are generally collectivist and high in power distance (Hofstede, 1994). They desire success in their studies and view education as a means to an end i.e. achievement in education would help them to get ahead in life (Kau, Jung, Tambyah, & Tan, 2004).

The Chinese value education (Nisbett, 2003). Teachers, who are highly respected, are expected to teach as well as guide students. They are the deciding authority and power on what knowledge to teach. Students readily accept the information and rarely question or challenge teachers in the classroom (Chan, 1999). As Chinese culture values modesty, Chinese students in the past would regard themselves "not worthy before their teachers". This modesty also causes students not to express their true opinions so as not to embarrass or offend others. In addition, classroom behavior serves to maintain face and prevent shame. For instance, students "lose face" for misconduct and poor performance (Chan, 1999). That explains their quiet behaviour in class (Biggs, 1996).

The cyber age offers conveniences in accessing materials. Digital technology allows broadcasts to be non-real-time, allowing for on-demand information to predominate. Electronic libraries, entertainment videos are all be available any time (Negroponte, 1995). Learners who are comfortable with the latest Internet technology and cyber culture, having embraced the telemetric world, can easily adjust to the 24 hour, multi-dimensional, global view of the world and are capable of learning when they want to, where they want to, and at their own time and pace (Harking, Turner, & Dawn, 2001). In addition, a new form of cyber communication with its emoticons and netiquette is emerging (Tapscott, 1998) and there is a new form of electronic literacy (Kiesler, 1997). Online communication influences the development of adolescents and new friendships are built online; cyber families and friends exist (Tapscott, 1998).

Chinese Online Learners

Culture influences the manner in which Chinese students interact online and they are more comfortable communicating online in a smaller group as there is more trust (Tu, 2005; Tu & McIsaac, 2002). This "inner circle" in the Chinese culture provides care and protection (Bond, 1991). In cross-cultural studies, Chinese learners have been known to be less critical than their American counterparts and avoid confrontation (Thompson & Ku, 2005). Chinese heritage students at an Australian university were found to have posted more messages associated with organizational matters while their Australian counterparts posted more messages associated with the intellectual contributions of the discussion (Smith, Coldwell, Smith, & Murphy, 2005).

Singaporean Online Learners

Online traits of Singaporean learners have been noticed in studies. For instance, trainee teachers were observed to avoid participating and interacting actively online; they did not keep the discussion thread for prolonged asynchronous discussion and posted independent statements of content unrelated to the prior messages (Myint & Yeap, 2004). They tended to be task-orientated, having little or no interest in socializing through electronic means. While they had contributed independent ideas online, there was a lack of heated discussions or debates where there would be sides taken on issues, negotiations or compromise (Hew & Cheung, 2003). Singaporeans have also been found lacking in displaying critical thought online (Myint & Yeap, 2004; Soo, 2003). National culture has influenced how Singaporeans students interact online: they were more collectivist compared to their US counterparts; they were less willing to challenge the majority position; and the majority influence remained unchanged when CMC replaced verbal and visual communication (Tan et al., 1998).

Methodology

The qualitative descriptive, single case study involved the 20 participants enrolled in a Speakers' Program. They were first and second year Engineering students in a polytechnic in Singapore. All were Singaporean Chinese between the ages of 17 and 19, and had been educated in the local school system. The training program, which was designed to prepare them to be Student Ambassadors of the polytechnic, was offered as blended learning during the polytechnic semester break between September to October 2005. It comprised six weekly face-to-face sessions with accompanying online sessions, ending in a project presentation. They were taught face-to-face and tutored online by a trainer, who was the researcher and a member of the faculty, as well as senior Student Ambassadors. Materials were placed on Blackboard 6. The program was designed to include Behaviorist, Cognitivist, Individual and Social Constructivist learning theories. Hence, the participants were provided with a variety of learning approaches, and a range of opportunities to interact with the content, each other, the trainer and senior Student Ambassadors.

Data was derived from their discussion board submissions, home pages, email messages, online chat, their personal records, and two interviews. The first interview was with individuals at the beginning of the program. The second interview was with the project group held at the end of the program. These were taped and transcribed. All data was saved on word documents. The individual interview, personal introductions, home page and personal records provided a profile of the participants. Data from their online responses provided evidence of their interactions with the content, each other and the training team. Data from a second interview revealed how they were learning, with whom and why. Data from these three sources were then triangulated.

Findings

The participants valued the program as it provided the desired skills would contribute to their personal development at work and in their studies. They were aware that the online work complemented the classroom sessions, having sensed the interconnectedness between these two mediums of learning. Hence, they were highly-motivated and conscientious in their assigned tasks. Responses were received during the day as well as late into the night, often after returning from their part-time job shift. They clearly determined what was learnt, from whom the learnt from or preferred to learn from, and how. These are reported under learning from the online content, each other and the SA Training Team, comprising the SA Trainer, the Online Coaches and Online Chat Leader.

Learning From Content

The participants were able to interact independently with the online materials, and attempted the required tasks and activities. Their submissions on the discussion board were excellent in quality, reflecting a maturity of thought. This showed that they had grasped the essence of the materials and were able to complete the exercises well. It was no wonder that they mentioned that they learnt much from the online materials and activities. The following exemplify their ability to learn quickly:

i) They used the materials to think for themselves. They showed an ability to identify positive information about the institution they were in, and achievements of competing institutions. In addition, they were able to highlight the key reasons for joining their institution, through selection, ranking and elaboration. Their responses revealed much sensitivity and thoughtful reflection on the topic. Asked which key words and phrases could be used, they highlighted the "conducive learning environment", "friendly lecturers", "wide variety of diplomas to cater to all students needs", "various interesting CCA [co-curricular activities] bring out [sic] the hidden talent in students", "healthier lifestyle" and how it "prepares one for the ever-changing society".

ii) They learnt by exploring, searching and synthesising information on their own. A web-quest activity required participants to recommend what would be the best course in Singapore for Ling Ling, a fictitious character, to enrol in. The advice provided was exceedingly sound, convincing and mature. One participant, WS, wrote with much confidence:

> I would strongly suggest … [institution's name and diploma course]. Since you are open to any engineering course, I assume you do have a clear sense on which field of engineering you want … [name of course] is a 3yr full-time engineering course. The Course equips you with systems thinking as well as facilitation skills, both of which are essential in today's market environment. Upon graduating from the course, you will possess the unique ability to integrate business and engineering principles to serve on cross-functional teams that drive improvements and productivity towards organisational excellence. Taking this course gives you more options because after completing the course, you will be able to know exactly what you want and to take which particular degree in Singapore's University as you have experiences in both fields.

The course will definitely gives you an edge over others as you have both business and engineering knowledge.

He went on to suggest several degree courses she could pursue at the two local universities upon completing the recommended diploma, highlighting the relevance of each to the working world. After mentioning the high ranking of the two universities, he concluded "so you can aspect [sic] quality education in Singapore. Hope I've give [sic] you some valuable information LingLing and Good Luck!"

iii) They learnt quickly from patterns that were provided. In their "Speech Class", they were quick to grasp the key principles of pronunciation that influence the intelligibility of Singaporean speech even though they had not received any formal training in pronunciation or linguistics. Yet, from the samples provided in one brief lesson, they could recognise the inherent problems with local pronunciation which could lead to miscommunication internationally. The participants responded with Singaporean examples, for instance, word pairs like "tin-thin", "library-library" and "think-thing" that could influence the intelligibility of Singaporean speech.

iv) They learnt from models provided. An example was when the participants selected their plan for their personal stories. Despite being presented with a variety of approaches for the introduction, the development of the speech and conclusion, all but one of the participants followed the same model in their first draft, submitting close to "cookie cutter" versions of their personal story as they were based on the same theme and event. For many, it was the first attempt at they were writing a speech, and they mentioned the sense of achievement they felt on their being able to write it. The model seemed to help them draft it quickly.

v) They learnt from an awareness raising activity. One activity required the participants to make identify which story reflected what was most appropriate to say in public. They made sensible decisions as to the best types of stories. One participant declared that it truly sensitized her to what could be said in public.

Overall, they seemed comfortable interacting with the content and could learn in a variety of ways. They could be considered as able to learn independently from the content.

Learning From Other Participants

Judging from the online submissions, the participants did not seem to have learnt much from each other. The lack of interaction may have limited learning directly from each other; however, it did not prevent them from learning indirectly from each other.

Group size seemed to affect interaction. Online, they were guarded and cautious to interact in a large group. Being generally unfamiliar with the other participants, they were also reluctant to comment on each other as individuals or their work for fear of offending the other. For instance, "Positive Vibes", an activity that provided the opportunity for public affirmation and appreciation of the other caused much discomfort amongst the participants. Neither did they engage in any issues raised. This absence of interaction prevented participants from contributing to the learning from each other. However, learning from each other was largely indirect, and hence vicarious. The participants learnt by reading each other's submissions, and from the comments and feedback given to others by SA Trainer and SA Online Coaches on the discussion board. Some read what their friends wrote out of curiosity, while others read the submissions to learn. Firstly, they learnt about each other without addressing them directly, and without their knowledge from their introductions, home pages and the organized chat. Secondly, the participants sometimes learnt by following the submissions of others. That was why the responses followed in quick succession after first submission. They looked for good answers, used them as models and followed the style or type of answer. At times, the first submission by a participant was taken as the model. For instance, many revealed that for the "WOW" factors activity, subsequent submissions were markedly similar in content and coverage to the first submission. No one tried to be different or leave out any information. It was probably a "safety in numbers" reaction. Also, when in doubt, the strategy was to look for the best submissions to follow. One pair confessed selecting the best answers, checking them, summarizing them and resubmitting the information as theirs.

They seemed to have learnt from each other in smaller groups. However, while they reported sharing ideas and working together in project groups for their final presentation, there was no evidence of "work in progress", discussions reflecting how they worked on their project on the discussion board. Whatever was submitted as responses which were observable to all, were found to be in their final, summative stage. Formative work that emerged from the shaping and exchanging ideas was not visible because these possibly took place in private, within the confines of their project group. Perhaps that was where they could freely discuss, agree or disagree. For example, two participants mentioned sending each other ideas and thoughts through email for their group assignments, but they also communicate through SMS messages and over the phone. Others discussed privately in their project groups via MSN messenger. Because the data was not available, it had to be assumed, such learning could have taken place, judging from the quality of their group presentations.

Learning From the SA Training Team

Different types of learning were derived from the members of the training team, comprising the Trainer (a staff member), and Online Coaches and Online Chat Leaders, who were senior Student Ambassadors. The context was an influencing factor.

The Trainer seemed to play a more consistent and dominate role in helping the participants learn in the formal setting in a large group. She consistently provided feedback or comments each time a participant posted a submission on the discussion board. However, the participants appeared to be passive learners, merely accepted the comments, feedback and suggestions, occasionally asking for clarification. They never challenged what was said. None of them pursued any matter or were engaged in a discussion with the Trainer. She had little influence in an informal learning situation. Apart from the occasional email requesting clarification, the Trainer was not invited to be on MSN with the participants when they chose to learn in small groups. Hence, the Trainer was not able to shape their learning or help them for discussions of work in progress in informal settings.

In addition, the participants showed a remarkable ability to learn quickly from the Trainer's feedback. This was evident when they scripted their personal story. Each participant was given individual feedback on the first draft personally via email. All revised versions showed marked improvement. The most evident change was in the number of words. Chart 1 below shows the word length percentage change in relation to their initial drafts. The participants have been ranked from 1 to 19 ranging from the greatest number of words reduced to the greatest number of words increased. One participant, who was ill, submitted her work after the program had ended and thus was not included in the data.
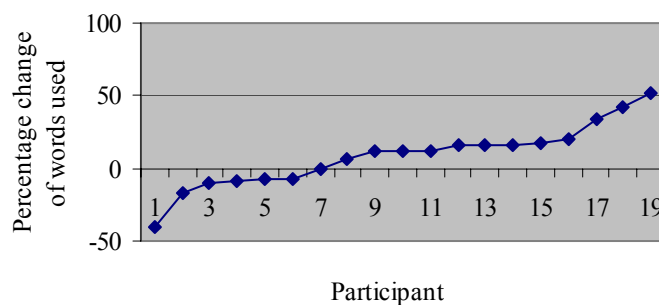
Chart 1. Change in Story Length
Note: Chart shows submissions of 19 participants

Once the participants learnt to include or exclude, their speeches became more focused. They then were then able to move away from the model used and borrowed sentences to incorporate more independent thought and personal experience. They sounded more convincing and confident in their revised speeches. One participant who did not follow any model and struggled to make sense of the writing process had a credible personal story. His revised draft showed much promise as it had the most original ideas and interesting insights. Hence, individual feedback allowed the participants to produce interesting, differentiated personal stories in a very short time.

The Online Coaches seemed to play a much less influential role, particularly in public, on the discussion board, rather than in private, on MSN. Their task was to provide assistance when needed. The participants hardly responded to the offers for help from the Online Coaches in public, however, they had some success in helping the participants in private. One member of an all female project group mentioned receiving encouraging comments and feedback on their drafts via email and passed them on to the others via a variety of sources, namely, email, SMS and phone. Another group benefited from the useful tips sent by their Online Coach though they did not engage him in their discussions. Another group chose not to bother their Online Coach. Two groups who chatted with their Online Coach on MSN reported that their assigned Online Coach to be very helpful. It was assumed that these groups received more help. The extent of the assistance could not be fully determined since the data of their invisible interaction was not available to the researcher.

Participants learnt least from their Online Chat Leader because they viewed the Organised Online Chat as a means to socialise, although it was based on a rather serious topic. Placed in groups of 11, they were chatty, and at

times unfocused during their discussion. Some claimed that their SA Online Chat Leader was very knowledgeable and had provided them with information on the topic for discussion. However, this was because their feigned ignorance was merely a ploy to increase social interaction with him; hence, it might not have increased their knowledge significantly.

Online Learning Mode

Seemingly passive learners online can be in actual fact, are active learners. If learning is only associated to visible interaction, not all the learning will be captured. The "invisible" learning could provide insights as to the participants preferred to learn. Hence, their online learning mode, depicted in Table 1, attempts to describe how the participants were learning, by reflecting the direct and indirect learning that took place online.

Table 1

Preferred Mode of Learning

Source of Learning	Direct	Indirect	Comments
Content	Predominantly from materials and activities	N A	Learnt directly and effectively in a variety of ways
Other participants	Limited in large group More with project group	Learnt by reading online submissions of other participants	Learnt directly from members in small group; learnt indirectly from how others responded in a large group
		Learnt by reading comments SA Trainer and Online Coaches made to these submissions	Learnt indirectly from feedback provided to other participants' responses
SA Trainer	From feedback of online submissions		Learnt directly in formal context
SA Online Coach	Limited, from comments, suggestions Able to work with project group, if included in discussions		Learnt directly Less in formal situation; possibly more in an informal situation if familiar with or invited by group members
Online Chat Leader	Not at all	Not at all	Chatting not considered a learning situation

Sensing Participants' Preferences

The participants' preferences for what they wanted to learn, how and with whom, influenced the way they reacted to the materials, tasks and activities. This resulted in the outcomes differing from the intended design of the lessons. There were times when the activities had a life of their own. For example, their introductions, which were on uploaded Microsoft word documents on the discussion board as well as on their home page, were designed to provide an opportunity to present themselves positively in public. Instead, they used the opportunity to reach out to others and included personal details and photos. In addition, the organised online chat, which was expected to be a rather serious discussion, turned out to be an enjoyable, interactive activity and out-of-focus discussion as the participants took it lightly. On the other hand, there were some activities that made them uncomfortable, and the lack of response signalled this. For instance, they either avoided invitations to comment on the participants or their work

or circumvented the issue by providing generalised statements. When asked to identify the worst story provided in the materials, they deliberately avoided commenting, claiming that they found none at the point of submission. Neither did they discuss their work online in a large group, choosing to do so in private. At times, they were held back by their shyness. The few bold attempts to reach out to the others in their introductions were not reciprocated and hence no friendships were formed online.

Discussion

The participants learnt through online interaction with non-humans (i.e., content) as well as humans, namely tutors and other students (Garrison & Anderson, 2002; Moore, 1989). Firstly, interaction with materials resulted in the change in learners' understanding, perspective, or the cognitive structures of the learners' mind (Moore, 1989). They seemed an effective mode of learning for the participants who could learn from a variety of resources provided and activities. Secondly, interactions with the instructor (the expert) allowed for the shaping of learning (Moore, 1989). However, this happened only in a formal learning context. They were not able to learn from their Online Chat Leader but managed to learn from their SA Online Coaches in a limited way, more with increased familiarity. Thirdly, while interactions with other learners at the group level was expected to lead to learning (Moore, 1989), the limited interactions resulted in learning to be direct in a small group and indirect in a large group. Overall, there was an active approach to learning (Brooks et al., 2001; Dringus, 2000) for learning that was public and visible (on discussion board) or private and not visible. Despite the design of the program based on different learning theories (Chen & Hung, 2003), the learners still influenced what and how they were to learn, and from whom. For instance, social constructivism possibly took place online within the smaller groups, while social learning and social cognitive learning (Bandura, 1976, 1985) or vicarious learning seemed to be reported in large groups. Perhaps this was why one participant aptly described learning online as a "visual" experience.

Cultural Interpretations

Culture could have subtly shaped what the participants, how and with whom. National culture was evident when the participants seemed to respond in the same manner, their inclination to collectivism (Hofstede, 1994). Chinese culture also predominated in several situations. Their respect for the SA Trainer as an authority (Chan, 1999) was reflected in the way they followed a model she provided for their speech writing and incorporated her feedback in their revision. The participants were quiet in a large class (Biggs, 1996), refraining from expressing their true opinions to avoid embarrassing or offending others, or even "losing face" for themselves (Chan, 1999). Their preference for learning was in their smaller group (Tu, 2005; Tu & McIsaac, 2002). Cyber culture was also evident. Learning could have taken place at any time (Harking, Turner, & Dawn, 2001) judging from the responses that were received in the day and night, even in the early hours of the morning. In addition, their casual communication included the use of emoticons in their personal introductions and online chat online (Tapscott, 1998) probably shaped their view that chatting was appropriate for social activities and bonding but not to engage in serious discussions for learning.

The influence of multiple levels of culture could have a complementary or competing effect. Similar cultural values at different levels could have reinforced what they learnt, how and with whom. For instance, the desire for success in studies (Kau et al., 2004) and the respect for learning (Nisbitt, 2003) could be the reason the participants took content materials and tasks seriously. In addition, high power distance (Hofstede, 1994) and respect for authority (Chan, 1999) resulted in their desire to learn from the SA Trainer only in a formal learning situation. At other times, they could have played a competing role. For instance, the opportunity for online friendships (Tapscott, 1998) were not realised in a large group, as the need to belong to a smaller group (Tu, 2005; Tu & McIsaac, 2002) seemed stronger. That was the most likely reason for their tendency to learn vicariously in a large group and directly from each in a smaller group.

Conclusion

The findings suggest that culture at the national, ethnic and cyber levels could have influenced the participants online in terms of whom or what they were learning from, and the preferred mode of learning. The different levels of culture could have influenced the participants directly or indirectly, consciously or unconsciously and could have a reinforcing or competing effect on each other.

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The Effects of On-line Essay Scoring on the Improvement of Writing of High School Sophomores

Julie Forbess
Michael M. Grant, Ph.D.
The University of Memphis

Abstract

National testing efforts indicate that students are lagging in developing adequate writing skills. Research that has been conducted on the use of word processors to improve writing skills at different grade levels has yielded mixed results at best. The purpose of this study was to determine the effectiveness of an online essay scorer in improving the writing of high school sophomores. Regression results found the automated online essay scorer combined with Group membership (experimental or control) explained 40% of variance, $p<.01$.

Introduction

According to the 2002 National Writing Report card, two-thirds of all children in the United States perform below the proficient level in writing, a level that indicates solid academic performance. Of all students, 75% perform at the Basic level, which indicates minimal effectiveness in getting main ideas across. These results do not differ significantly from the 1988 National Report Card (Applebee, Langer, Jenkins, Mullis, & Foertsch, 1990) wherein students at grades 4, 8, and 12 demonstrated poor writing abilities. Less than 45% of students across the nation wrote responses to informative prompts that were considered adequate or better. Additionally, only 27 to 36% of students provided responses to persuasive prompts that were considered adequate or better. Although students performed better on imaginative narrative responses, merely 9 to 56% performed at a level considered adequate or better. The low performance of students on the National Writing Report card across a time span of 12 years indicates that educators need to examine methods to improve the writing skills of our nation's learners.

Composition research initially experienced growth in the 1960s when researchers began to study the processes in which professional writers engage while producing written text (Humes, 1983; Tchudi & Mitchell, 1989). From these observations several different researchers developed writing as a process using both qualitative (Emig, 1971) and quantitative (Hillocks, 1984) research methods. This description of writing as a cognitive process in which writers go through a series of stages (i.e., prewriting, drafting, revising, and publishing) has dominated writing research for the past 46 years although it has been presented in various formats with emphasis on different components.

Instructional methods such as sentence combining (O'Hare, 1973) and scaffolding (Langer & Applebee, 1986) have been promoted, but these methods have been incorporated to varying degrees into the writing process approach, and so no viable alternatives to the writing process have been promoted at the secondary level. Research to date has emphasized that writing is a complex process that can be studied with many different methods, qualitative (e.g., Emig, 1971) and quantitative (e.g., Hillocks, 1984). The cognitive processes engaged in by writers are recursive and guided by goal setting and multifarious influences such as the task environment and long-term memory (e.g., Flower & Hayes, 1986). Furthermore, educators, as well as researchers, must acknowledge and accommodate this multifaceted progression if it is to be taught and studied effectively. Research has additionally indicated that writers can be aided by clear, concise, learner-centered goals and activities (e.g., Langer & Applebee, 1986; Hillocks, 1984). Student writers seem to benefit from the consistent application of scales and scaffolds (e.g., Hillocks, 1984: Langer & Applebee, 1986) as well as teacher commentary that suggests techniques for improvement but gives control over the writing decisions to the students (e.g., Straub, 1997).

Computer-assisted Writing

The mid-1980s through the present have produced many studies that examined the effects of incorporating new technology, namely word processors, into composition instruction (Dybdahl, Shaw, & Blahous, 1997). Naturally, the advent of word processors and the wider availability of computers in classrooms encouraged educators to incorporate these tools into the composition classroom.

Computer-assisted instruction is a method that has yielded mixed results with regard to writing instruction. Numerous quantitative and qualitative studies with various results have been conducted on the merits of computer-assisted writing instruction when used to aid students in developing writing skills (Grejda & Hannafin, 1992; Owston & Wideman, 1997; Dybdhal, Shaw, & Blahous, 1997). Although the use of word-processing has encouraged students to make both mechanical and organizational revisions throughout text, "word-processing may inadvertently direct proportionately more attention to structural than holistic aspects of writing" (Grejda & Hannafin, 1992, p. 148). More sophisticated forms of composition software may help alleviate this issue by providing feedback on issues of coherence or unity through comments on organization, thesis sentences, and word choice.

Frequent usage of word processors has, in fact, been shown to improve both the surface features of writing including grammatical structures, spelling, usage, and mechanics as well as the deeper structure which include general writing development, sense of audience, purpose for writing, overall meaning, unity, detail, and cohesion (Owston & Wideman, 1997; Lowther, Ross, & Morrison, 2003). Among the benefits of using word processors in composition classrooms are the relief of technical concerns for students such as handwriting and spelling (Gupta, 1998; Hansman & Wilson, 1998). In addition, the ability to revise text without having to entirely rewrite the product encourages frequent revision and modification of written work (Owston & Wideman, 1997).

Online Essay Scorers

Recent advances in technology have given rise to online essay scorers such as the Educational Testing Service's (ETS) *Criterion* as well as *SAGrader*. These scorers claim to give holistic scores, scores that include comments about content as well as about style, usage, mechanics, and organization and development. Students receive their feedback in about 20 seconds and are permitted to resubmit work for higher scores. Little research (c.f., Attali, 2004; James, 2006) currently exists that examines this new technology. Sophisticated online essay scorers have the potential to provide many of the conditions that previous research promotes in composition instruction. The feedback provided by the online scorer is nonjudgmental and is designed to provide support to students in making revision choices, not dictate revision choices. This is in line with research findings about effective commentary on student writing (Straub, 1997). Teachers may make comments on student writing, but the online grader assigns the score according to consistent scales. Consistent usage of scales may lead to internalization of the scales by the writer (Hillocks, 1984: Langer & Applebee, 1986). The scorer provides concrete examples of different elements it scores, such as topic sentences and transitional devices. These elements provide scaffolds to writers that lead them to higher levels of development while giving students the freedom to choose whether to access them or not (Straub, 1997).

A statistical analysis of *Criterion*, ETS's online scorer, in which 9000 essays were analyzed to assess the effectiveness of the feedback provided by the essay scorer, indicates that students are responsive to feedback for errors and are able to correct identified errors in successive drafts (Attali, 2004). Specifically, students were able to decrease grammatical errors, increase main points and supporting ideas, and also increase essay length.

Purpose of the study

The purpose of this study was to examine the use of a relatively new resource for evaluating writing, an online essay scorer. These scorers are more sophisticated than their predecessors and claim to offer holistic scores that include a basic analysis of grammar and spelling. Online essay scorers are an expensive resource for schools and their implementation in secondary settings is relatively unstudied. One primary research question guided this study: Is there a significant difference in experimental students' writing ability as assessed by human and online scorers when compared to that of control group students?

Method

Participants

The experimental participants were 63 sophomore English students who ranged in age from 14-16. Male and female students were included. African-American and Caucasian students made up the majority of the students; however, Hispanic, Asian, and Native American students were also included. The majority of the students had no significant health concerns. A small minority of the students were inclusion students.

The control group participants attended a mid-southern urban Title I school that is primarily African-American in population. The participants in the experimental group attended a mid-southern urban Title I school that has an ethnically mixed population. Approximately two% of the students are Asian, Native American or Hispanic, of the remaining students about half are African American and half are Caucasian.

Instrumentation

Two essays were collected from participants in the experimental group and control group – an initial estimate (pre-assessment) and a follow-up estimate (post assessment). All essays were submitted for two methods of scoring. First, essays were submitted to an online essay scorer. Secondly, essays were reviewed by an Advanced Placement English Composition reader using the Tennessee Comprehensive Assessment Program (TCAP) Writing Assessment rubric.

Online Essay Scorer. The online essay scorer was *Criterion Online Writing Evaluation* provided by ETS. *Criterion* uses automated scoring technologies to provide immediate constructive feedback online using a scale of 1 to 6. A score of 1 is low and a score of 6 is high. Students receive annotated diagnostic feedback on grammar, usage, and mechanics. *Criterion* provides a reference guide that contains basic grammar rules, usage, and mechanics. Students may receive instructor feedback online in conjunction with comments made by *Criterion*. Students are able to correspond with instructors online.

Teachers can choose the types of feedback that students receive and control the number of submissions students may make. Teachers also have the option to set the time period during which submissions can be made. Teachers receive a class error report for each writing assignment. Specifically, *Criterion* provides feedback on the following areas:

a. Grammar, specifically sentence fragments, garbled sentences, subject-verb agreement, verb-form errors, possessive errors, wrong or missing words;
b. Word usage including article errors, confused words, wrong form of word, faulty composition, nonstandard verb or word;
c. Mechanics, including spelling, missing capitalization of proper nouns, missing initial capital letter in a sentence, missing question mark, missing final punctuation, missing apostrophe, missing comma, missing hyphen, improperly fused words, improper compound words, duplicate words;
d. Style, including repetition of words, inappropriate words or phrases, passive voice, long sentences, short sentences, sentences beginning with coordinating conjunctions;
e. And organization and development such as introductory material, thesis statement, main ideas, supporting ideas, conclusion, transitional words or phrases.

Two scores from one to six for each participant were recorded—one for the initial estimate and one for the follow-up estimate.

Advanced Placement Scorer. The scoring rubric used by the independent scorer was developed by the state of Tennessee to score the TCAP writing assessment. It also uses a scale from one to six; one is Deficient and six is Outstanding. The scorer was provided anchor papers, sample essays for each score from one to six as a reference for the scorer, used by the state.

Writing Prompts. The prompts were selected from past prompts used by the state on the 11th grade TCAP writing assessment. Prompts were selected by the researchers for two purposes. One, older prompts were selected to limit the possibility that students had recently written about them on the state writing assessment. Two, the topics, banning cell phones at school and the possible elimination of extra curricular sports were selected because of the relevance these two topics have to students' personal lives since the essays were to be written in the persuasive mode. The prompts were used at both the experimental and control schools. A copy of the prompts is available in the appendix.

Procedures

A writing prompt on whether cell phones should be banned from high schools was given to the control and experimental groups in October 2005 to gauge an initial estimate of writing ability. All essays were scored by *Criterion* and by the Advanced Placement Scorer. The control group proceeded with its normal curriculum. The experimental group continued to use *Criterion* when appropriate for the next 5 months. All writing samples were collected from students after they had been scored by Criterion. In March 2006, a writing prompt on the possible elimination of extra curricular sports was given to the control and experimental groups to gauge a follow up estimate of writing ability. The teacher of the experimental group taught some computer skills as needed, such as formatting

and other skills necessary to allow students to access *Criterion* both from school and other settings such as at home or the local public library. As part of the writing curriculum at the experimental school, students completed a minimum of one writing-across-the-curriculum lesson in each subject area each nine weeks that was submitted to *Criterion*.

Analysis

Three statistical tests were conducted on the data: correlations, regressions, and t-tests. The results will be organized in this order.

The variables included in the data analysis were:

a. two estimates of writing ability: (1) the initial estimate of writing ability and (2) the follow-up estimate of writing ability
b. the two methods of instruction: (1) standard classroom instruction and (2) standard classroom instruction incorporating Criterion online essay scorer
c. the two methods of scoring the initial estimate and the follow-up estimate of writing ability: (1) the human scorer and (2) the online automated essay scorer, Criterion.

Results

Descriptive statistics are provided for each of the data in Table 1. The initial step in the data analysis was the running of correlations to look for a significant relationship among the variables (see Table 2). The three strongest relationships were: (a) the relationship between the initial estimate with the online essay scorer and the follow up estimate with the online essay scorer, reaching significance at $r(61)=.449$, $p<.001$; the relationship between Group and the initial estimate with the online essay scorer, reaching significance at $r(61)=.357$, $p=.004$; and (c) the relationship between Group and the follow up estimate with the automated online essay scorer, reaching significance at $r(61)=.580$, $p<.001$.

Next, a series of six regressions were conducted to determine if the variables of the study were significant predictors of writing ability. The regression results consistently indicated that when the follow-up estimate of writing ability was employed as the dependent variable, the initial estimate of writing ability and the group were significant predictors of the variance in writing ability with six of the variables having significant unique influence on writing ability. Due to space limitations we have only reported total variances of the variables, excluding descriptives and regression tables. In order to importance they were: composite ($R^2=.116$), initial estimate of writing ability scored by the online automated essay scorer ($R^2=.202$), initial estimate of writing ability scored by the human scorer and the online automated essay scorer ($R^2=.205$), composite and group ($R^2=.395$), initial estimate of writing ability scored by the online automated essay scorer and Group ($R^2=.404$), and the initial estimate of writing ability scored by the online automated essay scorer, the human scorer, and Group ($R^2=.406$).

Finally, *t*-tests were conducted to determine any significant differences with regard to the scorers between the control group and the experimental group. The first *t*-test measured the control group by comparing the initial estimate of writing ability and the follow-up estimate of writing ability scored by the human scorer and the initial and follow-up estimate of writing ability scored by the online automated essay scorer. When scored by the human scorer the mean for the control actually declined from the initial estimate (Mean=3.59) to the follow-up estimate (Mean=3.44), but no significant difference was detected ($t(31)=.926$ $p=.361$). When scored by the automated essay scorer, the mean for the control group increased from the initial estimate (Mean=2.44) to the follow-up estimate (Mean=2.50). Again, no significant difference was detected ($t(31)= -.210$, $p=.835$).

Table 1. Descriptive Statistics

	N		Means		Standard Deviations	
	Control	*Experimental*	*Control*	*Experimental*	*Control*	*Experimental*
Human Initial Estimate	32	31	3.59	3.23	1.043	1.230
Online Initial Estimate	32	31	2.44	3.52	1.523	1.338
Human Follow up Estimate	32	31	3.44	3.65	.914	.839
Online Follow up Estimate	32	31	2.50	4.03	1.344	.752

Table 2. *Correlations of estimates of Writing Ability, Scorers, and Group membership (N=63)*

		Initial estimate Human scorer	Follow up estimate Human scorer	Initial estimate online scorer	Follow up estimate Online scorer	Group
Initial estimate Human scorer	Pearson correlation	1	.241	.137	.004	-.162
	Sig. (2 tailed)		.058	.284	.974	.205
Follow up estimate Human scorer	Pearson correlation		1	.061	.323*	.119
	Sig. (2 tailed)			.633	.010	.351
Initial estimate Online scorer	Pearson correlation			1	.449*	.357*
	Sig. (2 tailed)				.000	.004
Follow up estimate Online scorer	Pearson correlation				1	.580*
	Sig. (2 tailed)					.000
Group	Pearson correlation					1
	Sig. (2 tailed)					

* p<.01

For the experimental group, when scored by the human scorer, the mean increased from the initial estimate (Mean=3.23) to the follow-up estimate (Mean=3.65) but no significant difference was detected (t(30)=-1.850, p=.125). When scored by the online automated essay scorer, the mean increased from the initial estimate (Mean=3.52) to the follow-up estimate (Mean=4.03) which neared statistical significance (t(30)= -2.232, p=.033).

Discussion

The statistical results have two key implications. First, the results of the human scorer are inconsistent and not significant in any test of single or combined independent variables. Where the human scorer is considered, neither the initial estimate of writing ability nor the group membership helped predict the final estimate of writing ability for either the control or the experimental group. When state sponsored writing exams are typically scored, more than one human scorer is employed to score each essay to ensure that scores are not inappropriately high or low. In contrast, classroom practice usually dictates that a single teacher scores each essay produced by a student. This study used a single highly trained, experienced Advanced Placement English essay scorer. The average English teacher does not have specialized training in scoring student essays. "Just as writers' work is affected by their attitude to their subject matter, so too the meaning and impact of a text is controlled by readers' purposes and any biases or feelings generated about the material they are reading" (Huot, 1997, p. 210). Even with specialized training and extensive experience, in this study, a single human essay scorer could not produce consistent scoring results. Nor did the human scorer's results agree with the online automated essay scorer's results. In fact, according to the human scorer, the average score of the control group declined from the initial estimate (Mean=3.59) to the follow up estimate (Mean=3.44) of writing ability.

Secondly, where the online automated essay score was considered, the independent variables were all good predictors of performance on the final estimate of writing ability with initial estimates combined with group membership explaining approximately 40% of the variance even when the human scorer's initial estimate is included with the previous two variables. According to the online automated essay scorer, both the experimental and the control groups show improvement in writing ability. Though the control group's improvement is not statistically significant, the experimental group's improvement is statically significant. Further, though the initial estimate of writing ability was an important predictor, group membership (i.e., control or experimental) was a much more important predictor.

The results indicate that the experimental treatment of incorporating an automated online essay scorer did improve student writing ability in this study. Although the human scorer's results were not statistically significant, the mean of the experimental group did increase from the initial estimate to the follow-up estimate of writing ability. The online scorer's results more strongly indicated improvement between the initial estimate and the final estimate of writing ability. The increase of the mean did reach statistical significance thus indicating an improvement according both scoring methods. These results show that the human scorer was unreliable in this study while the online scorer was very consistent. In line with previous research (Straub, 1997) that demonstrated that students prefer comments on their writing that is specific, elaborate, and points out problems with suggestions for improvement, the feedback and practice provided by the online automated essay scorer appeared to have had a

significant impact on writing ability when integrated into the experimental school's writing curriculum while the standard curriculum used by the control group did not. Therefore, the incorporation of online automated essay scorers into existing curriculums would provide an advantage to writing teachers and their students in improving standardized writing scores.The success of the online scorer in this study is consistent with research literature that emphasizes the importance of the use of consistent scales when evaluating writing (Hillocks, 1984; Langer & Applebee, 1986). The online essay scorer is not subject to the variability of the human scorer when rendering holistic evaluation of student performance. In addition, the handbook and suggestions for revision provided by the online scorer serve as instructional scaffolding (Langer & Applebee, 1986), which has also been put forth as an instructional model for composition instruction.

Conclusions

The results of this study support the integration of an online automated essay scorer because of (a) the reliability it demonstrated with regard to holistic scoring and (b) the statistically significant improvement in writing ability of the experimental group. However, this research was limited in scope. The actual instruction used by the classroom teacher in conjunction with the implementation of the automated essay scorer was not studied. Likewise, the instructional practices employed within the control school also went unexamined. The focus of this research was delimited to the examination of the scoring methods. In order for schools to make effective use of this expensive resource more data about the pedagogy with the experimental group would be beneficial. Further research should consider: (a) the number of times students actually used the automated essay scorer, (b) whether the students completed writing assignments without using the automated essay scorer, (c) what instruction the teacher provided prior to and after using the online essay scorer, and did topic selection influence student motivation and/or performance? How can the improvements seen in the experimental group be increased? In addition, some debate among researchers in writing assessment exists about the validity of holistic scoring, or "the value of the judgment given by a rater" (Huot, 1990, p.205), such as *Criterion*. Would other methods of assessment produce similarly statistically significant results? The use of scoring for (a) development and focus or (b) correctness and efficiency rather than holistic scoring has been debated as means of enhancing validity in scoring writing samples (Huot, 1990).

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Self-Regulation of Learners in an Asynchronous University Math Course

Charles B. Hodges
Virginia Tech

Introduction

In recent years a new model of course design has emerged which has become known as the "emporium model" (Twigg, 2003, p. 34). Synchronous class meetings do not exist for courses using the emporium model. Learners enrolled in an emporium-designed course work on most of their assignments asynchronously. Learners choose from a selection of online materials and one-on-one assistance in a computer lab. Some online activities may be accessed from any computer with access to the Internet and some activities are restricted to access from a central computer lab. The emporium model has been adopted at several institutions as the redesign option for mathematics courses ("The Learning MarketSpace," 2005). Yet, investigations into the needs of the learners in these environments have, for the most part, eluded publication. Given that in an emporium-designed course students are expected to manage their own learning, academic self-regulation is an area that must be considered. Academic self-regulation refers to the degree to which learners are "metacognitively, motivationally, and behaviorally active participants in their own learning process" (Zimmerman, 1989, p. 329). Self-regulation has been identified as an important skill for learners in emporium designed math courses (Hodges, 2006). This study was conducted to address the lack of research on emporium-designed courses, and the need for self-regulation research called for in recent publications (e.g. Hodges, 2005; van Gog, Ericsson, Rikers, & Paas, 2005; Whipp & Chiarelli, 2004). The research question guiding this investigation was, "What strategies do learners use to regulate their learning in an emporium-designed mathematics course?"

Participants

Seven individuals (4 female, 3 male) participated in this study conducted during the spring 2006 semester at a large mid-Atlantic university. All of the participants identified their ethnicity as White or Caucasian and their academic level as freshman. One female participant was 19 years old. Each of the other participants was 18 years old. The learners were enrolled in an emporium-designed, freshman-level, matrix algebra course. Academic majors of the participants included: mathematics (1), general engineering (4), mining engineering (1), and material science (1). The participants were solicited via email during the first week of the semester. An email invitation was sent to each of the 602 learners enrolled in the course.

The participants' experience with online courses was varied. Some participants had taken online courses previously and some had not. Some were taking online courses at the same time they were taking the course used in this study. One participant was repeating the course.

The Research Context

The context for this study was a 2-credit, emporium-designed, matrix algebra course. The majority of students enrolled in the course are engineering majors, but students majoring in mathematics, physics, chemistry, and other sciences must also take the course. Students attend a one-time, face-to-face introduction to the course during the first week of the semester. In that introduction the course facilitator explains that there are weekly quizzes, periodic tests, and a final exam. The quizzes and tests have set deadlines throughout the semester, but, working within those deadlines, students are free to schedule their time for the course, as they want. Various resources are available to support the students in their learning and the course facilitator highlights those during the course introduction. Resources available to the students include: web-based video lectures, practice quizzes, an online book referred to as *lesson pages*, and the human Instructional Assistants available in the computer lab. Each weekly quiz counting toward the students' semester grade is a four-question quiz. The practice quizzes also consist of four questions. Instructional Assistants are available most days of the week from 10:30 AM to 10:30 PM and no

appointment is necessary. Instructional Assistants do not offer extended, one-on-one tutoring sessions, but they do offer just-in-time guidance on specific math questions.

Research Design, Data Collection, and Procedures

This research was conducted as what Merriam (1998) refers to as a "basic qualitative study" (p. 11). It is a partial replication of a study by Whipp and Chiarelli (2004) involving learners in a web-based course. Data was collected through guided journal entries, one-on-one interviews, and artifact collection. Data was collected for this study throughout the spring 2006 semester and again in early 2007.

Participants were asked to complete guided journal entries during the first, sixth, ninth, and twelfth weeks of the 15-week semester. The journal entries were typed responses to specific questions supplied by the researcher. Journal questions were distributed in email notes and completed journals entries were returned to the researcher via reply email.   One-to-one interviews also were conducted. All interviews were conducted in the computer lab used for some of the course activities. The interviews were conducted during the third, seventh, and thirteenth weeks of the study. An interview guide technique (Patton, 2002, p. 343) was used to ensure a consistent line of questioning across the interviews. The audio portion of the interviews was recorded and transcribed for analysis. Artifacts were collected from two participants. One participant provided snapshots of his computer screen showing his method of scheduling his studies and another provided copies of a self-generated study guide. The researcher's field notes, taken during the interviews, were a secondary data source. Participants also were asked to complete a follow-up guided journal entry in early 2007.

Data Analysis and Findings

The interview and journal data was analyzed using a general data reduction technique (Creswell, 1998; Merriam, 1998). The researcher organized the data for analysis, read through all of the interview transcripts and journal entries making initial codes, classified all of the initial codes into categories, interpreted the code categories, and identified emergent themes.

With the exception of the participant who was repeating the course, participants did not anticipate any difficulty with the mathematical content of this course at the beginning of the semester. Most had heard from peers that the course was "not bad". At the beginning of the semester some participants were under the belief that they would have to teach themselves the course material. By early February the participants were reporting that they felt they could be successful in the course. Some participants had grown to appreciate the varied resources available for the course, but managing their time to complete required assignments in the computer lab was still a concern.

Participants used various resources in the course, but common strategies between the learners were revealed. Participants worked multiple practice quizzes and used the online lesson pages to support their work either before or after taking practice quizzes. A general learning strategy was to begin studying no later than Wednesday before a 4:00 PM, Friday deadline each week. Most participants chose to study for this course in their dorm rooms. Assistance from other students was not typically necessary, but when help was needed, learners chose to ask friends rather than the staff of assistants available at the computer lab. The lab is located off-campus and traveling to the lab from campus was perceived as a burden.

Individual participants took varied numbers of practice quizzes, but a trend of taking practice quizzes until 3 to 5 consecutive practice quizzes were completed with scores of 100% was established. For some, only 3 to 4 practice quizzes were needed to achieve this level of proficiency, while some reported taking as many as 15. This core strategy was used consistently throughout the semester.   The learning strategy is shown in Figure 1.

Figure 1: Observed learning strategy used by participants
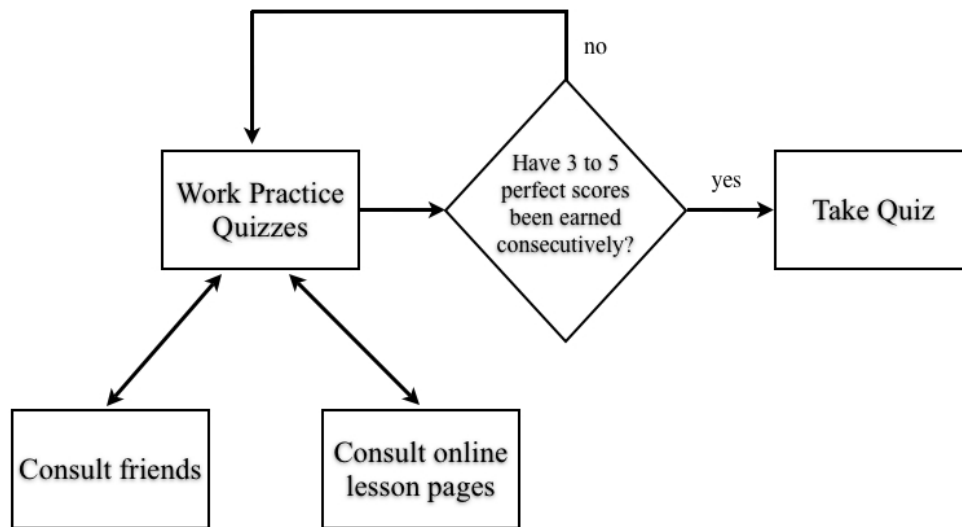
At the end of the study the majority (5 of 7) of participants in this study felt that they were at least as successful in this course as they would have been in a traditional face-to-face course. One participant commented that the format of the course "forces you to work and schedule yourself" and another felt "a sense of accomplishment" in this course since he was responsible for the learning the course.

Participants made use of various self-regulation strategies; of particular note were the goal setting and self-evaluating strategies. All participants set goals related to earning a good grade in the course. A *good grade* ranged from passing the course (1) to earning no lower than a B, but most considered a good grade to be an A. Most students tracked their progress week-to-week using the online quiz and test system to monitor their progress.

Nearly one year after the study began, five of the seven participants completed follow-up journal entries. These final journal entries were completed in early 2007. An analysis of the final journal entries confirmed the findings from the earlier data sources. The general strategy shown in Figure 1 was still reflected in the final journal entries. Two participants indicated in their final journal entries that their experience in the course changed their study habits in other courses. Those participants listed improved organization and time scheduling as benefits of taking the course. When asked if their experience in the course effected their opinion of *online* courses, four of the five participants completing the final journal entries indicated that they had better opinions of online courses after completing this course. The *better* opinions, however, were usually qualified with the fact that this was an introductory course and they felt that more difficult courses should not be offered in a similar format. When asked if the experience in the course had any impact on their confidence as a learner, participants responded in the affirmative. Two participants indicated that they were confident in their academic abilities before enrolling in the course and that the experience in the course reinforced that confidence. Three of the five participants completing the final journal entries commented that their confidence as learners had improved after completing the course. One participant commented, "I feel that I am able to learn in different settings. I'm not afraid to teach a class to myself anymore".

Conclusions

This research study was conducted to investigate the question, "What strategies do learners use to regulate their learning in an emporium-designed mathematics course?" Self-regulation strategies were identified that correspond to self-regulation activities previously determined. The strategies found in this study are summarized in table 1.

Table 1. Self-regulation strategies identified in an emporium-designed math course

Learner Behavior in Emporium-designed Course	Traditional Self-regulation Behavior
Working practices quizzes until 3 to 5 perfect scores in a row	Self-evaluating
Taking notes	Organizing & Transforming
Setting a goal of getting a good grade	Goal Setting & Planning
Watching week-to-week grade progress	Keeping Records & Monitoring
Rewarding completed work with leisure activities (friends, games, reading)	Self-Consequating
Asking friends assistance	Seeking Social Assistance
Reviewing notes	Reviewing Records

Note. Traditional behaviors from "A Social Cognitive View of Self-Regulated Academic Learning" by B. J. Zimmerman, 1989, Journal of Educational Psychology, 81(3), p. 337. Copyright © 1989 by the American Psychological Association

Designers using an emporium-model for their courses should carefully consider how these strategies can be supported for, or implemented by, their learners. In addition to identifying the self-regulation strategies used by learners in the course, unintended, yet positive outcomes were observed. Participants felt that their confidence as learners was increased as a result of participating in the course. The majority of participants also held "better" opinions of online courses after completing the course used in this study.

It should be noted that participants in this study were in math-intensive majors and most felt that the course content was not difficult. Participants cautioned that the emporium-design format may not be appropriate for courses with content perceived as difficult.

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Barriers to Hybrid Course Adoption: A Comparison of Student Perception and Performance

Jim Houdeshell, Ed.D
Sinclair Community College

Paul Giguere, Ed.D.
Tufts University

Abstract

The National Center for Manufacturing Education (NCME) in partnership with the Quality Engineering Technology (QET) Department received a NSF-ATE project grant in August 2003 to develop and test a hybrid instructional delivery methodology. The design uses small group activity-based instructional materials developed under previous grants in conjunction with supportive web-based content and learning objects for the individual online component. This allows face-to-face interaction to occur despite the groups' working at different locations and times. Web-based supplemental instructional materials and learning objects created and under test support the previously developed instructional modules.

The primary outcome of the NSF-ATE grant, *A Distributed Hybrid Approach to Creating a Community of Practice Using NSF Funded Manufacturing Engineering Technology Curriculum Modules*, is to evaluate the effectiveness of the delivery method as a means to increase the number of students in manufacturing-related programs by providing institutions, companies, and students a way to work together both onsite and online in a cost-effective, practical way. Of secondary importance of this study is to test Clark's "media does not influence learning" statement (Clark, 1994). Ultimately achieving the grant outcomes will answer one of Clark's fundamental evaluation question "Did the distance education media maximize student access to new, and/ or high quality courses and teaching when compared with other delivery choices? Access means increasing new groups of students and increasing access to the teacher" (Clark, 2000). This paper presents the updated results based on a prior report (Houdeshell, 2006) related to meeting the project objectives, in particular, barriers to hybrid course adoption when taking into consideration student perceptions and academic performance versus traditional face-to-face instruction.

Grant Progress and Challenges

Previous Results

Unexpected challenges were first encountered in 2004 with the challenge of no students volunteering to join a "hybrid" site i.e. not coming to class but meeting with an instructor/facilitator in a small group to carry out the activities. The author interviewed classes as to their reluctance to be excused from coming to face-to-face classes at the college. Students cited "I learn a lot from other student's questions" (Houdeshell, 2005). As a result, our external evaluator, Social Science Research and Evaluation Corporation (SSRE), developed a questionnaire to determine student's perceptions when comparing distance, hybrid (blended) and face-to-face instruction.

Houdeshell (2005) reported the results of the questionnaire submitted to 200 level Quality Engineering Technology (QET) students in three different face-to-face classes and to fifty-six students in pure distance-learning 200 level courses. The questionnaire allowed the use of a paired data t-test to determine preferences related to distance learning and pure face-to-face instruction. The questionnaire was administered to 200 level distance-learning students enrolled in the same course as one of the face-to-face course sections and to two additional courses. No significant differences among the responses among the three distance education courses were observed. No differences were apparent for these questions except for the statement; "Being required to attend class is helpful in motivating me to learn the material." The distance education students scored this as less important as a motivator when compared to the face-to-face students. Overall the only major benefit perceived by students for distance learning is convenience.

In order to meet this challenge the Principal Investigators in conjunction with the QET department split courses that have designated lecture-laboratory components into two separate courses, for example the 3 credit hour course, QET 201 Statistical Process Control (SPC) became 2 courses QET 201 SPC, 2 credit hours, a two-lecture hour course, and co-requisite QET 181 Laboratory for SPC, 1 credit, two-laboratory hours per week course. With

this course combination a variety of options are possible: Offering totally face-to-face, offering the face-to-face laboratory course (at the college and offsite) with a distance-learning lecture class (hybrid) or offering a pure distance-learning experience. Table one outlines the possible course combinations under a hybrid or blended mode.

Table 1.
Hybrid Course Offering Combinations

Course	Face-to-Face	Web	Day	Eve	Sat	Off site
QET 201		X				
QET 181	X		X	X	X	X

Using the same methodology and questions additional data was collected over the past year from classes that have been offered in the new course combinations. These are reported and discussed in the next sections along with analysis of student performance.

Course Description and Study Focus

The primary courses at part of the current study include courses with significant enrollment, two 100 level courses and one 200 level course. The 100 level "Survey of Total Quality" and 200 level "Statistical Process Control" courses are required course in four programs with the greatest number of students, primarily male, enrolling from the Industrial Engineering Technology. The "Metallurgy" course is required in four programs with the largest number of students coming from Mechanical Engineering Technology and manufacturing related programs. The day students in the Industrial Engineering Technology program are typical 18-25 years old and those in the evening sections typical reflect "adult learners". Approximately six years ago these courses, involved in the study, evolved from a more traditional course structure to greater emphasis on constructivist learning with the incorporation of instructional laboratory materials developed under NSF-ATE grants by the National Center for Manufacturing Education. The majority of the faculty who teach these courses were involved in the development and testing of these materials from the beginning. The current and historic course data sets used in this study assess a time frame after the new materials were incorporated in face-to-face classes. No major instructional design/materials changes occurred during the time frame reflected in the data, only delivery methods and course organization. The distance education (DE) delivery modes studied over this time frame include, for the QET 101 class, a videotape course offered through *TV Sinclair* and for the QET 201 class course materials and web-based activities supported through a WebCT course management system. Table two provides a summary of the course information used in this paper. The next section of this paper focuses on determining if any statistical differences exist between student performance based on course and delivery mode.

Table 2.
Quality Engineering Technology Course Information Involved in the Current Study

Course Name	Course Number	Delivery Mode	Number of Students	Grade Average
Survey of TQ (101) and	101-01 Day	Face-to-Face	219	3.08
Laboratory (171)	101-50 Evening	Face-to-Face	196	3.42
	101-D1	Video Tape	16	3.14
	101-49	Virtual	10	3.67
	171-01 Day	Face-to-Face	10	3.64
Metallurgy (132) and	132-01 Day	Face-to Face	109	3.44
Laboratory (173)	132-50 Evening	Face-to Face	162	3.45
	132-49	Virtual	6	3.33
	173-01 Day/Eve	Face-to Face	6	3.50
Statistical Process Control	201-01 Day	Face-to Face	107	3.00
(201) and Laboratory (181)	201-50 Evening	Face-to Face	109	3.25
	201-TC	Web DE	15	3.42
	201-49	Virtual	13	2.67
	181-01/50 Day	Face-to Face	13	2.91

Analysis of Student Performance

The analysis of the student performance addresses the question "Does the delivery mode affect student performance and retention in the three course areas?" To answer this question the author used Chi-square goodness of fit tests to determine if the grade and withdraw data reported from the Registrar's office indicated any statistical differences. In this case the distribution of letter grades and withdraw numbers formed the basis for the distribution cells. This is important because just because a course has the same overall course average the mix of letter grades and a high drop rate in one course could reject the hypothesis that they are the same distribution. For example, the Chi-squared statistical testing the differences in the distributions between the day and evening sections of QET132 indicate a probability of 0.10, that by chance alone these distributions are the same even though they had the same overall averages. A review of the actual grades, illustrated in Table 3, indicated that the day section had a spread of grades with lots of A's and the evening only reporting A's and B's and a larger percentage of withdraws.

Table 3.
Distribution of Grades by Percent in Metallurgy (QET 132)

Section	A's	B's	C's	D's	F'	W's
Day - 01	72	15	6	1	1	5
Eve - 50	79	9	0	0	0	11

The author also observed the same pattern in the comparison of the QET 201 day sections and the QET 201 web based course sections where the TC sections have A's and B's and lots of withdraws. Table four reports the Chi-Squared results when comparing courses based on, day versus evening sections and delivery mode.

Table 4.
Grade Distribution Comparisons between Quality Engineering Technology Course Sections

Course and Section Comparisons	df	c^2	p	Action
101-01 vs. 101-50	5	16.61	0.0053	Reject Same Distribution
101-01 vs. 101-D1	5	3.54	0.6171	No Significant Difference
132-01 vs. 132-50	5	9.12	0.1042	No Significant Difference
201-01 vs. 201-50	5	14.64	0.0120	Reject Same Distribution
201-01 vs. 201-TC	5	15.78	0.0075	Reject Same Distribution
201-01 vs. 201-49/181-01/50	5	2.50	0.8688	No Significant Difference

An observation indicates that the night and distance students typically are more successful focused based on grade distribution pattern. It appears that if they are not receiving an A or B then tend to withdraw at a higher rate. A second observation is that the delivery mode does not appears to have a significant impact on student performance in support of Clark's stated postulate that media does not influence learning (Clark, 1994) .

Additional Student and Faculty Perceptions

Over the past couple years data additional students have been surveyed in both face-to-face, and hybrid offerings as to their preferences for learning. These paired data t-test results displayed in Appendix A provides insight into the student's perceptions as to the benefits of face-to-face instruction versus pure distance delivery and face-to-face instruction versus hybrid delivery. Students enrolled in face-to-face, distance education, and hybrid (pre and post completion) defined the major perception outcomes. First, distance education students prefer face-to-face except for the convenience of distance education classes. They also perceived that it would be easier to work with other students within a face-to-face environment for all other questions. Face-to-face students prefer face-to-face instruction to pure distance education and inconclusive results for students preferences concerning pure face-to-face over a hybrid delivery. This could be based on the students' comfort level with the content material and preferred learning style (Martinez, 2002).

The group of distance-learning students answering the same questionnaire concurred with the face-to-face student results with the exception of two questions. The distance-learning students perceived, at a very significance level, that it would be easier to get questions answered within a face-to-face environment and also concluded participating in distance learning classes was more convenient than face-to-face classes. The students also completed

questions related to their learning styles and social interaction, No differences were apparent for these questions except for the statement; Being required to attend class is helpful in motivating me to learn the material. The distance education students scored this as less important as a motivator when compared to the face-to-face students.

Faculty perceptions follow student perceptions and for those results of the analysis for both students and faculty are found in Appendix A. The answers to faculty questions that did not apply to students typically reflect the amount of effort required in the classroom or on-line. Face-to-face classes are perceived to require the least amount of preparation and hybrid and distance education classes require the most.

Summary

The impact of the documented project adds to the scope of body of knowledge related to barriers to adoption. One of the most commonly cited reasons for blending is more effective pedagogical practice. "BL is the combination of instruction from two historically separate models of teaching and learning: traditional F2F learning systems and distributed learning systems" (Graham, 2004). This approach ends the isolation of pure distance education student by providing a combination of group face-to-face and individual asynchronous learning opportunities. The authors concur that well developed hybrid or blended courses based on sound instructional delivery are effect in student learning and retention. Since the original grant was funded in 2003 many authors have touted hybrid and blended instruction (Giguere & Houdeshell, 2005; Stinson, 2004; Swenson & Evans, 2003). The challenge is finding methods and practices that aid in overcoming the barriers to adoption based on administrative policy, faculty reluctance and student misconceptions. Also, additional studies that explore other barriers such as access to technology, course creation and/or adaptation issues, and integration and planning also need to be explored.

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Significance comparisons based on FtF versus hybrid or web delivery.

Faculty Perception Response

How hard will it be to respond to questions?

Delivery	Average
FtF	4.27
Hybrid	4.00
Web**	3.32

How hard will it be to have students work in teams?

Delivery	Average
FtF	4.41
Hybrid**	3.41
Web***	2.36

How hard will it be to teach the course?

Delivery	Average
FtF	4.41
Hybrid***	3.45
Web***	2.86

How hard will it be for an average student
to do well in the course?

Delivery	Average
FtF	4.05
Hybrid***	3.09
Web***	2.45

How much time will students spend if
they want to do well in the course?

Delivery	Average
FtF	3.41
Hybrid	3.57

Student Response

Receive answer to a question?

Delivery	Average
FtF	3.83
Hybrid**	3.22
Web***	3.11

Work with other students?

Delivery	Average
FtF	3.38
Hybrid**	2.68
Web***	2.18

Easy to learn?

Delivery	Average
FtF	3.23
Hybrid**	2.67
Web***	2.43

How convenient would it be to take
the course in the face-to-face format?
Distance-learning? or hybrid formats?

Delivery	Average
FtF	3.05
Hybrid	3.05
Web FtF**	2.18
Web DE**	3.80

Web*	4.10

Faculty response continued

How much time will you spend on the course?

Delivery	Average
FtF	3.27
Hybrid***	3.95
Web***	4.36

How satisfied will you be teaching the course?

Delivery	Average
FtF	4.41
Hybrid*	3.82
Web***	2.86

*	p<0.1
**	p<0.01
***	p<0.001

Developing a Cognitive Presence Scale for Measuring Students' Involvement during the e-Learning Process

Myunghee Ju Kang
Ewha Womans University

Ji-un Park
Ewha Womans University

Soyoung Shin
Hallym University

Cognitive presence, a sense of "being there" cognitively, has recently been considered an important factor for students' engagement in e-learning. There is, however, no widely accepted quantitative measurement scale for cognitive presence because most studies on cognitive presence have been conducted qualitatively. Therefore, existing theories on cognitive sector-related research regarding cognitive presence were reviewed and a new measurement scale for cognitive presence was developed. This study tested reliability and validity of the measurement scale of cognitive presence with 305 undergraduate students. Three major factors of cognitive presence were perceived levels of: 1) understanding content, 2) constructing knowledge, and 3) managing learning resources.

Introduction

Cognitive presence, a sense of "being there" cognitively, has been mainly researched by constructivists who stated that cognitive presence reflects higher-order knowledge acquisition and application in online learning (Garrison, 2004). Cognitive presence is also an important factor in facilitating learners' engagement and in affecting a learner's level of achievement and satisfaction (Wang & Kang, 2005; Kang, 2005).

Despite the importance of cognitive presence for successful online learning, there is no widely accepted measurement scale. Therefore, a new scale for measuring cognitive presence was developed based on the review of existing theories on the cognitive factors activating learners' engagement in an online learning environment. Then, reliability and validity of the new scale were tested with 418 undergraduate students in an e-learning environment. In this study, the developed scale was retested with 305 undergraduate students in online environments.

Theoretical Background

Studies related to online learning have begun to shift their focus to better understand the unique needs associated with online learners. The shift is increasing the importance of cognitive engagement in online learning (Richardson & Newby, 2004). One of the crucial factors for engagement in online learning is considered to be the level of perceived cognitive presence (Wang & Kang, 2005). In other words, engaged learners might have a higher level of perception of cognitive presence in an e-learning context.

According to cognitive engagement theory (Ryan & Patrick, 2001; Bangert-Drowns & Pyke, 2002; Wang & Kang, 2005), there are three characteristics that engaged learners might share: understanding, constructing, and self-regulating in knowledge construction. First, a high level of cognitive presence should be able to facilitate information acquisition, information transportation, and constructing knowledge (Corno & Mandinach, 1983; Wang & Kang, 2005). According to the cognitive engagement theory, knowledge construction has three factors: information acquisition, information transformation and constructing knowledge (Corno & Mandinach, 1983; Wang & Kang, 2005). Based on this theory, a high level of learners' perceived cognitive presence could facilitate knowledge construction (Wang & Kang, 2005).

Second, learners with a high level of perceived cognitive presence understand learning contents well. According to the cognitive engagement camp, cognitive engagement is the mobilization of cognitive strategies for interpretive transaction (Bangert-Drowns & Pyke, 2001). In other words, engaged learners are thought to be more intellectually concerned with their learning tasks intensively and extensively (Bangert-Drowns & Pyke, 2002).

Accordingly, students' engagement entails an intrinsically motivated involvement of the integrated cognitive process (Kearsley & Schneiderman, 1998).

Third, learners who perceive a high level of cognitive presence manage learning resources freely. Since cognitive engagement is considered a core variable in a well-developed self-regulating learning process, engaged learners will be able to manage well resources, environment and performance (Mckeachie et al., 1986; Pintrich & De Groot, 1990). Resource management involves the process of developing well-defined goals and scheduling the course to achieve the best results. Environment management is the development of a physical setting that is helpful to learners. Performance management includes self-effort, self-reinforcement and persistence (Mckeachie et al., 1986).

Learners' cognitive presence activating engagement in an online environment has been investigated from both constructivist and cognitive perspectives. Constructivists have defined cognitive presence as the extent to which learners are able to construct and confirm meaning through sustained reflection and discourse in a critical community of inquiry (Garrison, Anderson, & Archer, 2000). They argued that knowledge is constructed by the circular process of triggering events, exploring, integrating, and resolving tasks during online learning (Garrison, 2004). Cognitive presence has also been empirically validated with respect to cognitive engagement within online groups as providing a theoretical background for measuring the cognitive engagement of online learning (Oriogun, Ravenscroft, & Cook, 2005).

The above discussion led to the extraction of three factors of cognitive presence: understanding content, constructing knowledge, and learning resources management. Accordingly, the operational definition of cognitive presence in this study was defined as the 'perceived level of general understanding, knowledge construction, and learning resources management during e-Learning.'

Methods

As a result of primary factor extraction of 18 items from a survey of 418 students, three dimensions of cognitive presence were verified. To improve reliability, this study was retested with 305 undergraduate students. They enrolled in an online course titled 'Design of College Life' in the fall semester of 2006 at a large university in South Korea. The class lasted for eight weeks and the cognitive presence scale was distributed to participants as an online survey during the fourth week.

The three main components of cognitive presence are the level of understanding content, constructing knowledge, and managing learning resources. Each component has sub-components with 9 items based on a theoretical framework.

First, the level of understanding the contents has three sub-components: 1) consistency between content and objective, 2) organization of content, 3) articulation of content (Broadbent, 1958; Gagne, Yekovich & Yekovich, 1993). For example, the following items were used; "I could organize what I learned with diagrams and graphs," "I could explain what I learned in class," and so on.

Second, the level of constructing knowledge has the following sub-components: 1) information acquisition, 2) information transformation, and 3) constructing knowledge (Corno & Mandinach, 1983; Wang & Kang, 2005). For example, the following items were used; "I could collect information related to the class," "I could make a connection between new information and what I already knew."

Third, the level of managing the learning resources has sub-components: 1) time management, 2) performance management, and 3) environment management (Ryan & Patrick, 2001; Zimmerman, 1990; McKeachie et al., 1986). For example, the following items were used; "I could do assignments by making a plan," "I could avoid any distractions while studying."

As presented above, 27 items with a five-point Likert scale were developed via an online survey. The items were analyzed by an expert for content validity and modified based on recommendations. The online survey was conducted and 305 responses were collected. Exploratory factor analysis (EFA) was performed to verify the emergence of the three dimensions of cognitive presence. Principal axis factoring method was used to extract factors. To rotate factors, direct oblimin rotation method was used.

Results

The results of EFA with 27 items yielded three factors: understanding content, constructing knowledge, and learning resources management. The reliability of these factors with Cronbach's coefficient alpha yielded .844, .809, .640, respectively. Six items showing loading lower than .40 were removed (Thurstone, 1947). As a result, 21 remaining items are reported in Table 1.

Table 1: Emerged factors of cognitive presence

Main components	Remaining Items	Factor loading	Cronbach's alpha
Level of Understanding the Contents	The content of class is that I usually want to learn.	-.402	.844
	The content of class is what I expected.	-.404	
	I think I can understand content of class good enough to draw diagrams and graphs.	-.541	
	I can reorganize what I learned my class.	-.734	
	I think I can outline what I learned my class.	-.655	
	I think I can explain what I learned my class.	-.612	
	I think I can discuss what I learned my class.	-.667	
	I think I can briefly summarize learning material.	-.723	
Level of Constructing the Knowledge	I usually search for extra materials related to the class.	.450	.809
	I feel I can select materials what I need.	.457	
	I feel I can collect the information related to the class.	.606	
	I feel I can use what I learned in the class to do assignment.	.645	
	I feel I deeply understand what I learned.	.507	
	I feel that I'm learning in this class.	.584	
	I'm getting new perspective through this class.	.495	
	I feel I can apply what I learned in reality.	.471	
Level of Managing the Learning Resources	I feel that I can do assignments as planed.	.468	.640
	I know how to be helped.	.454	
	I reorganize the material for the assignment, the course activity, and the discussion.	.463	
	I look for the comfortable environment that I could focus on my study.	.595	
	I feel that I could eliminate the obstacles that disturb my study.	.494	

Discussion and Implication

We performed a second validation process on this measurement of cognitive presence based on theory. According to studies on the cognitive engagement camp, cognitive presence is composed of three dimensions: level of understanding the content, constructing knowledge, and managing learning resources. In this study, the cognitive presence scale was grounded in theory and validated three constructs through statistical analysis as in the preliminary study.

Consequently, this study shows that cognitive presence activating learner's engagement consists of three dimensions and these could be a basis for measuring the level of cognitive presence. At present, a follow-up study is in progress to conduct a CFA (confirmatory factor analysis).

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Students' Perception of Social Presence and its Influence on their Learning in an Online Environment: A Case Study

Eunmi Kim
Northern Illinois University

Abstract

This qualitative study investigates students' affective domain in an online class. Garrison, Anderson and Archer's Community of Inquiry Model (2000) and Rourke et al.'s Social Presence Templates (2001) were used to analyze transcripts, surveys, and interviews of all participants. The results of this study illustrate the nature of social interaction in an online environment confirming teaching, cognitive and social presences go hand in hand. Recommendations for instructors to create a community of learning are provided.

1. Objectives

The purpose of this study is to investigate the role of social presence in online learning environments, its relationship to students' perceptions of learning and satisfaction, and to provide some recommendations for the instructors and/or instructional designers in their future online course development.

2. Theoretical Framework

The importance of cultural and social context in constructing knowledge is recognized by many researchers in the field. Instructional methods from this view focus on dialogue, instructor co-learning, and the joint construction of knowledge. (Bonk & Wisher, 2000)

Computer Mediated Communication (CMC) supports a collaborative learning experience at a distance and independence of time and space. In designing online instruction, the learner's perspective, especially motivational and emotional influences on learning cannot be ignored.

Garrison and Anderson (2003) believe that the technology of online learning made it possible for both private reflection and public discourse within a community of learners (p. 23). They call this the "*Community of Inquiry Model*". In their research on the "Community of Inquiry Model", Garrison and Anderson defined it as a teacher-guided, non-authoritarian community where societal knowledge is revealed in an equivocal, multidisciplinary manner and its goal is to structure relationships (order) to achieve understanding and develop 'rationality tempered by judgment' (Lipman, 1991, p. 8). They listed three elements that interconnect and influence students' learning: cognitive presence, social presence, and teaching presence.

Cognitive presence is defined as the extent to which learners construct and confirm meaning through sustained reflection and discourse in a critical community of inquiry (Garrison, Anderson, & Archer, 2000, p. 11). Social presence is viewed as socio-emotional communication in text-based communication. Teaching presence is defined as the design, facilitation and direction of cognitive and social processes for the purpose of realizing personally meaningful and educationally worthwhile learning outcomes (Anderson, Rourke, Garrison & Archer., 2001). They find that instructors should bring all the elements of a community of inquiry in a balanced and functional relationship congruent with the intended outcomes and the needs and capabilities of the learners (Garrison & Anderson, 2003, p. 29). Among these three elements, this study is concentrated on the social presence, the socio-emotional part in text-based communication.

There are two types of social presence; innate and cultured. In earlier stages, social presence was considered being inherent in the medium itself, and technologies offer participants varying degrees of social presence (McIsaac & Gunawardena, 1996, p. 427). Later some scholars purported that social

presence can be conveyed both by the medium and by the people who are involved in using the medium for interaction (McIsaac & Gunawardena, 1996, p. 427). Gunawardena and Zittle (1997) claim that characteristics often associated with CMC---interactivity, collaboration, and reflectivity ---are not inherent within the medium, but can result based on design, moderator's roles, participation patterns, and involvement (p. 23-24).

In this belief, Garrison, Anderson, and Archer (2000) define social presence as the ability of learners to project themselves socially and affectively into a community of inquiry as "real" people through the medium of communication being used. Because CMC would be judged initially low on social presence, the role of the participants in compensating for lack of cues becomes more important.

Research on distance learning has demonstrated that social presence affects not only learning outcomes, but also the students' and the instructor's satisfaction with a course. In their study of a televised classroom, Hackman and Walker (1990) found that system design and teacher immediacy behavior increased perceived social presence, which impacted student learning and satisfaction. In their study, immediate behavior enhanced closeness in the teacher-student relationship.

Garrison and Anderson (2003) state that social presence needs to be established first, in order to sustain cognitive presence. They argue that there must be an effective presence of the remaining elements of a community of inquiry---teaching and cognitive, to establish the optimal level of social presence for the specific educational goal (p. 54).

Richardson and Swan's study of online education (2003) found that students with high overall perceptions of social presence also scored high in terms of perceived learning and perceived satisfaction with the instructor (p. 73). There was a strong correlation between perceived social presence and instructor satisfaction. Their findings correspond to Gunawardena and Zittle's research (1997), and confirm that learning is a social activity and that individuals learn more from their interactions with others than from reading materials alone.

These strongly support that social presence need to be cultivated in online classes through careful design and strategy, and that instructors actively teach the students social practice and use of the software elements that help to establish social presence (Stacey & Fountain, 2001).

3. Methods of Inquiry and Data Sources

This study is a qualitative case study using a combination of qualitative and quantitative data collection methods. This is an instrumental case study, which uses examination mainly to provide insight into an issue or to redraw a generalization of online courses in a degree-seeking higher educational institute (Stake, 1994, p. 437). Salkind sees the strong point of qualitative study as a unique approach with a different set of underlying assumptions reflecting a different worldview of how individuals and group behavior can be best studied (2002, p.143). This researcher strongly believes that online learning is a collaboration among the course instructor and the students and it could be best described as a group behavior through qualitative methods.

Participants

This 400 level English online class offered at a university in the Midwest initially had 18 students enrolled. There were 15 students who attended the first face-to-face session and participated in the Pre-survey. Two students dropped out after the first session. The demographics of these online class students were gathered and analyzed based on the remaining 13 students. Among them, one student dropped out during the middle of the semester resulting in 12 active students with successful grades at the end of semester.

Data Sources

At the beginning of this study, the researcher attained an approval from the publishing company of "E-Learning Companion: A Student's guide to Online Success" (Watkins & Corry, 2005) for use of their survey, "E-learning Readiness Self- Assessment", and named it a "pre-survey" in this research to examine students' computer skills and their computer working patterns.

A mid-term survey was developed to measure students' perception of interaction and social presence in their online class. Survey questions were constructed based on Rourke, Anderson, and Garrison's Social Presence Cues in their article, "Assessing Social Presence in Asynchronous Text-based Computer Conferencing" (2001), and modified after seeking feedback from the instructor of the online class, where the researcher did her pilot study.

The interview was a semi-structured process through the theoretical sampling method. Each face-to-face interview session (two) were audio taped and transcribed for further analysis and other interviews were done via emails.

To triangulate survey and interview data, a focus group was conducted. The participants of this focus group were junior/senior level undergraduate students who showed their interests of taking online classes in the near future. Through discusions with the researcher for clarification purposes, the survey and interview questions were modified based on their feedback by the researcher .

A "half-way survey" was developed and administered by the course instructor to assess students' progress and satisfaction levels in this class and used for data analysis upon the instructor's approval.

The researcher attended two face-to-face class meetings during the course and did class observations. All online course documents and synchronous and asynchronous chats from Blackboard Learning Systems were examined. Three whole class live chats and each group's weekly chats (four group's synchronous and asynchronous chats) were coded and analyzed by Rourke et al's "Social Presence Template" and its "Social Presence Density" formula (2001). Social presence density (SPD) is calculated as sum of raw number of instances divided by the total number of words. This researcher thinks SPD is more meaningful comparison of transcripts than the raw numbers of social presence instances.

In addition to using multiple sources of data and setting up case study databases, evidence and member checks were used to increase the validity of this study. This strategy allows the researcher to make sure that the study is based on participant's voices.

4. Results

The participants in this study were heterogeneous groups in their age, gender, student and work status (part time/full time) and online experience, etc. This online course was somewhat restricted in the sense of class meeting time. Three- time whole class live chat sessions went against the notion of distance education's "any time, any where" learning. Some students complained the designated online whole class chats sessions which were set up during their work hours and the inflexibility of scheduling. Most of them seemed to get the enough interactions through the group and class chats, but some longed for more.

Most of the social presence coding was based on synchronous chats in the course. At the beginning of group chats students' interactions were primarily at the lower levels of communication, only sharing information and discussion dissonance. With the progress of the class most of the groups developed a relationship among them as in McDonald and Gibson's study (1998) and the length of chat sessions and social presence density were increased. Initially most of the students did not see the importance of social presence, thinking their learning in this class was an individual matter even though they negotiated meanings and confirmed understanding throughout group chats and whole class chats. In their Half-way

survey and other postings, they expressed the value of group discussion before the whole class discussion. While the numbers in affective and interactive social presence increased significantly, cohesive social presence increased drastically. *See* the table below.

Table: Analysis of Whole Class Live Chats by Social Presence (SP) Coding*

	Affective SP	Interactive SP	Cohesive SP	Total SP
First session	41	166	63	270
Second session	47	159	84	290
Third session	55	230	126	411

* from Rourke et al (2001)'s "Model and Template for Assessment of Social Presence"

There was some disparity among groups and its variability was hard to determine by the demographic information itself. This researcher interprets it to be due to the personal characteristics of the participants. In general female students used higher social presence cues in their chats. Also there was a discrepancy between students' social presence preference in the midterm survey and their actual use of social presence cues in postings. This researcher interprets it as not only their lack of knowledge in social presence but also learner characteristics in each session. For example, the atmosphere (social presence usage) of three people chats was different from two people chats even in the same group. Each participant communicated differently to other participants depending on whom s/he was talking to, making it very unique and interesting for further research.

Many students' concerns in these synchronous chats echo with the findings of Branon and Essex's findings, such as "getting students online at the same time, difficulty in moderating larger scale conversations, lack of reflection time for students, and intimidation of poor typists" (2001, p. 36). The characteristics of a text-based medium as being reflective, explicit, and precise as described by Garrison and Anderson (2003, p. 50) helped some in focusing and elevating the cognitive level of the exchange, but frustrated some who "can't get my thoughts down fast enough".

5. Discussions

Several issues emerged during data analysis. While the length of chat sessions and social presence density (SPD) increased over time, some students were shown as having the highest SPD in spite of their low utterances and passive participation in chat sessions. Those students were interestingly all males whose utterances stayed low, but ended up having a high SPD. Because the formula was calculated as the sum of the raw number of instances divided by the total number of words, the low number of utterances was weighed more heavily than usual. This researcher interprets that SPD as not describing the whole picture of online learning, and that it is inconsistent with other findings. She believes that a rich narrative is more valuable in describing this online class rather than the SPD itself.

Another issue was the relationship between cognitive presence and social presence. One student had a low cognitive presence but a high social presence. Although in some sessions his social presence was high with low cognitive presence, he encouraged his group members to express their ideas and supported them emotionally. His contribution was valuable in a different way and would be an interesting future research topic.

In this heterogeneous group, each individual's characteristics emerged over the chat sessions. Some take a role of discussion leader, time keeper, lurker, poster, etc. Their chatting styles varied considerably from one individual to another. Some posted long messages at one time while some preferred short

message postings. Some were very academically oriented, focusing only on the class discussion topic and rushing the discussion in 30 minutes. Another group consisting of all female students was very effective in sharing not only course discussion topics but also their personal stories. All of them showed high SPD and high utterances and stayed in the chat room for over an hour. This group seemed to enjoy the small group live chats very much and expressed their gratitude of having small group chat session before the whole class chat. This researcher believes that it helps to get to know each individual and their characteristics to figure out the online environment.

In general the social presence functioned to support the cognitive and affective objectives of learning in this online class. The findings strongly support that social presence needs to be cultivated in online classes through design and strategy. Some recommended strategies for instructors are:

- have a face-to-face first session to build rapport
- establish small groups early and have a small group discussion before the whole class chat
- model effective communication by inviting individual students and using humor and emoticons, etc.
- guide questions to keep the focus on topics
- provide timely feedback
- have a "Q & A" online forum
- have private one-on-one chat sessions with students, if necessary.

6. Educational Importance of the Study

Smith and Ragan (1999) believe that the traditional separation of "cognitive, affective, and psychomotor domains" is very much under question. They believe that any "cognitive" or "psychomotor" objective has some affective component to it. Rather than viewing the domains as completely separate, educators should strive to integrate them when they design instruction. The social presence functioned to support the cognitive and affective objectives of learning in this online class. These research findings and recommendations will be helpful in understanding the nature of social interaction in a non-verbal environment and how this can be utilized to create a community of inquiry.

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Opportunities and Challenges in the Development of Four Dimensions of Online Instructors Roles: A Phenomenological Study

Hee-Young Kim
Armstrong Atlantic State University
11935 Abercorn Street Savannah, GA 31419
Email: jackie.kim@armstrong.edu

Abstract: Due to the general lack of understanding about online teaching practice in the altered learning environments, some faculty are ill-prepared to make the shift from traditional face- to-face classroom setting to the online academic forum (Care & Scanlan, 2001; Lichtenberg, 2001; Palloff & Pratt, 2001). Therefore, this study is aimed at exploring what online instructors perceive challenges in online teaching based on their own experiences. The study further explored strategies of how online instructors grapple with the challenges in varying cases, and examined what, in their belief, causes the students' certain behaviors and classroom phenomena presented in the online classroom. Based on the archive of narrative of online instructors, the article sorted out the instructional challenges in online instruction according to the framework of Berge's four dimension of instructors' roles: Pedagogical, social, managerial, and technical roles. This article concludes that online instruction can be best approached with understanding of challenging aspects of online teaching. This article serves as a comprehensive map to see where the hindrances of proceeding online instruction are located.

Introduction

As Garrison (2000) has observed, the challenge facing distance education theories in the 21st century is to provide an understanding of the opportunities and limitation of facilitating teaching and learning at a distance with a variety of methods and technologies. While institution and faculty members are feeling pressure to offer Web-based course to meet economic and students' demands, we have yet not developed a clear directions of adaptive teaching methods which play a role to familiarize online instructors how to be a teacher in the altered learning environments. As traditional education integrates the use of interactive, multimedia technologies, to enhance individual learning, the role of teacher changes from knowledge source to knowledge facilitator (Gunawardena & McIssac, 2004). However, due to the general lack of empirical- and theory-based understanding and guidance to be knowledge facilitator, some faculty, are ill-prepared to make the shift from traditional face- to-face classroom setting to the online academic forum (Care & Scanlan, 2001; Lichtenberg, 2001; Palloff & Pratt, 2001).

The lack of understanding of what it entails to teach courses online calls for the exploration on what are the critical challenges and opportunities in the development of altered instructors' roles in online education. In addition, to make the exploration more plausible, this paper follows online instructors' own practice projecting four different dimension of online instructors' empirical knowledge: pedagogical, managerial, social, and technological roles.

Faculty challenges in the literature have predominantly appeared as the administrative concerns to deter faculty from participating in distance education. The themes of challenges of faculty in online distance education have been clustered around high workload and the lack of time and incentives (Muilenburg & Berge, 2001), the lack of the relationship to tenure (Wolcott, 1993; Markel, 1999), the lack of expertise in the design and delivery of course materials (O'Quinn & Corry, 2002; Anderson, et. Al., 2001), and the feeling of isolation (Childers & Berner, 2000). There have been limited research done on what challenges are facing online instructors in the Web-based classrooms. The article surveys literature about four instructors' roles. The empirically-proven or evolving strategies to handle the challenging situation will be discussed followed by the description of the challenges in literature.

The systematic archive of lived challenges in online instruction constructed in this study makes the fact of online teaching classroom visible to novice as well as experienced online instructors. Therefore, this study is aimed at exploring what online instructors perceive challenges in online teaching based on their own experiences. To open to more opportunities in distance education, the study further explored strategies

of how online instructors grapple with the challenges in varying cases, and examined what, in their belief, causes the students' certain behaviors and classroom phenomena presented in the online classroom.

Theoretical Frameworks

With the archive of narrative of online instructors, the article sorted out the instructional challenges in online instruction according to the framework of Berge's four dimension of instructors' roles: Pedagogical, social, managerial, and technical roles.

Challenges Pedagogical Roles in Literature

As much as the extent of change from the delivery medium which is static, asynchronous, printed, hypertext materials to deliver their instruction, the substantial delay in the flow of communication between teachers and learner (Moore& Kearsley, 1996) and the removal of physical presence has challenged online instructors to alter the concept of teaching. The mutual relationship between the medium of instruction and the role of instructors has been reconstructed in a different format from synchronous chalk and talk after Internet influence whole paradigms of learning and teaching in education. The changed learning concept demands the shift the ways in which the instructor organizes and delivers materials (Palloff & Pratt, 2001). Such a shift requires the instructor to be knowledgeable about skills necessary to develop the adaptive pedagogical strategies to accomplish online learning objectives.

In altered learning environment, the pedagogical roles of online instructors, therefore, revolve around facilitating educational processes to promote students' understanding of critical concepts, principles, and skills (Berge, 1995). The facilitation is best achieved when the instructor understands the characteristics of altered learning modes and landscape. Because of the medium facilitated, the students are not only interact with teachers and their peers, but also with content of instruction and interface built in the medium (Hillman, Willis, & Gunawardena, 1994; Moore, 1989).

The independence of study is generally recognized as a form of learning in online learning environments, which seems to reduce the responsibility of accomplishing learning on the instructors' side. Despite the preoccupied issues of the self-directed and independent nature of online learning (Moore, 1989), however, Garrison (1993) asserts that teachers are responsible for establishing the balance of control that will ensure worthwhile outcomes and continuing efforts to learn. It is more challenging when the teacher has to play integral role in education as a transactional process and has his and her own legitimate responsibility (Garrison, 2003) to link instructional strategies to relevant creativity, critical thinking, and cooperative learning. Such challenging role responsibilities involve in questioning, encouraging students knowledge building, designing a variety of instructional activities, eliciting reflection, weaving and summarizing discussions, offering constructive criticism, pushing to articulate ideas and exploring resources, and providing explanation and elaboration where necessary (Ashton et al., 1999; Berge, 1995; Bonk, Kirkley, et al., 2001; Mason, 1991).

Due to the nature of independent leaning in online environments, the parameter of online instructors' roles has been widened to promote the active independent learners in online environments requiring online instructors to reckon another pedagogical area.   The instructor's mastery should extend to identifying self-motivating factors and enabling self-direction of participants (Powers & Guan, 2000). The effective instructor enables self-motivated students to create meaning of content rather than impart the course content by synthesizing points which students raised, as "weavers," or "e-moderators", by collecting up statements, and by linking them to course content(Salmon, 2000; Hiltz, 1988). Such weaving comments supply a unifying overview, interpreting the discussion by drawing its various strands together in a momentary synthesis that can serve as a starting point for the next round of debate. (Feenberg, 1989). The pedagogical roles of instructors in online environments have added a wide range instructional tasks that require the sufficient level of guidance, in-depth training and reflections.

Challenges in Managerial Roles in Literature

The managerial role relates to class and course management (Coppola, Hiltz & Rotter, 2002), which involve "agenda setting, pacing, objective setting, rule making, and decision making.(Stake, 1994). The managerial role has increased the complexity of teaching in online teaching because this managerial role involves more the management of human resources and instructional resources than synchronous chalk and talk instruction.

Human resources, such as teaching assistants, instructional designers, and members of support service offices, are oftentimes given to instructors to facilitate teaching. This course manager role have been "unbundling" by universities which are disaggregating the multiple tasks of the instructor, traditionally performed by one person, by assigning them to specialized teams and professionals (Paulson, 2002).

The role of facilitating the instructional resources includes instructional materials, use of technology, course design, and course procedure. Online instructors should provide the clarity in coordinating courses. They are required to offer explicitly written target objectives of the course, expectations, requirements, course activities, schedule, and rubrics of the evaluation (Mason, 1991; Bonk, at. el.).

One of the frustrating challenges in managerial roles comes from the misunderstanding of instructors' intentions. Since the delivery medium eliminates the nonverbal and verbal cues and the contexts of communication, the misunderstanding in communication is more likely take place in online environments. Despite providing strong leadership and a definite structure and agenda for the course in pursuit of the organized, effective course management, the instructor must be aware of and responsive to organizational dynamic and the unexpected reactions due to the misunderstanding of the instructor's intentions (Mason, 1991). Studies found that well-designed course template may mitigate the managerial issues (Conrad,2004), which evolve in the earlier stages of online courses before new instructors gain extensive online experience (Teles, 2001). The successful managerial role will result in the optimal level of learning in the learning community where students learn more with self-reliance, from each other, than from the instructor while the instructor is omni-present (Mason, 1991).

Challenges in the Technical Role in Literature

The technical role is an additional requirement to the conventional role of the instructors. This role highly demands instructors to ensure students' access to and familiarity with the technology so that students are comfortable with using technology and, in turn, could concentrate on the academic tasks (Berge, 1995). Online instructors are required to successfully perform of this role to decreases the degree of technical difficulty as indicated one of the most significant causes of students' dissatisfaction with web-based courses (Hara & Kling, 2000). Technical tasks include assisting students with technology issues, addressing technical concerns, diagnosing and clarifying problems encountered, and allowing students sufficient time to learn new programs, and techniques (Ashton, Roberts, & Teles, 1999; Berge, 1995;.Bonk, Kerkeley, Hara, and Dennen, 2001).

Palloff and Pratt (2001) emphasize that the instructor's responsibility must not end the technology itself, pointing to more the important matter of how the instructor use it in the design and delivery of online courses. To perform technological role effectively, the online instructors should have a capability to evaluate the effectiveness of technology. Without evaluating the pros and con's of using the up-to-date technology, the adoption of streaming audio and video could create the least interesting lecture which is impossible to sit and listen for even seemingly brief period of time. Anderson and others (2001) also note that the teacher is also familiar with a wealth of the digitized resources to which they can refer students for further individual or group study.

Challenges in social role in literature

Social roles in online environments are often neglected and misunderstood. Social roles of online instructors requires the understanding of the nature of online learning community in developing the friendly, social environment which is essential for online learning (Berge, 1995). Creating social, friendly environment in an online environment is a challenging task because of the absence of the non-verbal communication that occurs in the face-to-face settings of conventional education, and the reduction in the amount of paralinguistic information transmitted. Since the delivery channel is lean, plain text may not be capable of delivering the desired level of stimulation, and one may find it more difficult to express intended meaning or friendly tone. However, solely through this limited text, the instructor creates trusting, familiar social environments, communication, and interactivity. In such online environments, the issues related to the communication and interactivity predominantly influence social learning environments. Such issues include demonstrating caring, exchanging information, conveying feeling and emotion, timely response, stylistic communication styles, the level of formality, initiation of conversation, greeting, praise, inviting tones, and so forth (Tu & McIsaac, 2002).

Online instructors also should be aware of the influence of the social relationship among learners in online learning effectiveness. The relationship among students, as called "group cohesiveness" (Berge, 1995; Baker & Wood, 2004), needs to be in a component of course design to develop "psychological sense of community (Sarason, 1974;McMillan & Chavis, 1986). Sarason (1974) sees psychological sense of community (PSC) as the sense that one is "part of a readily available, mutually supportive network of relationships upon which one could depend" (p.1). Studies have found that a weak sense of social cohesiveness could result in increasing the drop-out rate of online students who feel isolated and stressed (Eastmond, 1995).. Online instructors are demanded to establish a leadership role in nurturing community and modeling the social roles so that instructors lead to motivate and engage students in a community of inquiry (Anderson, et. al., 2001).

The social role may be difficult to define for novice instructors when they discover predominantly the task-oriented online students (Bonk, 2000). Conrad's (2004) study noted that inexperienced online instructors often lacked essential social skills and preferred personalized communication instead of taking leading roles in establishing a wider community. Fulfilling the complex social responsibilities of an instructor necessitates sustained and authentic communication between and among teachers and students (Kerr, 1986).Such social role is intertwined with the pedagogical role which support student cognitive learning processes (Baker & Wood, 2004).

All four instructional roles—pedagogical, social, managerial, and technical—would not necessarily be carried out "in their entirety" by the same person. In fact, Collins and Berge thought it would be unusual if they were (Collins & Berge, 1995). This multidimensional role of the instructor are interconnected and overlapping, with different emphases at different times and in varying degrees throughout the life of the course (Berge, 1995).

Method

Narrative inquiry, a qualitative research, was used. Online instructors' experiences are a main resource of this study. To find an answer to the problem of gaps between practice and theory, this study adopted Schön (1987)'s suggestion for research which led this study to start not by asking how to make better use of research-based knowledge but by asking what we can learn from a careful examination of the competence by which practitioners such as online instructors actually handle their practice. Following John Dewey (1938), Schön (1983), and Clandinin and Connelly (2000), This study focuses on personal practical knowledge of online instructors reflected on their experiences and embedded in their practice, in the hope that it would inform practice and theory.

The primary participants of this study included three online instructors who are teaching undergraduates and graduates at a large, urban four-year university in Houston, Texas. The secondary participants were volunteered students of the online instructor participants. The pseudonyms were used for the participants' anonymity. This study used the interview method combined with conversations and observations. 60-90 minute-interview was conducted four times to collect data with instructor participants. Student participants were interviewed two times for about 60 minutes.

Results

Findings of the study are categorized according to the Berge's four instructors' roles: Pedagogical, managerial, social, and technological roles.

Challenges in Pedagogical Roles

Pedagogical lived challenges are discussed in regard to inherent limitation in text- based communication asynchronous communication, vulnerable autonomous learning, and the process-oriented content courses.

1. Challenge in inherent limitation in text- based communication

The inherent limitation in text- based communication challenged online instructor participants to adjust their pedagogical approaches to fit into the altered teaching environments. One of instructor participants who has been a traditional teacher for more than 20 years, relied on reading and interpreting students'

visual and verbal cues. Online, however, he could not receive any of those cues in his online classroom. There was absence of nodding or puzzled face expression for interpreting their progress in learning. The lack of physical cues caused the instructor to fail to determine to what extent students understand his instruction. As a result, he felt frustrated and oblivious of the state of their learning. The no provision of the visual cues from students led him to search the different way to understand students' responses. One of his solutions was monitoring the chat session which not only allowed him to monitor the status of students' learning but also allowed students congregating and communicating at the certain point of time. His intent of this chat session was to simulate the face-to-face classroom where students meet and discuss at the scheduled time in one place. His methods of understanding students have since been adjusted. Another instructor participant stated the similar concerns. One of the aspects that she disliked about online teaching was the difficulty of expressing her ideas and understanding students' thoughts through the textual form. She believes that learning only through the textual form inherently held limitations in terms of understanding the content or students. As Short, Williams, and Christie (1976) stated that one of the most critical aspects of the advent of new telecommunications systems is human adjustment, Web-based environments require the endeavor of seeking adjusted ways of delivering their instruction.

2. Challenge in Procrastination and Vulnerable Autonomous Learning

The narratives of this study revealed that online instruction can not solely rely on students' autonomy. Students' procrastination followed by a variety of excuses were major challenging for the online instructors. They believed that the flexibility of online learning would allow students to work anytime anywhere, but in fact, this flexibility created a negative effect; the students delayed their work to the last minute. This procrastination resulted in students missing deadlines, low participation on class activities, missing exam times, and the like.

One of instructor participants found a way to keep students on task in activities that students had to participate on a regular basis. Weekly discussion board and journaling activities were used to build online learning routines which were difficult tasks to build since in online environments there were no scheduled classes and regular physical attendance. His student participants responded positively on his well-structured online class which kept them on task and prevent panicking experiences at last minute.

Proactive where communication is concerned, he also initiated contact with students were reticent about soliciting help. He believed that monitoring students progress regularly and supporting students were effective way to reduce the dropout rate.

Since the online environment has inherent limitations, such as the absence of physical and contextual cues, and the limitation of the technology, the online instructors are to aware of the instructor-led forms of instruction in the beginning of the semester until students develop their learning pace and routines.

3. Challenge in the process-oriented content courses

Since the instructor participants of this study were drawn from the different subject area classes, this study found a myriad of evidence that the effectiveness of Web-based instruction could be determined the kind of the subject matter of instruction. This study showed that the certain subject areas are easier to transfer to online mode from face-to-face instruction that others. Instructors and students in certain subjects courses were more struggling in online courses than other subject areas because of the conflict between the process of instruction and the capacity of online delivery tools. Content areas such as English, in which writing and reading are major learning activities, are a perfect fit with the online delivery mode. One of instructor participants, an English professor, believed he got more out of students online, and students performed better through a variety of interaction channels. Online courses provide more opportunities to communicate with students than face-to-face lecture-based instruction with more than 100 students. Also, in his online class discussion topics were as myriad and various as he wanted. His class was benefited from open online discussion hours not limited by traditional hours of instruction.

However, the instructors who taught mathematics or accounting found it difficult to reach out the best way to deliver the content through the means of online environments. One of participants expressed this difficulty in her interview. " Accounting are process-oriented courses", she explained. Students needed to see the process of solving problems. One of instructor participants, a mathematics professor, believed that he would not benefit from the suggestions from professors in such content areas as history and English. He had concerns about the special characteristics of math and the capacity of technology as a delivery tool.

Both subject instructors found a way to show the problem-solving process through the use of presentations that included a simultaneous voice lecture and handwritten note-making technology. However, the courses required high-tech support for both teaching and learning parties. Technology often did not work as it was supposed to do. Even some accounting students commented that they did not understand why the school offered the accounting course online.

Challenges in Managerial Roles

This paper located challenges in managerial roles in facilitation of teaching assistants, students' dissociation from the learning environments, the lack of sense of urgency, facilitation of face-to-face meetings, and burdening load of work.

1. Challenge in facilitation of teaching assistants

The narrative of one of instructor participants brought attention to the facilitation of teaching assistant. Since the communication in online environments is based on one-on-one interaction, when it comes to answering questions, there are more question entries than face-to-face students daily. Oftentimes instructor participants were overwhelmed by the feedbacks and responses they had to provide to students. One of instructors who had 130 students in her accounting class set up a system of answering students' questions through the discussion board with her TAs since she believed that immediate responses were significant in online learning. She believed that since students transcribe their questions in writing, there is a delay of response and this lessens the pleasure of learning. The process of getting an answer was usually tedious. Sometimes the unanswered problem prevented the course from proceeding. The answer would be given to students after they had lost interest in the question. So she decided to facilitate TA to respond to students and their needs in an immediate manner. However, the interview results with students showed that the negative effects of the TA facilitation. Students believed that their instructor barely answered questions on the discussion board—even though her two TAs covered all questions students asked. It seemed that students preferred to receive answers directly from the instructor. Several of students even commented negatively about the absence of the instructor in the class. "The teaching assistants kind of teach the class." Students, it seems, who are trained in the traditional classroom setting might expect instruction to be delivered mainly by the instructor. They want to see the dominant instructional responses and feedbacks provided by the instructor, even though the online environment has a totally different mode and culture from the traditional one.

2. Challenge in facilitating face-to-face meetings

One of instructor participants, an accounting professor, who were struggling to deliver the process-oriented courses through online created a blended approach to online learning. She understood the limitation of learning accounting through online so she attempted to compensate the limitation by instituting review sessions, so that both learning and teaching parties could seek the merits of face-to-face meetings.
She also believed that even in an online environment students should have an opportunity to see the instructor face-to-face. The face-to-face meeting laid a foundation; students and teachers could then form images of each other. She assumed that his image formation made the interaction work smoothly, and it initiated the relationship between both parties.
However, the face-to-face meeting resulted in the complaints from the students who could not able to attend on those face-to-face review days. Her intention of bettering students' understanding of course materials resulted in the complaints of the unfairness from students who were not able to attend the face-to-face session. They felt the deprivation of privileges. The instructor felt challenged when her good intention turned out to be as an ineffective instructional activity.

3. Challenge in dissociation from the learning environments

Instructor participants realized that his students needed a guide to set the pace of online learning. Some students did not log on to the class site for three weeks in the beginning of the semester. As soon as the class began one of participants always sent email messages to each student asking them to reply to him

through both WebCT mail system and students' private mail system. "For one thing, I just want to know that they have logged in, and that they were paying attention. And also that is one way to get them immediately to ask me anything that occurs to them." He encouraged the class to ask questions through emails or by telephone when the need for assistance arose. He sent emails if he noticed problems with students. Relying on the WebCT email system is sometimes not enough to broadcast information to every student because some students were irresponsible. In this case, he suggests "external email, and even [the] telephone" would be other solutions that would bring students to online classes after monitoring their log-in frequency. Although he assumed that students would have enough maturity to take care of their work, some students need extra reminders to keep up-to-date on class information.

One of instructor participants noticed that nontraditional students who have not been exposed to online environments or have not taken traditional courses for a while lack the sense of rigor and intensity necessary of online students. Many of nontraditional students lost their study habits when they were out of school. Also, their study habits in the traditional settings did not translate well in the new environment. He also mentioned that to be successful in online learning or in one's profession does not involve the same requirements. Students who were successful in their profession were not always successful in the class. Students who have lost the established habits of study need to increase their efforts in order to return to the practice of studying. He used the regularly-held chat session to help his students too establish the pace of online learning; he also monitored students to see if they are keeping up with the learning events.

4. Challenge in the lack of sense of urgency

One of instructor participants analyzed the causes of more procrastination in online classes. Students enrolled in face-to-face classes had more opportunities to feel pressured to finish their work by hearing the instructor repeat reminders aloud and by observing their peers discuss and prepare assignments. Talking to peers about the assignment and their work process also provided a sense of urgency to traditional students in regular classes. This was the pressure arising from their learning communities. He noticed that online students lacked the support from instructors' physical messages and the pressure from learning communities.

5. Challenge in burdening load of work

One of instructor participants who had 130 students felt limited and overwhelmed to answer all emails in a immediate manner. The feeling of guilty of not completing responding was the constant nuisance during the semester. The balance between other job responsibilities and her online instruction was her main concern while she was constantly answering students' questions. Her negotiation with her time management came to the conclusion that setting a blocked time for responding and made an announcement about the frequency of replying answers for students.

Students report that they check back frequently to see if there is a response. If they are left dangling for days on end, they lose a feeling of connection and begin to feel lost in cyberspace. This is a negative loop that contributes to a lessening of participation in the discussions (Markel, 2001). For instructors who have more than 100 students, however, it is an impossible mission to provide feedback within a 24-hour time span. The guidelines should be adjusted for the situation in which the online instructors are placed.

Challenges in Technological Roles

The discussion of challenges in technological roles in this paper include facilitation of the adaptive delivery method, adoption of new technology, and low technology in high tech course design.

1. The challenges in facilitation of the adaptive delivery method

One of the instructor participants found the facilitation of innovative technology challenging in her online instruction. She initially adopted the PowerPoint presentation with her voice-over into the each slideshow to compensate the removal of verbal instruction in her online classroom and to increase the more audio-sensory dimension of her instruction which is recognized to be an effective way to promote the learning take place. She believed that the written mode had a limited ability to draw students' attention to the instructions to follow. Therefore, she decided to facilitate audio cues to deliver her instruction by adopting voice-over PowerPoint presentations. Despite her time and efforts to create the voice-over

instruction, few students listened to her PowerPoint instruction. The task-oriented online students simply downloaded course materials from the computer and read them at their own convenience. When online students were asked why they did not take of advantage of PowerPoint instruction, they stated that PowerPoint instruction created the atmosphere of the face-to-face classroom where they had to sit in the class for a long time. They chose the online classes because the class attendance and sitting time in class were not their learning preference and did not fit into their life. The innovative technology facilitation as the supplement of face-to-face instruction is best achieved when the instructor understands the characteristics of altered learning modes of students, and students' learning styles and preferences.

2. Challenges in adoption of new technology

One of instructor participant's use of technology in his class is an attempts to compensate for the removal of face-to-face interaction. In learning technologies for his online classes, Dr. Williams relies mostly on his self-teaching. The conferences he attends are his main sources of ideas for what kinds of methods and technology are available. Once he gathers the ideas on how to enhance online classes from conferences, he takes action without hesitation. Any initial complications in learning the use of technology did not stop him from continuing to develop his course in effective ways.

He has experienced many self-taught training for technology use experiences, for example, Camtasia which flash movie software it captures the movement and voice on the computer screen, and voice-over lecture. He facilitated the Camtasia Studio add-in for PowerPoint records. This software has allowed him to record all multimedia elements of live PowerPoint presentation, including animations and voice narration, and to publish it on a Web site. However, there was no assistance to teach him. Self-training is the only way to master how to adopt technology for his classes. He does not have anybody to whom he could turn when he needs to learn new technology.

One of the significant findings was the emergence of a community of practice among the mathematics faculty members in the same department who faced the common problems. The faculty members who taught the mathematics courses congregated informally to share the information and technology skills to cope with the sustained problems. The faculty members were grouped together because they had common difficulties, the same content area, and similar goals; similar students; and a ready-built relationship because there were geographically and socially closer to communicate, to learn, and to develop ideas without any hesitation to ask for help. The distance education administration needs to pay special attention to the community of practice implication, and find a way to aid and encourage the development of these kinds of communities through infrastructural support.

3.   Challenge in low technology in high tech course design

Instructor participants came to realize that the innovative, high technology could be a nuisance to student who used their not-up-to date technology which did not have capacity to support high technology. Many of student participants had experienced frustration when their computers were not comparable to use the online course materials developed with high technology. Even if students' computers had capacity to use the online course materials, the downloading high technology materials took a great amount of time on the student end. Even if instructors designed a course with high-tech applications, the recipients would not fully benefit from the effects of the technology. It is easy to fall into the illusion that expensive technology could solve all pedagogical dilemmas and lead us to instructional success. However, for online students who are mostly task-oriented, who are not up-to-date on technology, and who lack the time to attend class on campus, the use of time-consuming technology is not appealing.

Challenge in Social Roles

In this section of the paper, challenges in social roles are discussed in relation to physical dispersion.

1. Challenges in physical dispersion

One of instructor participants pointed that the major challenges of building social dynamics in online environments were largely caused by physical dispersion. In instructor participants narratives revealed that since online instructors taught mainly through the written format, online instructors felt limited to express

their enthusiasm and caring attitude toward students because the paralanguage and non-verbal cues were removed in their instruction online. Another reason is, they also pointed, that since online communication is one-to-one based interaction, there were no communication and interaction networks which were simultaneously and naturally built with an entire group of students when they were in face-to-face instruction with the entire class. Since they had limited time for online instruction, it was difficult tasks for them to connect socially with all of students in class. They were only able to build rapport with the limited number of students who actively interacted with instructors. All of instructor participants were facilitated a variety of the communication channels to increase the ways to communicate students including online chat session at 9 O'clock PM, questions through discussion board, telephone lines, online office hours and the like. These kinds of class activities which encouraged communication and interaction mostly failed unless the activities were mandatory. Most of instructors were discouraged to continue those activities or some were determined to change these activities as the mandatory.

Conclusion

The findings of study revealed that the challenges came from four dimensions of online instructors. The majority of challenges are attributed to physical dispersion, text-based communication, overwhelmed workload, and the expanded parameter of job responsibility.. The instructors were challenged to adjust their pedagogical roles in the text-based communication environments. The act of adjustment are required for both teaching and learning parties. Particularly, challenges in pedagogical roles is closely related to the culture of online learning environments where the pressure from peers and the sense of urgency from the surrounding are removed. The instructors who taught process-oriented courses such as mathematics and accounting had more difficult time to find the right delivery tools since the static online feature is not right fit for the process-oriented instruction. Challenges in managerial roles become more complex in online environments since the online instructors had to deal with both students and different resources to organize the class. They had to manage not only students but also human and technological resources. It added more burdens on instructors' workload. The challenges in managerial roles calls for the instructors' balance of control in accomplishing the online learning goals. Challenges in technological roles are challenged when the instructors had the general lack of understanding about the students' learning styles and preferences. The learning and adopting new technology required more experimental and frustrating moments in online teaching. The findings also suggested that the infrastructure of supports for the common interests groups will be needed. This article concludes that online instruction can be best approached with understanding of challenging aspects of online teaching. Challenges in roles have interrelated and overlapping nature.

This archive, in this sense, provide for online instructors what are expected in teaching online, and allow them to have better preparation in terms of coping with the challenges in online teaching roles with vicarious experiences provided by participants of this study. In addition, this article serves as a comprehensive map to see where the hindrances of proceeding online instruction are located.

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Measuring System Structural Properties of Autonomy-Support in a Montessori Classroom

Joyce H. L. Koh
Theodore W. Frick
Indiana University Bloomington

Purpose

This qualitative case study analyzes classroom structures that supported student autonomy in a Montessori classroom. Using the Axiomatic Theories of Intentional Systems (ATIS) as a theoretical model, it also explores how a logico-mathematical general system model can be used to characterize the configurations underlying classroom interaction.

Montessori classrooms and autonomy-support

Deci, Vallerand, Pelletier & Ryan (1991) defined autonomy or self-determination as a state where one's volition was totally internalized and unaffected by external conditions. Surveys of school-age children found that students perceived teachers to be highly autonomy- supportive when they gave choice, had confidence in their ability, respected, and empathized with them (Hardre & Reeve, 2003). Autonomy-supportive social contexts were also found to have positive effects on children's interest for learning, level of conceptual learning, and willingness to perform uninteresting activities (Grolnick & Ryan, 1987; Joussemet, Koestner, Lekes, & Houlfort, 2004).

Montessori schools exhibit the characteristics of autonomy-support as described by the preceding studies. Its founder, Dr Maria Montessori, believed that education should help each child become a disciplined individual who is "master of himself, and can, therefore, regulate his own conduct when it shall be necessary to follow some rule of life." (Montessori, 1964, p. 86). It is also undertaken with a scientific approach where children were treated as natural phenomenon to be observed and understood. Teachers prepare the classroom with *Works* or instructional activities, and allow students choice to engage in what interests them (Cossentino, 2006). Teachers then make observations, and modify the *Works* to maintain students' learning engagement, and to stimulate interest in the *Works* they do not naturally choose. Even though children were given liberty to manifest themselves naturally, Montessori believed that they should be disciplined when they cause disruptions to learning.

When the social context of Montessori and traditional middle schools were compared, Rathunde and Csikszentmihalyi (2005) found that Montessori students reported more support from teachers; more order in the classroom, and a greater feeling of emotional/psychological safety. They also spent more time with academic work, group work, collaborative learning, and individual projects; but less time in passive listening via lecturing and note-taking. The authors concluded that analysis of school contexts that fostered intrinsic motivation could provide concrete ideas for improving student engagement in public schools.

Logico-mathematical General System Theory models

General systems theory (GST) postulated that systems could have common characteristics and behavior regardless of whether these were scientific, natural or social (von Bertalanffy, 1968). Mathematical models were used as an "exact language permitting rigorous deductions and confirmation (or refusal) of theory" (von Bertalanffy, 1972, p.30). Maccia and Maccia (1966)'s SIGGS theory model was developed specifically for educational theorizing. Thompson (2005a; 2005b; 2005c; 2006; 2007) formulated the Axiomatic Theories of Intentional Systems (ATIS) by improving on the consistency of SIGGS nomenclature, and converting SIGGS hypotheses into a set of axioms or assumptions underlying general systems behavior. ATIS basic properties describe system characteristics such as the number of system components (*size*), and the number of *affect relations* or connections between system components (c*omplexity*). Structural properties characterize the configuration of an *affect relation* set, while dynamic properties describe event changes that occur within a system, or its transactions with the *negasystem* (environment outside system boundaries).

Cossentino (2005) found Montessori classrooms to be characterized by discernable rituals that teachers use. Using the ATIS theory model, this study attempted to describe these rituals by measuring nine general system properties from the interactions between teachers and students, and triangulating these with qualitative and survey data to determine the structural configurations that support student autonomy in a Montessori classroom.

Method

Subjects

The study was conducted in an upper elementary (fourth to sixth grade) classroom of a Montessori school located in the state of Indiana. It consisted of 28 students, ranging from 9 to 11 years old, a Montessori-certified head teacher, and two assistant teachers.

Classroom context

In each 16-week session, students completed mandatory number of *Works* which include research projects; book reports; workbooks in Math and flash card drills. Teachers made a punch on individual cards that tracked their progress when an item of their required *Works* was completed. A typical day in the school was from 8:30 a.m. to 3:30 p.m. The morning started with students working on a *Head Problems* worksheet that consisted of math and logic-related problems designed by teachers. When this was completed, students moved into the *Morning Work Period* where they were free to work individually or collaboratively on their *Works*. About half an hour before recess at noon, students re-gathered to present their answers for the *Head Problems*. After lunch at 1 p.m., students attended Spanish or History classes and would end the day with cleanup duties at about 3 p.m.

Procedure

This study was first approved by the School Board of the Bloomington Montessori Association, following which consent forms for study participation were circulated to parents; where consent was obtained for 10 students. Ten one-hour observations were then conducted in the classroom during April 2006 where two to three observations were made each week. Each observation lasted about an hour, usually between 8:30 a.m. to 9:45 a.m. This time segment was chosen upon consultation with teachers as they felt that the classroom activities best reflected how the major portion of students' learning goals were completed in a mixed-grade Montessori classroom.

Montessori classrooms emphasized children's freedom to move around and work where they felt most comfortable. Even though the use of video equipment would have afforded greater precision for data collection, it was not possible to film only those subjects with parental consent without disrupting the normal operations of the classroom. Therefore, ethnographic field-notes were used to record the various types of interactions occurring between teachers and students. Cossentino (2006) employed the same data collection strategy in an effort to respect its classroom norms when studying work patterns in a Montessori classroom.

To determine if the motivational style of teachers is associated with their teaching method, the *Problems in Schools Questionnaire* (SDT Website, 2006a) was administered to each teacher at the beginning of the study. The purpose of the questionnaire and their results were not revealed until the end of observations Teachers rated 32 motivational strategies on a Likert scale of 1 (very inappropriate) to 7 (very appropriate). A one-hour semi-structured focus-group interview was also conducted with them at the end of the observations.

Students' level of intrinsic motivation for doing schoolwork was assessed through the *Academic Self-Regulation Questionnaire* (SDT Website, 2006b). This was administered only to the students with parental consent both at the beginning and end of the observations so that consistency of ratings could be verified. It consisted of 32 questions that measured four types of motivations for doing schoolwork. Each question was scored on a Likert Scale of 1 (Not at all true) to 4 (Very true).

Data analysis

Categorizing classroom interactions

The constant comparative method (Creswell, 1998) was used to derive 43 common interactions that occurred between teachers, students, and learning resources. These were further grouped into three categories (affect relations): *Instructional*, *Support,* and *Control*. The interactions and their proposed categories were verified with the teachers through an interview.

Measuring system properties

Interactions underlying each affect relation was identified by matching of frequency and pattern occurrences (Yin, 2003), and then described as ordered pairs that characterize the direction of connections between components. It is a notational system used by the Set and Diagraph theories which underlie ATIS. The nine system properties for each type of affect relation (Thompson, 2006) were measured as follows:

1. Size: The number of components in a system.

$$\text{Size, } Z(\mathfrak{S}), =_{df} \text{ components of an object-set.}$$

$$Z(\mathfrak{S}) =_{df} \mathcal{W} \subset \mathfrak{S}_0$$

2. Complexity: The total number of connections occurring between components in a system.

$$\textbf{Complexity-component partition, } {}_X\mathfrak{S}, =_{df} \text{ a } \textit{partition, } \mathfrak{Y} = (\mathcal{V} \subset G_0, \mathcal{R} \subset G_A), \text{ characterized by the number of affect-relations.}$$

$$_X\mathfrak{S} =_{df} |\mathfrak{Y}(\mathcal{R})|$$

3. Passive Dependence: The extent to which system components are receiving connections. It is computed by first tabulating the number of connections received by each component, and then taking their product.

$$\mathcal{M}: \textbf{Passive dependent-component partition measure, } \mathcal{M}(_{PD}\mathfrak{S}), =_{df} \text{ a measure of receiving component affect-relations.}$$

$$\mathcal{M}(_{AD}\mathfrak{S}) =_{df} [(\Sigma_{i=1,\dots,n}[\Pi d_T(v) \div \log_2|\mathcal{A}_i|]) \div n] \times 100$$

4. Interdependence: The extent to which components initiate and receive connections. It is computed by first identifying components that both initiate and receive connections. Then, the product of total paths initiated and received by these components is computed.

$$\mathcal{M}: \quad \textbf{Interdependent system measure, } {}_N\mathfrak{S}, =_{df} \text{ a measure of initiating and receiving associated component affect-relations.}$$

$$\mathcal{M}(_N\mathfrak{S}) =_{df} [(\Sigma_{i=1,\dots,n}[\log_2\Pi d|r_{\tilde{a}(I,T)}(e) = 1]) \div \log_2|\mathcal{A}_i|]) \div n] \times 100$$

5. Strongness: The extent to which system components are connected. It is measured by the product of total connections received and initiated by each component.

$$\mathcal{M}: \textbf{Strong-component partition measure, } {}_S\mathfrak{S}, =_{df} \text{ a measure of the degree of connected components.}$$

$$\mathcal{M}(_S\mathfrak{S}) =_{df} [(\Sigma_{i=1,\dots,n}[\log_2\Pi d(v) \div \log_2|\mathcal{A}_i|]) \div n] \times 100$$

6. Centrality: The extent to which primary-initiating components have indirect control. It is computed by the total path length of connections from primary-initiating components that have a path length greater than 1 and comparing it $|A_i|$. Primary-initiating components are those that only initiate and do not receive connections.

$$\mathcal{M}: \textbf{Centralized-component partition measure, } \mathcal{M}(_C\mathfrak{S}), =_{df} \text{ a measure of primary-initiating, non-adjacent component affect-relations.}$$

$$\mathcal{M}(_C\mathfrak{S}) =_{df} [(\Sigma_{i=1,\dots,n}[|r_{\tilde{a}(1,\tilde{s})}(e) > 1|) \div \log_2|\mathcal{A}_i|]) \div n] \times 100$$

7. Complete Connectivity: The extent to which system components are able to connect to other components either directly or indirectly. This is computed by the sum of completely connected paths occurring in the system.

$\mathcal{M}$: **Complete-component partition measure**, $\mathcal{M}(_{CC}\mathfrak{S})$, $=_{df}$ a measure of pair-wise directed associated component affect-relations.

$$\mathcal{M}(_{CC}\mathfrak{S}) =_{df} [(\Sigma_{i=1,\ldots,n}[|\mathcal{r}_{a}(e) \geq 1|] \div \log_2|\mathcal{A}_i|]) \div n] \times 100$$

8. Hierarchical Orderness: The extent of the occurrence of a *tree*. A tree is an acyclic simple-graph. Except for the root, every connected component is directly connected to only one other component. The root is an initiating component (does not receive) and is directly connected to one or more other components.

$\mathcal{M}$: **Hierarchy system measure**, $\mathcal{M}(_{HO}\mathfrak{S})$, $=_{df}$ a measure of a *tree*.

$$\mathcal{M}(_{HO}\mathfrak{S}) =_{df} [(\Sigma_{i=1,\ldots,n}[(|\mathcal{r}_{d(branch)}(e) \geq 1| \times |\max(\mathcal{r}_{d(walk)}(e) + 1)|) \div \log_2|\mathcal{A}_i|]) \div n] \times 100$$

9. Heterarchical Orderness: A pair of components is associated if they are either adjacent or non-adjacent and have a directed connection between them. The length of the path between associated components is greater than or equal to one. Components are heterarchy-connected if they are associated and each associated pair has a two-way connection, or if a component is a leaf (receiving only) and associated

$\mathcal{M}$: **Heterarchy system measure**, $\mathcal{M}(_{HA}\mathfrak{S})$, $=_{df}$ a measure of initiating and receiving associated component affect-relations, or receiving associated (leaf) component affect-relations.

$$\mathcal{M}(_{HA}\mathfrak{S}) =_{df} [(\Sigma_{i=1,\ldots,n}[(|\mathcal{r}_{d(I,T)}(e) \geq 1| + |\mathcal{r}_{d(leaf)}(e) \geq 1|) \div \log_2|\mathcal{A}_i|]) \div n] \times 100$$

Results

Structural differences arising from choice

The activity pattern of *Head Problems* followed by the long *Morning Work Period* was relatively stable across the ten observation days. Students had to complete the worksheets prescribed by teachers during *Head Problems* but could choose the *Works* they wanted to do, and whether they wanted to work on them individually or collaboratively during the *Morning Work Period*. The different structural configurations with respect to *Choice* resulted in *Complexity* being substantially lower during *Head Problems* as only one *Choice* affect relation was present (See Figure 1); being that between the teacher and the problems assigned to students. This is represented as an affect relation set {t1, a100} where a100 denotes the *Head Problems* for that particular day. In comparison, the *Morning Work Period* found *Choice* affect relations occurring between each student and the *Works* they selected, thereby resulting in a higher level of *Complexity*. This is modeled by the affect relation set:
{(s1,a1) (s2,a2) (s3,a3) (s4,a4) (s5,a5), (s6,a25), (s7, a26), (s8,a29), (s9,a6) (s10,a7) (s11,a8) (s12,a9) (s13,a10) (s14,a11) (s15,a12) (s16,a13) (s17,a14) (s18,a15) (s19,a16) (s20,a17) (s21,a18) (s22,a19) (s24,a20) (s25,a21) (s26,a22) (s27,a27) (s27,a23) (s28,a28) (s28,a23)}.

Figure 1. Comparison of structural configurations with respect to student choice of learning activity
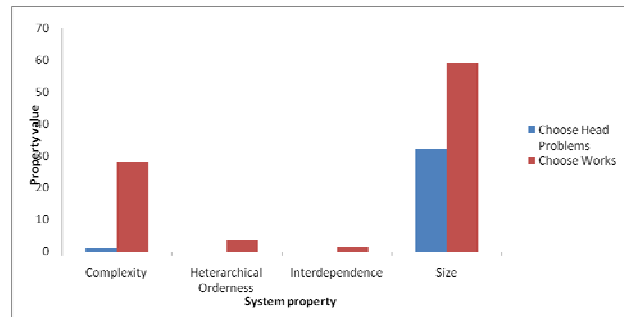
Interdependence was created when each student initiated and received *Choice* connections by selecting their work partners, and negotiating how they wanted to work on the project. For example, two students (s27 and s28) collaborated on a paper about the Olympics (a23). This is represented by the ordered pairs (s27, a23) and (s28, a23). They also completed other individual *Works* during this time i.e. (s27, a27), (s28, a28). The *Morning Work*

Period also had more *Works* (a1 to a28) that could be chosen by students, resulting in a larger *Size* (number of components in a system). As a result, the system showed more *Heterarchical Orderness* as *Choice* relationships were not prescribed hierarchically from one source, i.e. the teacher.

Structural configurations with respect to Instructional affect relations

        Instructional affect relations were created between teachers and students; and between students when they exchanged instructional content. Differences in *Instructional* affect relations were found during three time periods: before starting *Head Problems*, during *Head Problems* and during the *Morning Work Period*.
        Direct instruction was the primary mode of instruction used before teachers distributed *Head Problems* worksheets for the day. Children would be gathered at one side of the classroom where the requirements of the worksheet were reviewed with a short refresher of related contents. This usually lasted for about 15 minutes, and is represented by the affect relation set:
        {(t1,s1) (t1,s2) (t1,s3) (t1,s4) (t1,s5) (t1,s6) (t1,s7) (t1,s8) (t1,s9) (t1,s10) (t1,s11) (t1,s12) (t1,s13) (t1,s14) (t1,s15) (t1,s16) (t1,s17) (t1,s18) (t1,s19) (t1,s20) (t1,s21) (t1,s22) (t1,s23) (t1,s24) (t1,s25) (t1,s26) (t1,s27) (t1,s28) (t2,s1) (t2,s2) (t2,s3) (t2,s4) (t2,s5) (t2,s6) (t2,s7) (t2,s8) (t2,s9) (t2,s10) (t2,s11) (t2,s12) (t2,s13) (t2,s14) (t2,s15) (t2,s16) (t2,s17) (t2,s18) (t2,s19) (t2,s20) (t2,s21) (t2,s22) (t2,s23) (t2,s24) (t2,s25) (t2,s26) (t2,s27) (t2,s28) (t3,s1) (t3,s2) (t3,s3) (t3,s4) (t3,s5) (t3,s6) (t3,s7) (t3,s8) (t3,s9) (t3,s10) (t3,s11) (t3,s12) (t3,s13) (t3,s14) (t3,s15) (t3,s16) (t3,s17) (t3,s18) (t3,s19) (t3,s20) (t3,s21) (t3,s22) (t3,s23) (t3,s24) (t3,s25) (t3,s26) (t3,s27) (t3,s28) (s1,t1) (s2,t1) (s3,t1) (s4,t1) (s5,t1) (s6,t2) (s7,t2)}
        When direct instruction was used, *Instructional* affect relations were initiated from the teacher to each student resulting in a high level of *Centrality* (see Figure 2) because the teacher was primary-initiating.

Figure 2. Comparison of structural configurations with respect to *instructional* relations
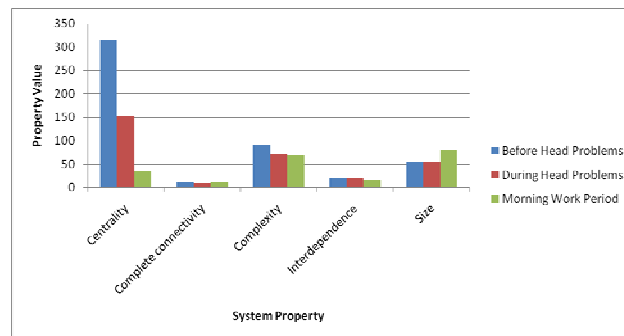
        Despite the high level of *Centrality*, there was a corresponding presence of *Complete Connectivity* and *Interdependence* because teachers always called upon students to share their knowledge, and used their answers to reinforce important concepts. Comparison of observation data during this time found that about 5 to 7 students were called upon during these mini-lecture sessions. This is modeled with ordered pairs (s1,t1) (s2,t1) (s3,t1) (s4,t1) (s5,t1) (s6,t2) (s7,t2) in the affect relation set.
        Work-time during *Head Problems* was structurally similar to that for the *Morning Work Period* except that students had no choice over their learning activity. This is modeled by the affect relation set:
        {(a100,s1) (a100,s2) (a100,s3) (a100,s4) (a100,s5) (a100,s6) (a100,s7) (a100,s8) (a100,s9) (a100,s10) (a100,s11) (a100,s12) (a100,s13) (a100,s14) (a100,s15) (a100,s16) (a100,s17) (a100,s18) (a100,s19) (a100,s20) (a100,s21) (a100,s22) (a100,s23) (a100,s24) (a100,s25) (a100,s26) (a100,s27) (a100,s28) (s21,t2) (t2,s21) (s22,t2) (t2,s22) (s1,t3) (t3,s1) (s2,t3) (t3,s2) (s28,t3) (t3,s28) (s28,s10) (s18,s19) (s19,s18) (s4,t1) (s4,t2) (s4,t3) (s4,computer1) (s4,s1) (s4,s2) (s4,s3) (s4,s5) (s4,s6) (s4,s7) (s4,s8) (s4,s9) (s4,s10) (s4,s11) (s4,s12) (s4,s13) (s4,s14) (s4,s15) (s4,s16) (s4,s17) (s4,s18) (s4,s19) (s4,s20) (s4,s21) (s4,s22) (s4,s23) (s4,s24) (s4,s25) (s4,s26) (s4,s27) (s4,s28)}
        Centrality was also higher as compared to the *Morning Work Period* (See Figure 2) since a larger number of *Instructional* affect relations originated from *Head Problems* assignments, as shown by ordered pairs (a100,s1), (a100,s2)…(a100,s28). *Complete Connectivity* arose out of *Instructional* affect relations that were formed when students sought help from teachers and peers to solve *Head Problems*. Teachers rarely told students answers directly but used this time for personalized coaching, thereby creating bi-directional *Instructional* affect relations between

teachers and students, as modeled by ordered pairs such as (s21,t2), (t2,s21) and (s1,t3), (t3,s1). *Complete Connectivity* was also observed between students. For example, small groups of two or three could be gathered around the teachers' tables clarifying a question about the *Head Problems*. This is modeled by ordered pairs (s1,t3) (t3,s1) (s2,t3) (t3,s2) (s28,t3) (t3,s28) in the affect relation set where s1,s2, and s28 initiated *Instructional* affect relations with t3. s28 then returned to her desks and instructed another, as modeled by (s28,s10), where s28 forms *Instructional* affect relations with s10 by explaining what she learned from discussion with the teacher. Teachers also created opportunities for *Interdependence* by encouraging students to raise questions about the assigned *Head Problems*, especially when they found mistakes. They believed that this motivated buy-in for undertaking challenging work and allowed students to initiate suggestions for improving the contents they were working with.

At first sight, the *Morning Work Period* could seem unstructured or even chaotic as each teacher and student seemed to be engaged in their own agendas. Five or six students could be typing up book reports on the computers while two or three others are working on Math workbooks at their desks. One teacher could be searching for a book with two students in the library; the second engaged in an individual feedback session while the third was grading assignments at her desk. A significant difference between *Head Problems* and the *Morning Work Period* was that *Instructional* affect relations with students originated from the different *Works* they chose to be engaged in, thereby resulting in a much lower value for *Centrality* as compared to the other two time periods. This is modeled by (a1,s1)…(a28, s28) in the *Instructional* affect relation set for the *Morning Work Period*:

{(a1,s1) (a2,s2) (a3,s3) (a4,s4) (a5,s5) (a5,s7) (a6,s6) (a8,s8) (a9,s9) (a10,s10) (a11,s11) (a12,s12) (a13,s13) (a14,s14) (a15,s15) (a16,s16) (a17,s17) (a18,s18) (a19,s19) (a20,s20) (a21,s21) (a22,s22) (a23,s23) (a24,s24) (a25,s25) (a26,s26) (a27,s27) (a28,s28) (computer1,s12) (s12,computer1) (computer2,s13) (s13,computer2) (computer3,s14) (s14,computer3) (computer4,s15) (s15,computer4) (computer5,s16) (s16,computer5) (computer6,s6) (s6,computer6) (s27, computer7) (computer7, s27) (s28, computer7) (computer7, s28) (books1,s14) (s14, books1) (books2,s20) (s20,books2) (t1,s1) (s1,t1) (t1,s2) (s2,t1) (t1,s3) (s3,t1) (t2,s6) (s6,t2) (t2,s9) (s9,t2) (t3,s19) (s19,t3) (t3,s20) (s20,t3) (t3,s21) (s21,t3) (s4,s5) (s5,s4) (s27,s28) (s28,s27)}

Size was also larger during the *Morning Work Period* (see Figure 2) because individual *Works* and learning resources provide content information to support student learning. These are modeled by ordered pairs such as (computer1, s12) (s12, computer1), and (books1, s14) (s14, books1). Bi-directional *Instructional* affect relations were created as students searched for and received content information from these resources. The *Morning Work Period* was also a time where teachers met individually with students to provide feedback on their projects. These interactions are illustrated by the bi-directional connections occurring between teachers and students such as (t,s1) (s1,t1). The feedback process was described by one teacher as a time where "most of the teaching happens." A meeting could sometimes take up to 45 minutes where teachers not only clarified misconceptions but also provided support by recommending books and resources that help students improve their projects. This thorough feedback process contributed to *Complete Connectivity* and *Interdependence* between teachers and students in terms of *Instructional* affect relations.

The flexibility for students to engage in collaborative projects also created opportunities for *Interdependence* in *Instructional* affect relations during this time. For example, s4 and s5 chose to help each other check their drafts for a Science project on the topic of Convection. They were observed to be asking each other questions related to their drafts, thereby forming bi-directional *Instructional* affect relations as shown by (s4,s5) (s5,s4). At a computer station, s27 and s28 were found to be looking up information on the World Wide Web for a writing project on the Olympics, thereby create *Instructional* affect relations between themselves and computer resources. Despite increased opportunities for collaboration, *Interdependence* during the *Morning Work Period* was lower than the other two time periods because it was left to the sporadic intent of students.

Structural configurations with respect to *Support* affect relations

Even though *Instructional* affect relations were predominant, *Support* affect relations were found to coexist with them. These involved interactions related to information that was required to support instruction but were not instructional in nature. During *Head Problems*, such interactions usually involved the clarification of work instructions as modeled by the following affect relation set:

{(s1,t1) (s2,t1) (s4, t1) (t1,s1) (t1,s2) (t1,s3) (t1,s4) (t1,s5) (t1,s6) (t1,s7) (t1,s8) (t1,s9) (t1,s10) (t1,s11) (t1,s12) (t1,s13) (t1,s14) (t1,s15) (t1,s16) (t1,s17) (t1,s18) (t1,s19) (t1,s20) (t1,s21) (t1,s22) (t1,s23) (t1,s24) (t1,s25) (t1,s26) (t1,s27) (t1,s28) }

In comparison, *Support* affect relations were more predominant during the *Morning Work Period* as students were not constrained to doing the same activity at the same time (See Figure 3). This provided greater flexibility for students to engage in *Support* activities with each other, such as one student teaching another how to use the scanner. This is modeled by the interactions between s1, s2, s3 and the scanner in the *Support* affect relation set during the *Morning Work Period:*

   {(s1,s2) (s3,s1) (s1,s3) (s3, scanner), (scanner,s1) (s10,s11) (s11, s10) (s23, s24) (s24,s23)(t1,s26)
   (t1,books4) (s26,t1) (s26,books4) (t2,s25) (s25,t2) (s7,books1) (s8,books2) (s14,computer1)
   (s15,computer2) (s16,computer3) (s17,computer4) (computer1,s14) (computer2,s15) (computer3,s16)
   (computer4,s17) (books1,s7) (books2,s8)}

Figure 3. Comparison of structural configurations with respect to *support* relations
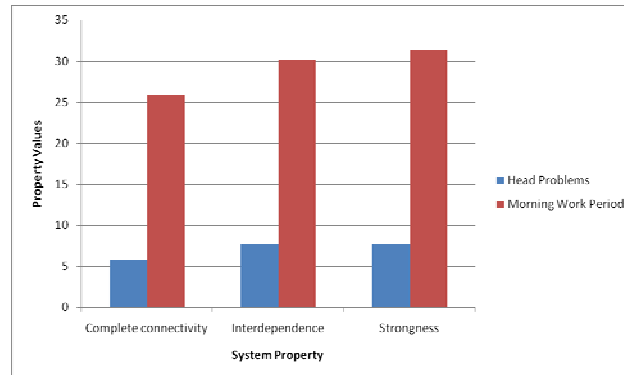
Another type of *Support* affect relation that occurred naturally between students would be during the orientation of new students. For example, when approached by new student s11, s10 demonstrated how to clip a grading sheet to the *Head Problems* worksheet when handing it up. s23 served as a student mentor for s24 who was a visitor from the lower elementary class by showing her the format for citing sources in a research report. Teachers also provided support to students by helping them search for additional books and resources to support completion of *Works* as shown by interactions between t1, s26 and books4. As a result, *Complete Connectivity*, *Interdependence* and *Strongness* were higher during the *Morning Work Period* as there was a larger number and more variety in the types of *Support* relations that were present.

Structural configuration with respect to *Control* affect relations

Even though student autonomy was a feature of the Montessori classroom, Figure 4 showed that this did not preclude the need for control.

Figure 4. Structural properties relevant to *control* relations
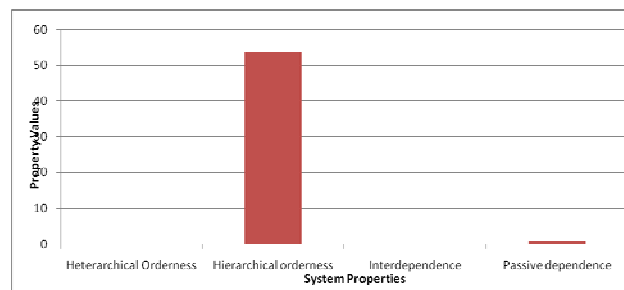
Figure 4 shows that *Control* affect relations were characterized by the presence of *Hierarchical Orderness* and *Passive Dependence*, which described connections whereby components received, rather than initiated relationships. *Heterarchical Orderness* and *Interdependence* were absent as *Control* was imposed on students without any means for negotiation. This is modeled by the affect relation set:

{(t1,s1) (t1,s2) (t1,s3) (t1,s4) (t1,s5) (t1,s6) (t1,s7) (t1,s8) (t1,s9) (t1,s10) (t1,s11) (t1,s12) (t1,s13) (t1,s14) (t1,s15) (t1,s16) (t1,s17) (t1,s18) (t1,s19) (t1,s20) (t1,s21) (t1,s22) (t1,s23) (t1,s24) (t1,s25) (t1,s26) (t1,s27) (t1,s28)}

Teachers initiated *Control* affect relations in four situations: To focus students for instructional purposes; for disciplinary reasons when trying to help students stay on task during the *Morning Work Period* and to help students transition between *Head Problems* and the *Morning Work Period*.

Impact on student motivation

Table 1 shows the average rating of respondents by motivation category.   Using the internalization process as outlined by Deci, Eghrari, Patrick and Leone (1994), these figures showed that respondents had a greater tendency to undertake learning activities because they perceived some personal value and identification with the learning goals (Identified Regulation) rather than because they felt compelled by external factors (External Regulation).

Table 1. Students' Motivation Level for Schoolwork

Type of motivation	Score (Beginning)	Score (End)
External Regulation	2.47	2.54
Introjected Regulation	3.04	2.88
Identified Regulation	3.13	3.12
Intrinsic Motivation	2.15	2.10

Note. n = 9

Motivation styles of teachers

The teachers' score on the *Problems in Schools Questionnaire* by motivational style is shown in Table 2.

Table 2. Teachers' Motivational Style

Motivational Style	Average Score
Highly autonomy supportive	46.33
Moderately autonomy supportive	28.67
Moderately controlling	23.00
Highly controlling	16.00

Note. n = 3, maximum possible score = 56

The three teachers varied in terms of their teaching experience in Montessori schools. The Head Teacher had 32 years of teaching experience, while the two assistant teachers had 4 and 1 year of teaching experience respectively. Regardless of the number of years they taught in a Montessori school, all the three teachers had the highest scores for the category related to *Highly Autonomy Supportive* and lowest scores for the *Highly Controlling* category.

Discussion

Autonomy support in the Montessori classroom

The results of this study show that the instructional methods employed by teachers were congruent with the basic Montessori philosophy of cultivating self-mastery. Regardless of whether students sought help for *Instructional* or *Support* issues, teachers consistently used these opportunities to help them arrive at their own answers for resolving problems, resulting in the presence of *Complete Connectivity* throughout *Head Problems* and the *Morning Work Period* in terms of *Instructional* and *Support* affect relations. This underlying philosophy for Montessori teaching accounts for why all the three teachers rated themselves as being *Highly Autonomy Supportive.*

This study also shows that *Complete Connectivity* in terms of *Instructional* affect relations could be created when teachers provide opportunities for students to contribute ideas and suggestions for improving the learning contents they are working with. This recognizes students as legitimate partners in the learning process, and impacts

their willingness to learn challenging content. In terms of *Support* affect relations, a free-flowing work system such as that of the *Morning Work Period* provides scope for *Complete Connectivity* and *Interdependence* between students. When *Support* affect relations are less centralized and dependent upon the availability of teachers, it allows them to focus on personalized instruction. The structural organization of the *Morning Work Period* also increases the *Strongness* of connections between system components, providing opportunities for students to foster social relationships and relatedness, or secure connections with people (Stipek, 2002).

While Assor, Kaplan, Kanat-Maymon & Roth (2005)'s study found that controlling strategies predicted higher levels of anger and anxiety, this study found that being autonomy-supportive does not imply the absence of control. On the contrary, discipline and control are periodic and necessary activities for maintaining engagement on learning goals. They need not necessarily result in negative affect with students if used appropriately.

MAPSAT: Map & Analyze Patterns & Structures Across Time

The measures of classroom structure reported in this study are new. Originally, Frick (1990) devised analysis of patterns in time (APT) as a methodology for measuring system dynamics – i.e., maps of temporal configurations or processes. APT has since been extended by Thompson (2006) to include analysis of patterns in configurations (APC). Configural patterns characterize *structures* in education – i.e., how education is organized, or relations between parts and whole. Together, this approach to mapping of data and methods of analysis is called Map and Analyze Patterns and Structures Across Time (MAPSAT). In conventional measurement, variables are *measured separately for each case*, and then some method is used to relate the separate measures statistically for a set of cases (e.g., correlation, ANOVA, regression, and other linear models approaches). On the other hand, in MAPSAT, the researcher constructs configurations. A configuration is a temporal or structural map that describes a given case at a given time (the case is viewed as a single *system*). Then properties of those maps are determined from either sequences of event changes (APT) or from digraphs of affect relations (APC). Values of these temporal or structural properties *of a case* is the system measure. For example, in the present study we determined the value of the property, interdependence, of affect relations during the morning work period in the Montessori classroom we observed. This is a measure of the configuration of affect relations. For interdependence, it is a measure of the pattern of components that both initiate and receive.

MAPSAT also includes APT. Instead of a structural map, through observation we create a temporal map of category changes in classifications that describe *changes* in system events. APT was not done in the current study. However, in Frick (1990) one of the temporal patterns was student engagement when there was interactive or direct instruction. The mean likelihood of that temporal event pattern was 0.97, which means that if interactive instruction was occurring in a classroom, then the probability of student engagement was very high within each of the 25 learning environments for elementary students observed in his study.

Axiomatic Theories of Intentional Systems (ATIS: Thompson, 2005a; 2005b; 2005c; 2006; 2007) provides the theoretical framework for MAPSAT. APT was designed originally to measure system dynamics, whereas APC has been more recently designed to measure system structure. ATIS has the potential to help us better understand and predict the behavior of educational systems. More information on ATIS is available in reports by Thompson (2005a; 2005b; 2005c; 2006; 2007).

Limitations and suggestions for future research

The first limitation of this study is that only one Montessori classroom was studied. Comparison and contrast of structural configurations between systems was not possible, thereby limiting generalizability. The second limitation is that only about a third of the students could be surveyed. The motivational profiles of students may not have been similar for students whose parents did not allow us to collect data on them. Therefore, the student survey results need to be interpreted with caution.

For future research, this study could be replicated in more Montessori and K-12 classrooms and the structural properties compared. The relevance of other structural systems properties such as *Compactness*, *Flexibleness*, *Weakness* and *Vulnerableness* towards explaining classroom configurations could also be explored to allow additional properties of classroom structure to be understood.

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A Systems-Based Mentoring Model of Technology Integration

Theodore J. Kopcha
San Diego State University

Eric Lindner
Robert K. Atkinson
Arizona State University

Abstract
Research on technology integration indicates that longer-lasting, sustainable approaches to professional development are needed to integrate technology effectively into the lessons of teachers. This paper presents an initial evaluation of a systems-based model of technology integration that uses mentoring as the main method of professional development. The model was put in place at an elementary school in the Southwest with 31 teachers and approximately 800 students. Results indicate that teachers under this model feel supported when using technology, show a tendency to increase their use of technology in the classroom, and tend to learn new ways to integrate technology into the curriculum. Limitations and implications for the use of the model in K-12 settings are discussed and suggest that the model is robust enough to address a wide variety of unique and individual barriers to technology integration.

It is not altogether surprising that the presence of computers in the classroom has not naturally led to increased student performance. Teachers often receive improper technology training, lack the time to learn new technology, lack access to technology, of have poor attitudes about using technology (Ertmer, 1999; Koehler & Mishra, 2005; Mumtaz, 2000; OTA, 1995). Ertmer (1999) noted that teachers learning to integrate technology often experience these barriers in two related but different ways: externally and internally. First-order barriers are barriers that deal with issues external to the teacher (access to technology, time, support, resources, and training) and second-order barriers are barriers that deal with issues internal to the teacher (attitudes, beliefs, practice, resistance). A number of researchers have also noted that a major obstacle to teachers using technology for teaching subject-specific content is that they lack knowledge of the pedagogy associated with teaching with technology and designing meaningful learning opportunities that use technology (Bauer & Kenton, 2005; Hew & Brush, 2007; Hughes, 2004; Koehler & Mishra, 2005; Waight & Abd-El-Khalick, 2007).

Mentoring has been found to overcome many of the barriers to technology integration in the schools (Frankli, Turner, Kariuki, & Duran, 2001; Gallagher, 2000; Smith & Smith, 2004). Technology mentors have taken a number of forms in the past decade. They have been preservice teachers guiding inservice teachers (Franklin et al., 2001; Smith & Smith, 2004), inservice teachers guiding preservice teachers (Bullock, 2004), colleagues or peers (Clark, 2004; Polselli, 2002; Glazer, Hannifin, & Song, 2005), an outside expert (Lai, Trewern, & Pratt, 2002; Swan, Holmes, Vargas, Jennings, Meier, & Rubenfeld, 2002), or the students of the teachers themselves (Snoeyink & Ertmer, 2001/2). For example, Snoeyink and Ertmer (2001-2002) found that teachers used technology in ways that were more constructivist in nature and student-centered when the students were allowed to act as experts at using technology as well as with subject-matter. Regardless of who they are, mentors provide teachers with just-in-time support while learning to integrate technology into lessons they are actually teaching (Bullock, 2004; Lai et al., 2002; Whitfield & Latimer, 2003). They present teachers with a model of the various approaches to teaching with technology (Ertmer, 1999; Glazer et al., 2005; Lim & Khine, 2006) and provide assistance that meets the specific needs of the teacher (Swan et al., 2002).

Despite its success as an approach to technology integration, mentoring is not often used as a professional development strategy. Some researchers (Chuang, Thompson, & Schmidt, 2003; Gallagher, 2000) suggest that mentoring models place too high demand on school resources such as time, money, and teacher support. Franklin et al. (2001) similarly note that little research exists supporting the use of mentoring as a method of technology professional development in schools. It is clear that while mentoring is effective at teaching teachers to integrate technology, it needs to be refined to improve its popularity in schools.

The purpose of this paper is to: 1. Present a systems-based model of technology integration that uses mentoring as the main approach to the professional development of teachers and 2. Present the results of using the model after one year in an K-5 setting.

The model

The model contained in Figure 1 contains four distinct phases of technology integration set within a larger recursive system. The four phases of technology are: I. Initial Setup, II. Teacher Preparation, III. Curriculum Focus, and IV. Self-Sustaining. The system that contains and guides the four phases of technology integration was based on the systematic elements found in several instructional design models (Dick, Carey, & Carey, 2004; Morrison, Ross, & Kemp, 2001; Reiser & Dick, 1996). For example, the system begins with an analysis of needs. It then progresses through the establishment of goals, the selection of strategies to meet those goals, the development of instruction/materials, and the continuous evaluation of the model throughout. The concentric circles of the technology integration phases indicate that no phase is every fully complete. Rather, the concerns of each lower phase continue to be a concern for each higher phase, but to a lesser and lesser degree. The model has been in place at a K-5 school for one year. During that time, the mentor was able to move through the model into the third phase. The specific tasks of the mentor are contained in Figure 2, the Phase Progression Matrix. The matrix outlines the major activities of the mentor during each phase of technology integration.
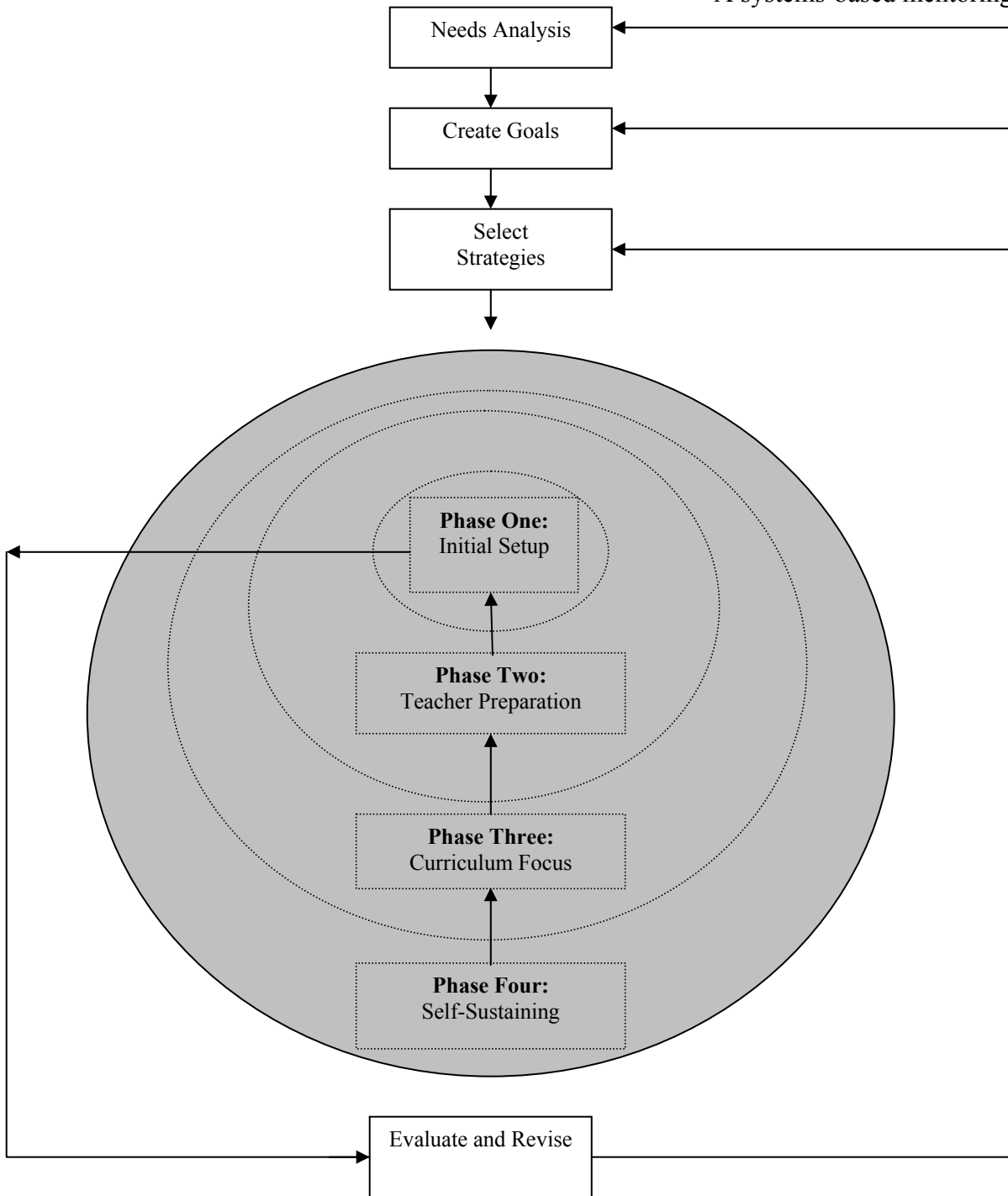
Figure 1. Systems-based mentoring model containing the four phases of technology integration.

	Mechanics	**Systems**	**Culture**	**Curriculum**
Phase One Initial Setup	Initial setup of technology and testing that technology	Develop systems that make technology use easiest for teachers and students	Work with teaches who already have a positive attitude about technology. Use them as a bridge between you and reluctant teachers.	Model simple yet effective ways of teaching with technology.
	Main Focus of the Mentor			
Phase Two Teacher Preparation	Time will be split (not always equally) between troubleshooting technology and setting up new technology.	Refine the initial systems, create new systems as the level of technology use increases.	Work with teachers that approach you for help integrating technology. Avoid 'forcing' teachers to use technology.	Begin working more heavily with teachers willing to creating lessons that use technology.
	Main Focus of the Mentor			
Phase Three Curriculum Focus	The mechanics of the technology created in earlier phases deals with troubleshooting and refining rather than creating	Evaluate, refine, and/or remove systems from earlier stages. Create new systems as technology demands increase.	Continue cultural practices adopted over the previous phases. Focus on teachers who are still reluctant to adopt the integration of technology in their lessons.	Begin to monitor and observe the use of technology. Visit classes using technology and offer suggestions for improvements during the actual classroom lesson or activity.
			Main Focus of the Mentor	
Phase Four Self Sustaining	Continue to troubleshoot and update the mechanics that are set in place	Look to improve and create new and more efficient systems	Form teacher technology leaders who will become the technology mentors for their grade level	Offer to model lessons for teachers in the classroom and continue to build up materials in digital lockers.
			Main Focus of the Mentor	

Figure 2. Phase Progression Matrix.

Method

Participants

Participants were 31 teachers at an elementary school (K-5) in the southwest who were provided with a technology mentor. Each week teachers visited a computer lab equipped with two teacher computers and 32 computers for the students. Also available to teachers were five mobile carts containing 15 wireless laptops with access to the Internet and a printer. The average class size for each teacher was 22 students. Teachers also had available to them five carts containing 15 wireless laptops. These could be signed out ahead of time and up to two

carts at a time, enough for each student in a classroom to have their own laptops computer. The computers were less than two years old at the time of the study. Teachers had a variety of software applications available, both online and on the computers, including Microsoft Office.

The teachers in the study had access to this technology the previous year, but had no mentor to support its use and their experience with learning to integrate the technology into the curriculum.

Materials

Skills Inventory. The mentor designed a Skills Inventory for determining the teachers' initial skills with technology. The Inventory was a 27-item instrument on which teachers rated themselves from one to four in a Likert-type fashion, where a one (1) represented knowing very little about using a piece of technology and a four (4) represented knowing a lot.

Teacher Interview Protocol. A six-item protocol was designed by the mentor to assess teachers' technology growth during the year they received a mentor. Questions on the protocol addressed teachers' use of computers in the classroom, frequency of use, obstacles encountered when integrating technology, and strategies used to overcome those obstacles.

Teacher Survey. A seven-item survey was designed to assess teachers' comfort with using technology after having a mentor for one year. Teachers reported on the gains in skills they experienced due to the mentor and changes in their comfort and proficiency with technology. The survey used a Likert-type scale of four levels – SD (Strongly Disagree), D (Disagree), A (Agree), and SA (Strongly Agree).

Laptop Usage Data. The use of laptop carts was tracked From September to April according to the number of times teachers elected to use the laptop carts in their classroom practices.

Process

Throughout the school year, the mentor employed the model of technology integration devoting approximately three months to each phase, completing the model into the third phase. The mentor met individually with teachers on a weekly basis and as a grade-level team once a month to plan technology-integrated activities. The mentor also engaged in modeling the use of technology with each teacher 5-10 times throughout the year. Teachers could request just-in-time support as needed throughout each school day.

Design

Qualitative and quantitative data were analyzed using descriptive statistics to determine the success of the model. The interviews were analyzed for major themes and the frequency with which those themes occurred in teachers' responses to the interview items according to the recommendations of Miles and Huberman (1984).

Results

The results for the Skills Inventory, Teacher Interview Protocol, Teacher Survey, and Laptop Usage Data are presented below.

Skills Inventory. The results of the Inventory in Table 1 indicated that the areas of most need for teachers were inserting images and photos into presentations and documents, using software to create graphs and calculate mathematics formulas, and using the online resources available throughout the district. Teachers indicated that they knew the least about using Excel to create formulas, simulations, and charts and graphs.

Teacher Interview Protocol. A total of six teachers were interviewed and the interview data was analyzed for major themes. All six teachers stated they were using computers more this year than the year before. Four of the teachers also noted that their use of technology over the past year has changed and they use it more for finding online resources now. When asked what the biggest obstacles to integrating technology were, the major themes were lack of time and lack of confidence.

Teachers were also asked how having an on-campus mentor helped them integrate computers into their teaching. All stated it was helpful to have a resource that could think of ideas for integrating technology and be able show them how to make the idea happen in an actual classroom setting. Three said it helped to have someone who could answer questions and troubleshoot problems.

Teacher Survey. Twelve teachers responded to a seven-item survey (see Table 2) regarding their comfort with technology. Ninety percent or more responded that they agreed to strongly agree with these four statements: "I can usually fix computer problems", "I can create presentations with graphics", and "I am comfortable importing digital images". Also, all 12 teachers indicated that they agreed or strongly agreed with statements about how the mentor helped them learn new technology skills and improve how they teach with technology. Table 2 shows the responses to the survey.

Laptop Usage Data. The use of carts containing laptop computers increased steadily throughout the school year, beginning with 23 uses in September (one to two carts per day) and growing to 135 uses in April (four to five carts per day). Figure 3 contains a graph of laptop use by month for the past school year.

Table 1
Results for Skills Inventory Survey (N = 31)

Technology / Software	I know very little	I know a little	I know more than a little	I know a lot about this	Total (out of 4)
Accelerated Reader					
-Enrolling students	13%	4%	35%	48%	3.17
-Producing Reports	0	9	43	48	3.39
PowerPoint					
-Create a slide	17%	9%	13%	57%	3.17
-Change font, color, etc.	13	9	13	65	3.30
-Add ClipArt	13	13	13	57	3.22
-Add digital photos	39	4	22	35	2.52
-Add images from the Web	35	13	13	39	2.56
Word					
-Change font, color, etc.	4%	4%	9%	83%	3.69
-Add digital photos	39	17	9	35	2.39
-Add images from the Web	35	17	4	43	2.56
-Use Drawing tools	9	17	26	48	3.04
Excel					
-Write formulas	57%	13%	26%	4%	1.78
-Create charts and graphs	52	17	26	4	1.83
-Create simulations	22	9	22	4	1.65
Search the Internet for resources	9%	4%	17%	70%	3.48
Outlook (send email)	0%	0%	14%	95%	3.88
Galileo (online benchmark assessment tool)	24%	24%	33%	19%	2.48
Knowledge Box (online self-contained lessons)					
-Assign Lessons	33%	24%	19%	24%	2.36
-Find a lesson	38	19	14	29	2.36
-Modify / create a lesson	33	14	29	24	2.45
UnitedStreaming Online Videos					
- Find a movie	10%	10%	33%	48%	3.19
- Download movie	19	0	38	43	3.05
- Play movie full screen	19	5	24	52	3.09
SMARTBoard					
- Making sure it is working	29%	19%	38%	14%	2.38
- Troubleshooting	43	10	43	5	2.09
- Teaching with it	29	14	52	5	2.33

Table 2
Teacher response to survey items (N = 10)

	Statements	Strongly Agree	Agree	Disagree	Strongly Disagree
1.	I can usually fix computer problems	6 (60%)	4 (40%)		
2.	I can create presentations with graphics	3 (30%)	6 (60%)	1 (10%)	
3.	I am proficient with formatting web pages	2 (20%)	5 (50%)	3 (30%)	
4.	I am comfortable importing digital images	3 (30%)	6 (60%)	1 (10%)	
5.	Because of the mentor I have learned new ways to teach with technology.	5 (50%)	5 (50%)		
6.	The mentor has helped me improve how I teach with technology.	3 (30%)	7 (70%)		
7.	I have learned new technology skills by working with the mentor.	6 (60%)	4 (40%)		
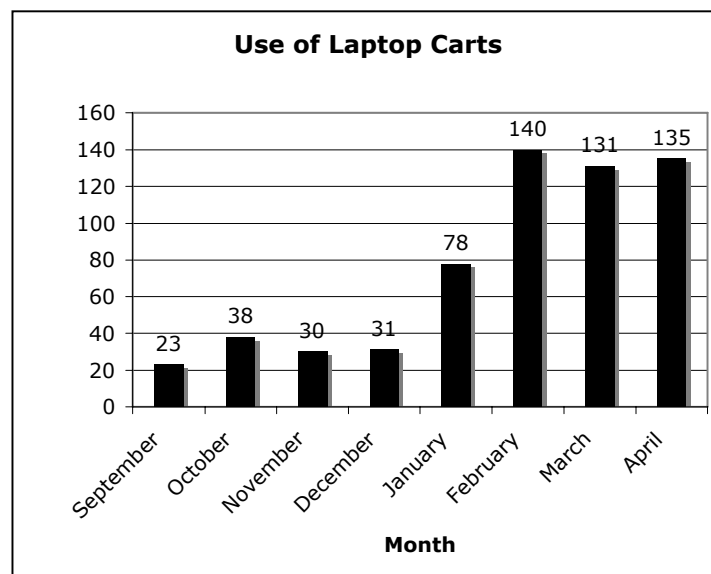
Figure 3. Laptop cart use by month.

Discussion

This paper presents the results of an initial evaluation of a self-sustaining systems-based mentoring model through the third phase of technology integration. While the data collected from teachers was limited, the results of the surveys, documentation of laptop usage, and interviews with teachers indicate that this model of technology integration resulted in an increase in teachers' use of technology in the classroom and has improved how they use technology for teaching. The mentoring component of the model is most likely the reason for these successes. Mentoring has been found to overcome many first- and second-order barriers to technology integration (Bullock, 2004; Franklin et al., 2001; Gallagher, 2000; Polselli, 2002; Ward, West, & Isaak, 2002). For example, Bullock (2004) found that teachers who received a technology mentor for 12 weeks felt less frustrated with technology and used technology more frequently over time. Franklin et al. (2001) found that K-6 teachers who learned to integrate technology with a mentor more easily overcame barriers such as finding time to integrate technology, learning to troubleshoot problems with technology, and learning to integrate technology into an actual classroom setting. Gallagher (2000) found that elementary school teachers who received classroom-based training with technology felt

more confident and integrated technology into their teaching strategies. The teachers in this study received a one-on-one mentor for the course of a year and indicated that their success using that technology in their teaching was due, in part, to the mentor.

The model appears to successfully address specific first- and second-order barriers to technology integration that prevent teachers from using technology in the classroom – particularly issues of access, support, training and knowledge. Teachers reported that the mentor helped them learn to use new technology and improve how they teach with that technology. The mentor was also noted as helping them troubleshoot technical problems and to help teachers design effective lessons that incorporate technology. This finding supports researchers who suggested that mentoring can effectively address teachers' need for both basic skills with technology as well as the pedagogy associated with teaching with technology (Ertmer, 1999, 2005; Zhao & Frank, 2003).

A surprising finding was the dramatic increase in the use of laptops throughout the course of the year. The increase coincides with the end of the phase dealing with basic skills and the beginning of the phase dealing with integrating technology into the curriculum. This supports Hew & Brush (2007), who suggested that teachers need to obtain basic skills with technology before they can begin integrating it in their curriculum. It is unclear if this increase would have occurred naturally, meaning without the use of this model. However, teachers noted that they used technology more when the mentor was present than in the previous year when the mentor was not present. It is possible that teachers' use of this technology would have improved without the mentor, but their experiences with the mentor may account for the extreme rise in technology use.

This study is limited in several ways. The study is a snapshot of teachers' experiences using technology under this model rather a before-and-after comparison. While the latter would have provided more evidence of the specific nature of the impact of the model, the former suggests that the model is effective at managing many common barriers to technology integration. Data was not collected on the barriers of time, teacher beliefs, and attitudes. It is not clear from the results whether these barriers were managed or not – more research on the model is needed to determine if the model addresses those barriers effectively. Also, the model was in the middle of the third phase at the time of this study. More time is needed to determine how teachers ultimately integrated technology into the curriculum and if they successfully developed a self-sustaining system of technology integration.

The results also do not indicate if the quality of teacher instruction increased as a result of the model – only the quantity. Teachers reported that they learned new skills and pedagogy due to the mentor, but in relation to themselves and their own growth rather than an external focus. Future research on the model should measure the quality as well as the quantity of technology use among teachers as compared to other external visions of how to integrate technology successfully. For example, teachers' actual use of technology could be compared to the vision of technology integration set by Jonassen, Howland, Marra, and Crismond (2008), who suggested that meaningful learning with technology occurs when students actively seek and organize information, construct new representations of that knowledge, and work cooperatively with peers to solve problems grounded in the context of the subject they are studying.

Conclusion

Despite the limitations of the study, the use of the model appears to have a positive impact on the use of technology among teachers – both in their technology skills and their teaching with technology. It is likely that this model would meet with success in other K-12 settings. The model employs a system, which is robust to the changing needs of teachers as they learn to integrate technology. This model systematically addresses the barriers that are unique to each given technology integration effort and designs teacher-oriented strategies for managing and overcoming the negative impact of those barriers. Such a model is a valuable tool for researchers, administrators, and teachers interested in using technology to improve the learning of students.

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The role of perceived organizational goal structure and leadership style as determinants of employees' work motivation, and intentions of innovative behaviors in the workplace

Hwasook Lee
Ewha Womans University

Abstract

This article examined the mediating role of employees' work motivation between perceived organizational goal structure and leadership styles, and intentions of innovative behavior ($N = 241$). Results indicated that learning goal structure and transformational leadership shared a latent factor. Learning goal structure and transformational leadership was related to worker's learning goal orientation, self and collective efficacy, and intentions of innovative behavior, whereas performance goal structure was only related to worker's performance goal orientation. And these work motivation partially mediated the relationships between learning goal structure and transformational leadership, and intentions of innovative behavior. The implications of these findings are discussed.

Keywords: goal structure, leadership style, goal orientations, self-efficacy, collective efficacy

Introduction

Nowadays, coping with change is essential to survive in dynamic business environment. And innovation is continuously required for the future of corporation. In this sense, it is necessary to consider human as core subjective for the sustainable growth. Therefore, it is critical to identify what motivates innovative behavior in the corporation.

Since innovation is easy to fail, however, organizational culture that positively evaluates new idea is important employees' innovative behavior (Jung, Chow, & Wu, 2003). When organization is not likely to accept innovative idea, employees hardly ever produce and implement it. For encouraging innovation, organization should emphasize continuously learning new things and challenging the status quo.

However, many corporations tend to emphasize performance rather than learning and innovation which rarely produce outcome immediately. On the contrary, the researches of innovation have usually considered only innovative organizational culture (Scott & Bruce, 1994; Jung, Chow, & Wu, 2003). Therefore it is necessary to compare with performance-oriented organization and learning-oriented organization together. For this purpose, this study explored two contradicting type of organizational goal structure and leadership style, that is learning and performance goal structure, and transactional and transformational leadership.

Furthermore, work motivation of employees is critical for innovation, as well as innovative organizational culture and leadership. Workers who has strong work motivation tend to put an effort to enhance the quality of product, choose more challengeable tasks, and persist longer when they face with obstacles (Schermerhorn, Hunt, & Osborn, 2003). In the present study, individual goal orientation and efficacy was explored as work motivation.

The present study proposed two primary objectives. First, this study examined the relationships between organizational goal structure and leadership styles, and employees' intention of innovative behavior. Second, it also explored the mediating role of work motivation between these relationships mentioned above.

Organizational Goal Structure and Individual Goal Orientation

Individual achievement goal orientation is defined the reason why people approach, engage in and respond to achievement activities (Dweck & Leggett, 1988). Two contrasting goal orientations are salient in achievement goal theory (Dweck, 1986). First of all, learning goal oriented person is willing to learn new skill or knowledge and put an a lot of effort, choose challenging tasks, persist with obstacles (Ames & Archer, 1988; Ames, 1992; Nicholls, 1984). On the other hand, performance goal oriented person tends to focus on outperforming performance to others, regard an effort as lack of ability.

This goal orientation could be influenced by situation (Ames, 1992; Ames & Archer, 1988; Button, Mathieu, and Zajac, 1996). For instance, if school or classroom emphasizes mastery of tasks and effort, students tend to pursue learning goal orientation. On the other hand, if it emphasizes competition and demonstration of ability, students tend to endorse performance goal orientation (Gutman, 2006). These environment are called goal structure by many researchers (Anderman & Midgley, 1997; Anderman & Anderman, 1998; Ames, 1992; Ames & Archer, 1988; Roeser, Midgley, & Urdan, 1996; Elliot & Dweck, 1988).

Goal structure is defined as the type of achievement goal emphasized by the prevailing practices and policies within a classroom, school, or other learning environments (Wolters, 2004). It is consisted of the task structures, the degree of authority, and evaluation/recognition (Ames, 1992). Researchers have discussed about two types of goal structure – learning goal structure and performance goal structure. Learning goal structure emphasizes improvement of ability and putting an effort to the challenging tasks. On the contrary, performance goal structure focuses on outperforming others and regards failure as the lack of ability.

Although there are a lot of researches regarding goal structure in school environment, there is hardly ever seen in corporations. In this situation, there is remarkable importance to discuss about Dragoni(2005)'s research. She proposed that leader's achievement goal orientation might affect work group climate (she divided it into three aspects – learning, performance-approach, and performance avoidance oriented culture). She also insisted that these work group climate could influence worker's goal orientations. In this sense, as teachers in schools did a key role to give a message to students whether focusing on mastery of tasks or outperforming others, leaders in companies expected to perform an critical role for organizational goal structure.

Leadership Style

There are a lot of researches about two contrasting leadership style – transactional leadership and transformational leadership(Howell & Avolio, 1993). Transactional leaders expect desirable performance to group members. If group members meet the leader's requirement, they can get rewards what they want. Further, transactional leaders tend to comment followers' work when they make a mistake. In this sense, transactional leadership focused on maintaining performance, would not encourage any innovative idea. On the contrary, transformational leaders encourage group members with enthusiasm and vision. Bass and Avolio (1994) identified four components of transformational leadership: 1) charismatic role modeling, 2) inspirational motivation, 3) intellectual stimulation, and 4) individualized consideration. Transformational leaders also emphasize autonomy in follower's work and encourage challenging the status quo (Jung & Sosik, 2002; Lim & Yoon, 1999). Consequently, they stimulate employees' innovative behavior and make them achieve higher performance than their ability. Although these leadership styles have definitely different composition, transactional leadership and transformational leadership have often coexisted in corporations. According to Howell & Avolio (1993), many transformational leaders have also used transactional leadership in real companies.

Self-Efficacy

Self-efficacy is "a belief in one's capabilities to organize and execute the courses of action required to produce given attainments" (Bandura, 1997, p. 46). In addition, individuals who have strong self-efficacy tend to put greater effort, persist longer when faced with obstacles (Pajares & Miller, 1994), choose more challenging tasks (Bandura & Schunk, 1981), adapt new technology (Hill, Smith, & Mann, 1987), and self-regulate better than others (Zimmerman, Bandura, & Martinez-Pons, 1992). Furthermore, self-efficacy predicts performance better than any other motivational construct (Ahearne, Mathieu, & Rapp, 2005; Locke, Frederick, Lee, & Bobko, 1984).

Based on social cognitive theory, self-efficacy is formed by interaction between socio-cultural context and individual. In this sense, organizational goal structure positively have an influence for individual self-efficacy. Wood & Bandura(1989) examined goal structure and self-efficacy. They set two groups, one group got a message that ability can be incremental by effort, the other group got a message that ability is fixed, not changed by effort. As a result, the former group showed stronger self-efficacy, chose more challenging goal, and used more effective strategy than the latter group. Therefore, the more organization emphasizes learning and positively recognizes failure, the more employees have strong self-efficacy.

Similarly, leadership style could have an implication for self-efficacy. Transformational leaders usually provide a model as experts, vision, intellectual stimulation, and individualized consideration with their followers. In other words, workers are vicariously experienced what they are going to do, verbally persuaded what they should do, and given positive affection for their mission from their transformational leaders. Through these processes transformational leaders encourage workers to have strong self-efficacy for their work.

In addition, individual goal orientation is also closely related to self-efficacy. VandeWalle and his colleagues (2001) found that learning goal orientation was usually associated with stronger self-efficacy, whereas performance goal orientation did not have any relationship with self-efficacy. Even when learning goal oriented person failed in his/her job, he/she would not be frustrated and even put more efforts to overcome the fault (Bell & Kozlowski, 2002).

Collective Efficacy

Whereas self-efficacy is defined as a belief of his/her own capability, collective efficacy can be defined as a belief of group's capability (Bandura, 1997). Collective efficacy has been researched in recent years because it has demonstrated a power to predict group's performance effectively in various organizations such as school,

public organization, corporation, and even online learning environment (Ahearne, Mathieu, & Rapp, 2005; Goddard, 2001; Goddard, Hoy, & Woolfolk-Hoy, 2000; Lee, Park, & Adler, 2005; Wang & Lin, 2006).

This study suggested that organizational goal structure and leadership style might affect collective efficacy. However, evidence regarding the association between goal structure and collective efficacy is rare. In this situation, Porter(2005)'s approach to team goal orientation is worth to discuss. He investigated how team goal orientation influenced backing up behavior, performance, collective efficacy, and commitment. If team members have strong learning goal orientation, they are willing to help each other, show a commitment and have a strong collective efficacy. On the contrary, when team members have strong performance goal orientation, the results were confused by their performance. Although this research has an implication for goal structure, it has a limitation not to consider leader's role in a group. According to many researchers of school or classroom goal structure, teachers play an important role to influence students' goal orientation (Ames, 1992; Ames & Archer, 1988; Gutman, 2006; Roeser et al., 1996). This process would be same in corporations. Dragoni(2005) also argued that leaders play an key role to make the group's climate and workers usually tend to meet the group's expectation. Therefore, leader's role should be considered in organizational goal structure. That's why this study transferred the classroom goal structure focusing teacher's role into corporations.

As well as goal structure, leadership style has an implication for collective efficacy. Transactional leadership emphasizes to accomplish the negotiated performance between leader and follower, whereas, transformational leadership emphasizes to pursue organizational value and vision. It motivates employees to interact with their colleagues beyond individual interest, and gives an collective identity to them (Howell & Avolio, 1993; Jung, Chow, & Wu, 2003). That is the critical difference between transactional leadership and transformational leadership (Jung & Sosik, 2002).

Innovative Behavior

Innovative behavior is defined that "taking initiative in improving current circumstances; it involves challenging the status quo rather than passively adapting present conditions" (Crant, 2000, p.436). Organizational culture that emphasizes learning positively affects organizational innovation (Bates, 2004). One of hypotheses in this study is that organizational learning goal structure might have an implication for employee's innovative behavior. Also, leadership style could have an association with innovative behavior. For instance, Jung and his colleagues (2003) found that transformational leaders motivated followers to question about assumption, and access the problem with new perspective. That is, transformational leadership positively affects worker's innovative behavior.

Besides, work motivation might be an important role to provoke innovative behavior. Learning goal oriented people are willing to learn and choose difficult tasks that make them develop their ability. They don't care about the failure. Whereas performance goal oriented people are always interested in demonstrating their ability to others (Ames & Archer, 1988; Ames, 1992; Nicholls, 1984). Therefore, employees' goal orientations affect their innovative behavior.

Second, workers' efficacy could perform a critical role for their innovative behavior. Most of the time, individual usually considers the probability of success when they think about innovative behavior (Morrison & Phelps, 1999). Efficacy is a belief for future behavior and a person who has strong self-efficacy tends to take challenging tasks. Parker, Williams, & Turner (2006) studied that people who have strong self-efficacy tend to convince themselves that they have the ability of innovation, and finally challenge the status quo.

Although individual initiate innovative behavior, he/she could not complete their innovation without colleague's help. On the other hand, employees have a conservative view and do not like change though organization drives to innovation. In this sense, it is required to consider individual innovative behavior and group innovative behavior separately.

Method

Sample

The sample consisted of 241 employees from 17 companies, Korea. Although 278 employees participated, 37 employees were excluded because they responded insincerely. Approximately same numbers of female ($n = 128$, 53.1%) and male ($n = 113$, 46.9%) employees participated in this study. Participants' age was 20s ($n = 154$, 63.9%), 30s ($n = 60$, 24.9%), 40s ($n = 11$, 4.6%), more than 50s ($n = 11$, 4.6%). Many participants worked for administration ($n = 90$, 37.3%), sales ($n = 36$, 14.9%), marketing ($n = 21$, 8.7%), research and development ($n = 28$, 11.6%), and manufacture ($n = 7$, 2.9%). Most of their positions were staff ($n = 161$, 66.8%), assistant manager ($n = 48$, 19.9%), manager ($n = 20$, 8.3%), deputy general manager ($n = 8$, 3.3%), and general manager ($n = 1$, 0.4%) were following.

Measures

In this study, all data were collected using a self-report survey. The survey was conducted from March to April, 2007. The survey consisted of three sections. The first and second section measured perceived goal structure, leadership style, individual goal orientation, self-efficacy, collective efficacy, and intentions of innovative behavior. And the last section, participants responded demographic information, including gender, age, job, position, years of work at the department and the company. Many participants had worked 'from 1 year to 5 years' ($n = 120$, 49.8%) in their company, and 'less than 1 year' ($n = 60$, 24.9%), 'from 5 years to 10 years' ($n = 44$, 18.3%), 'more than 10 years' ($n = 12$, 5.0%) were following. In addition to that, many participants had worked 'less than 1' year ($n = 111$, 46.1%) in their current department, and 'from 1 year to 5 years' ($n = 99$, 41.1%), 'from 5 years to 10 years' ($n = 19$, 7.9%), 'more than 10 years' ($n = 3$, 3.7%) were following.

In the first and second section, to avoid central tendency of answer, 6-point scales were used with 1 (strongly disagree), 2 (a little disagree), 3 (somewhat disagree), 4 (somewhat agree), 5 (a little agree), 6 (strongly agree). They are summarized below.

Organizational goal structure. These items were taken from Patterns of Adaptive Learning Survey (PALS) developed by Midgley and his colleagues (2000). Since these scales were designed to examine classroom goal structure, they should be modified to apply corporation. Items for goal structure consisted of learning and performance goal structure. Learning goal structure composed of 6 items ($\alpha = .79$), including "My leader really wants us to enjoy learning new things at work". Performance goal structure was measured with five items ($\alpha = .67$), including "My leader tells us how we are compared with other colleagues".

Leadership style. These items are adapted from Tepper and Percy (1994). They abstracted and validated items from Bass & Avolio(1990). Transformational leadership consisted of 10 items ($\alpha = .92$), including "I am ready to trust him/her to overcome any obstacle". Transactional leadership consisted of 6 items ($\alpha = .83$), including "I can get what I want if I work as agreed with him/her".

Individual goal orientation. Employees' learning and performance goal orientations were measured from Button, Mathieu, & Zajac (1996). Items for learning goal orientation ($\alpha = .81$) included "When I fail to complete a difficult task, I plan to try harder the next time I work on it. Whereas items for performance goal orientation ($\alpha = .79$) included "I prefer to do things that I can do well rather than things that I do poorly".

Self-efficacy. These scales were measured with 7 items adapted from Parker, Williams, & Turner (2006). Items included "How confident would you feel helping to set targets in your area". The reliability was $\alpha = .84$.

Collective efficacy. These items were assessed with 9 Items adapted from Lent, Schmidt, & Schmidt (2006). Items included "How confident are you that your team could reach agreement about what needs to get done at each meeting". The reliability was $\alpha = .87$.

Intentions of Innovative behavior. These items were from Scott and Bruce (1994). Although this scale was designed to measure individual innovative behavior, this study applied it to individual and group level simultaneously. Items for individual innovative behavior ($\alpha = .86$) included "I search out new technologies, processes, techniques, and/or product ideas". And Items for group innovative behavior ($\alpha = .91$) included "Our group search out new technologies, processes, techniques, and/or product ideas".

Results

Preliminary Analyses

Table 1 shows descriptive statistics and zero-order correlations among the variables. First of all, organizational learning goal structure closely related to transformational leadership ($r = .78$), and transactional leadership ($r = .72$). Transformational leadership was also closely related to transactional leadership ($r = .83$). They created a problem of multicollinearity. Theoretically, learning goal structure and transformational leadership are similar because they emphasize challenging the current status and learning new things. However, transactional leadership focused on established performance and do not allow exceptional error. So it cannot be theoretically combined with learning goal structure and transformational leadership. Therefore, to solve the problem of multicollinearity, transactional leadership was removed and learning goal structure and transformational leadership were combined with one factor.

- Table 1 is presented here -

Besides, to demonstrate the construct validity, exploratory factor analysis using principal axis factoring was conducted on learning and performance goal structure, and transformational leadership. Two factors were optimal and accounted for 46.57% of the total variance. The six items of learning goal structure and the ten items of transformational leadership loaded onto the first factor, and the five items of performance goal structure was associated with the second.

Regression Analyses

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This study examined the mediating role of individual goal orientations and efficacy among organizational goal structure, leadership style, and intentions of innovative behavior. According to Baron and Kenny (1986), to demonstrate mediated relations, there must be significant relations between (a) the predictors and the mediators, (b) the predictors and the outcomes, and (c) the mediators and the outcomes. Especially, in the third step, all of the variables should be entered into the same model and the direct effects of the predictors on the outcomes must be reduced.

For demonstrating mediated effect, this study conducted three sets of regression analyses. In the first set, it is assessed the relations between organizational goal structure and leadership style, and individual goal orientations. In the second set, it is tested individual goal orientations' mediating role between organizational goal structure and leadership style, and efficacy. In the third set, it is examined whether individual goal orientation and efficacy mediated the relations between organizational goal structure and leadership style, and intentions of innovative behavior.

Goal Structure and Leadership Style to Goal Orientations

As presented in Table 2, organizational goal structure and leadership style predicted a significant amount of variance in personal goal orientations, $F(2, 241) = 12.01$, $p < .001$. They accounted for 9% of learning goal orientation, and 4% of performance goal orientation. Employees who perceived their organization has emphasized challenging and learning new things were likely to report that they were willing to put an effort to learn new things and improve their ability. On the contrary, employees who viewed organization as emphasizing competition and performance reported that it is important for them to demonstrate their ability compared with others.

- Table 2 is presented here -

Goal Orientations between Goal Structure and Leadership Style, and Efficacy

To explore mediated effects of goal orientations between goal structure and leadership style, and efficacy, 2 step hierarchical regression analyses were conducted. The results are presented in Table 3. In the first step, goal structure and leadership style accounted for 8% of self-efficacy, $F(2, 241) = 10.15$, $p < .001$; 26% of collective efficacy, $F(2, 241) = 42.35$, $p < .001$. It is remarkably seen that a majority of variance for collective efficacy was explained by learning goal structure and transformational leadership ($\beta = .52$, $p < .001$).

- Table 3 is presented here -

In the second step, adding individual goal orientations more explained an additional 24% for self-efficacy, $F(4, 241) = 27.10$, $p < .001$; 10% for collective efficacy, $F(4, 241) = 33.79$, $p < .001$. As expected, learning goal orientation strongly predicted self-efficacy ($\beta = .51$, $p < .001$) and collective efficacy ($\beta = .34$, $p < .001$), even when other predictor was considered. In contrast, performance goal orientation did not predict self-efficacy and collective efficacy. However, learning goal orientation and transformational leadership stayed a significant predictor of self-efficacy ($\beta = .12$, $p < .05$) and collective efficacy ($\beta = .43$, $p < .001$). Therefore, personal learning goal orientation partially mediated from learning goal structure and transformational leadership to self-efficacy and collective efficacy.

Goal Orientations and Efficacy between Goal Structure and Leadership Style, and Intentions of innovative behavior

Finally, this study testified goal orientations and efficacy's mediated effects from goal structure and leadership style to intentions of innovative behavior. 3 steps of hierarchical regressions for intentions of innovative behavior were conducted. First, organizational goal structure and leadership style were entered. As presented Table 4, goal structure and leadership style accounted for 15% of intention of individual innovative behavior, $F(2, 241) = 21.19$, $p < .001$, 33% for intention of group innovative behavior, $F(2, 241) = 57.58$, $p < .001$. Learning goal structure and transformational leadership positively predicted intention of individual innovative behavior ($\beta = .38$, $p < .001$), and group innovative behavior ($\beta = .58$, $p < .001$). However, performance goal structure did not predict anyone.

- Table 4 is presented here -

In the second step, adding individual goal orientation increased the amount of variance explained by additional 13% for intention of individual innovative behavior, $F(4, 241) = 22.41$, $p < .001$, additional 3% for intention of group innovative behavior, $F(4, 241) = 32.59$, $p < .001$. When learning goal structure and transformational leadership was explained, personal learning goal orientation positively predicted intention of individual innovative behavior ($\beta = .37$, $p < .001$), and also group innovative behavior ($\beta = .18$, $p < .001$). However, personal performance goal orientation did not predict any variables. Interestingly, learning goal structure and transformational leadership predicted intention of group innovative behave more strongly than personal learning goal orientation (see Table 4).

In third step, efficacy was added into the equation. They increased the total amount of variance explained by

additional 13% for intention of individual innovative behavior, $F(6, 241) = 26.69$, $p < .001$, additional 14% for intention of group innovative behavior, $F(6, 241) = 38.29$, $p < .001$. When learning goal structure and transformational leadership, and learning goal orientation were accounted for, self-efficacy strongly predicted intention of individual innovative behavior ($\beta = .38$, $p < .001$). But, it did not predict intention of group innovative behavior. On the other hand, collective efficacy strongly predicted intention of group innovative behavior ($\beta = .44$, $p < .001$), whereas it did not predict intention of individual innovative behavior. That is, self-efficacy and collective efficacy predicted outcomes discriminately. People who have high self-efficacy were willing to take innovative behavior personally, and people who have high collective efficacy were likely to behave innovation with other colleagues.

Consequently, even when organizational goal structure and leadership were accounted for, personal learning goal orientation and efficacy positively predicted intentions of innovative behavior. In this sense, employees' work motivation partially mediated between perceived organizational goal structure and leadership style, and intentions of innovative behavior. The results are summarized in Figure 1.

- Figure 1 is presented here -

Discussion

The present study suggested that corporation that is perceived as emphasizing learning new things, challenging the status quo, and positively recognizing an error is related to learning goal orientation, self-efficacy, collective efficacy, and intentions of innovative behavior. On the other hand, organization that is perceived as emphasizing competition, demonstrating performance is not related to these desirable psychological processes. Most of all, this results suggested that goal structure theory could apply to corporations. Although goal structure research has broadly studied in school or classroom environment, it is hardly ever performed in industries. However, current researchers viewed goal orientation as not a trait, but a state that can be easily influenced by situation (Dragoni, 2005). In this sense, which goal is emphasized in organization is critical to make worker's goal orientation. Theoretical and practical implication is discussed below, as well as limitation of this study.

Organizational Goal Structure and Leadership Styles

Although these constructs have never been studied together before, they are theoretically similar. But, this study failed to identify this relationship clearly. Learning and performance goal structure classified clearly, whereas two contradicting leadership styles were closely associated with each other. One reason of this result is that many leaders have used both transactional and transformational leadership to balance the reality with the future (Howell & Avolio, 1993)

Organizational Goal Structure

This study is consistent with the research findings at schools (Gutman, 2006; Roeser, et al., 1996; Wolters, 2004). Learning goal structure was closely related to personal learning goal orientation, self and collective efficacy, and intentions of innovative behavior. On the other hand, performance goal structure is only related to individual performance orientation. This results supported Dragoni (2005)'s hypotheses.

Nowadays, companies have to compete with all over the world. Although results are critical for corporations to maintain their present, learning should be needed to prepare their future. Further, since the business environment has changed very fast, it might be unexpectedly altered. In this situation, the way driven the present results is useless to cope with these problems. Therefore, learning and innovation are getting important today's corporations.

In this sense, the strategy for learning goal structure in classroom or school might be useful in corporation. Ames (1992) suggested some strategies for learning goal structure. According to him, it is consisted of task, authority, and evaluation/recognition. First, leaders should assign task that is diverse, new, and moderately challengeable. And they also support followers to set short-term and self-referenced goal, give some tips to achieve these goals. Second, leaders should empower authority to followers. For instance, they are able to let followers participate in decision making process, or require responsible and independent attitude at work. And also leaders should check follower's progress.

Finally, for learning goal structure, leaders should consider how to evaluate or recognize followers' effort and performance. They should praise followers for their improvement and progress. In this process, leaders must comment to their followers privately, not publicly. Even if followers make a mistake when they try new things, leaders should encourage them and emphasize it could be helpful for better outcomes in the future.

Work motivation as a mediator

This study considered a mediating role of work motivation between organizational goal structure and leadership styles, and intentions of innovative behavior. First, employees who tend to improve their ability have strong self and collective efficacy. And they are willing to take an action for innovation in their workplace. However, people who focused on demonstration of ability do not have self and collective efficacy. And, of course, they were not prepared to take an action for innovation. It is consistent with previous research findings in school or classroom (Bell & Kozlowski, 2002; Porter, 2005; Roeser et al., 1996).

Second, this study confirmed again that self and collective efficacy had a stronger power to predict outcomes than any other variables (Ahearne et al., 2005; Locke, Frederick, et al., 1984; Pajares & Miller, 1994; Wood & Bandura, 1989). Even when learning goal structure and transformational leadership, and personal learning goal orientation were accounted for, self and collective efficacy strongly predicted intentions of innovative behavior. Although self-efficacy and collective efficacy was moderately correlated, they are distinguished clearly by predicting different outcomes. People who had strong self-efficacy were prepared to challenge the status quo individually, whereas those who had strong collective efficacy were willing to innovate collectively. This result also supported Wang & Newlin (2002)'s suggestion.

Limitations

Several limitations are worth to note for future research. First, the present study only focused on employees' psychological experiences using self-report data. Consequently, it did not explored how people's perceptions

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regarding organization related to real policies, systems, or practices in workplaces. They might have a great influence on organizational goal structure. Therefore, it is worth to compare objective organizational conditions with employees' perceptions in the future studies.

Second, this study did not consider participant's individual characteristics. Perception of goal structure might be affected by personal job, gender, or performance level. In the case of adolescence, academic domain, gender, ability, and year at school had an effect on perception of classroom goal structure (Anderman & Midgley, 1997). In this sense, it should be studied which factors influence perception of organizational goal structure.

Finally, this study conducted the survey only one time. Hence, it did not consider the effect of performance on individual goal orientation, efficacy, and intentions of innovative behavior. Employees' motivation is able to stronger or weaker by their performance. For instance, strong self-efficacy makes people do their tasks successfully and also this successful performance increases self-efficacy (Lindsley, Brass, & Thomas, 1995; Wood & Bandura, 1989). It is certain that success of innovation might encourage employees to keep learning and trying to innovate. That is, there are reciprocal relationships between work motivation and performance over time. In this sense, longitudinal measures are needed, including outcomes such as performance in the following research.

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<Figure & Tables>
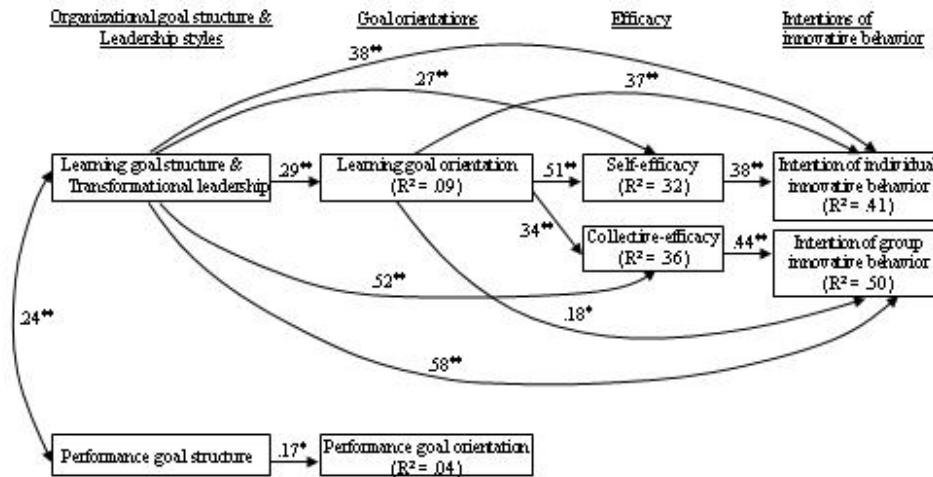
Figure 1
Results of hierarchical regression analyses. $N = 241$.
Standardized regression coefficients and R^2 s are presented.
$^*p < .05.$ $^{**}p < .001.$
※ Original Figure attached another file.

Table 1
Means, Standard Deviations, and Correlations among Variables

Variable	M	SD	1	2	3	4	5	6	7	8	9	10
Organizational goal structure												
1. Learning goal structure	4.08	.88	-									
2. Performance goal structure	3.32	.88	.20**	-								
Leadership style												
3. Transformational leadership	3.76	.90	.79**	.26**	-								
4. Transactional leadership	3.62	.98	.72**	.33**	.83**	-							
Individual goal orientation												
5. Learning goal orientation	4.56	.56	.30**	.11	.27**	.23**	-					
6. Performance goal orientation	4.35	.62	.08	.19**	.15*	.21**	.18**	-				
Efficacy												
7. Self-efficacy	4.22	.71	.32**	.10	.21**	.30**	.55**	.09	-			
8. Collective efficacy	4.15	.72	.48**	.08	.48**	.46**	.45**	.08	.59**	-		
Intentions of innovative behavior												
9. Intention of individual innovative behavior	3.60	.79	.39**	.11	.34**	.34**	.57**	.49**	.45**	.08	-	
10. Intention of group innovative behavior	3.50	.93	.56**	.12	.53**	.45**	.41**	.64**	.34**	.09	.69**	-

Note. $N = 241.$ $^*p < .05.$ $^{**}p < .001.$

Table 2
Regression Analyses Predicting Individual Goal Orientation

Independent variable	Dependent variable							
	Learning goal orientation				Performance goal orientation			
	B	SE B	β	R^2	B	SE B	β	R^2
Learning goal structure & Transformational leadership	.19	.04	.29**	.09**	.06	.05	.09	.04*
Performance goal structure	.03	.04	.04		.12	.05	.17*	

Note. $N = 241.$ $^*p < .05.$ $^{**}p < .001.$

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Table 3
Hierarchical Regression Analyses Predicting Efficacy

Independent variable	Dependent variable							
	Self-efficacy				Collective efficacy			
	B	$SE\ B$	β	R^2	B	$SE\ B$	β	R^2
Step 1								
Learning goal structure & Transformational leadership	.22	.05	.27**	.08**	.43	.05	.52**	.26**
Performance goal structure	.03	.05	.04		-.04	.05	-.05	
Step 2								
Learning goal structure & Transformational leadership	.10	.05	.12*	.32**	.35	.05	.43**	.36**
Performance goal structure	.01	.05	.02		-.04	.04	-.06	
Learning goal orientation	.64	.07	.51**		.43	.07	.34**	
Performance goal orientation	-.02	.06	-.02		-.02	.06	-.02	

Note. $N = 241$. $^*p < .05$. $^{**}p < .001$.

Table 4
Hierarchical Regression Analyses Predicting Intentions of Innovative Behavior

Independent variable	Dependent variable							
	Intention of individual innovative behavior				Intention of group innovative behavior			
	B	$SE\ B$	β	R^2	B	$SE\ B$	β	R^2
Step 1								
Learning goal structure & Transformational leadership	.35	.06	.38**	.15**	.61	.06	.58**	.33**
Performance goal structure	.02	.06	.02		-.02	.06	-.02	
Step 2								
Learning goal structure & Transformational leadership	.25	.05	.28**	.28**	.55	.06	.52**	.36**
Performance goal structure	.00	.05	.00		-.03	.06	-.03	
Learning goal orientation	.52	.08	.37**		.30	.09	.18*	
Performance goal orientation	-.03	.07	-.02		-.01	.08	-.00	
Step 3								
Learning goal structure & Transformational leadership	.17	.06	.18*	.41**	.35	.06	.33**	.50**
Performance goal structure	.00	.05	.00		-.00	.05	-.00	
Learning goal orientation	.20	.09	.14*		.01	.10	.01	
Performance goal orientation	-.02	.07	-.01		.01	.07	.01	
Self-efficacy	.43	.08	.38**		.07	.08	.05	
Collective efficacy	.12	.08	.11		.57	.08	.44**	

Note. $N = 241$. $^*p < .05$. $^{**}p < .001$.

Assessing the Use of Video Conferencing for Linking Teacher Preparation Programs with K-12 Schools

James D. Lehman and Jennifer Richardson, Purdue University

Abstract

Teacher preparation programs face many challenges including preparing future teachers to work in diverse classrooms and to effectively use technology. Video conferencing technology offers a means for teacher preparation programs to broaden opportunities for future teachers to obtain desired knowledge and skills through linkages with K-12 schools at a distance from campus. Projects at Purdue University have explored the potential of linking teacher education classes/candidates with K-12 teachers/students via video conferencing. Data collected from participating university and school faculty as well as from participating pre-service teachers suggest this approach has certain benefits but also limitations. Project results suggest that this approach may be a useful way to augment traditional field experiences in teacher preparation programs.

Introduction

University teacher preparation programs face many challenges today. Over the past two decades, a number of national reports have emphasized the need to improve teacher preparation (Carnegie Forum, 1986; Holmes Group, 1986; Levine, 2006; National Commission on Teaching and America's Future, 1996). Today, teacher preparation programs must prepare future teachers to meet national and state standards with regard to both content and pedagogy in a time of increased emphasis on performance and accountability. Colleges of education must also help pre-service teachers learn to effectively use technology (ISTE, 2002) and develop their understanding of diversity and multiculturalism (NCATE, 2001). Meeting these various standards and requirements is difficult in the best of circumstances, and it may require college of education to find new approaches to prepare prospective teachers for the classrooms of today and tomorrow.

Field experiences are a key means to better prepare teachers for the diversity and complexity of today's classrooms (Goodlad, 1990). While field experiences are generally recognized as critically important and rated as the most valuable aspect of preparation by prospective teachers, the amount of field experience in teacher preparation programs is often limited (Levine, 2006). Further, many colleges of education, particularly those in rural areas, have difficulty placing students in field settings that provide for needed experiences with, for example, diverse student populations. New technologies, such as Internet-based video conferencing, offer capabilities that might be employed to provide needed experiences for pre-service teachers when appropriate field sites are not in close proximity. To explore this potential, Purdue University initiated an innovative project in the use of technology-enabled field experiences as part of a Preparing Tomorrow's Teachers to use Technology (PT3) implementation grant (Lehman, 2003; Lehman, Richardson, Malewski, & Phillion, 2005). This project was designed to address key components of Purdue's teacher preparation program, including understanding of classrooms and diversity as well as appropriate technology integration, through video conferencing connections with K-12 schools at a distance.

Video conferencing technologies allow teacher educators and future teachers to connect in real time with distant K-12 classrooms to observe and interact with students and teachers. This can provide opportunities for future teachers to work with schools and student populations that might otherwise be unavailable for traditional field experiences. Further, the process of using this cutting-edge technology simultaneously provides a model of technology integration for pre-service teachers. In Purdue's project, different models or ways of using the technology for remote observations and virtual field experiences were explored, including short-term connections focused primarily on pre-service teacher observations of classrooms, longer-term connections in which pre-service teachers actively worked with school children, and distant supervision of student teachers by teacher education faculty members. The objective of this study was to assess participants' perceptions of the benefits and limitations of this use of video conferencing as a tool for linking the university with K-12 school sites at a distance. Participating pre-service teachers were surveyed, and participating faculty members and classroom teachers from various pilot projects were interviewed. The data, both quantitative and qualitative, were analyzed to identify perceived benefits and limitations of this approach.

Background Literature

The concept of using live video to allow pre-service teachers to observe K-12 classrooms has been around for a number of years. Closed circuit television was used for observation of classrooms in teacher education programs as far back as 1960 (c.f. Abel, 1960). In the 1980s, Iowa State University's Teachers on Television program showed that the observation skills of pre-service elementary teachers could be improved through practice that involved viewing live microwave-based video broadcasts from public school classrooms (Hoy & Merkley, 1989). While providing proof of concept, early applications of closed circuit and microwave video for observations of K-12 classrooms were expensive, difficult to set up and maintain, and typically provided only one-way video from the K-12 classroom into the university classroom.

Today's video conferencing technologies are a much more flexible, capable, and cost-effective option for observation of and interaction with school-aged learners at remote school sites. Modestly priced equipment for video conferencing over the Internet, so-called IP-based video conferencing, is now available. Using this equipment, a two-way audio and video connection can be established between any two sites, such as university classroom and a K-12 classroom or other instructional space, equipped with a local area network and relatively high speed Internet connection. Thus, video conferencing today has great potential for helping universities and schools to make real-time connections.

Recent literature concerning applications of video conferencing in education, particularly involving the linking of universities and K–12 schools, is limited. Uses of video conferencing that have been reported include virtual field trips, remote observation of teaching practicum students, teacher professional development, and what might be termed virtual field experiences for prospective teachers.

Virtual field trips involve the use of video conferencing for short-term experiences where K–12 or college students connect to a distant site to learn more about the site or engage in a planned activity (LeBlanc, 2002; Pachnowski, 2002). In Indiana, for example, K–12 schools that are part of an in-state video network are able to connect to informal education service providers such as the Indianapolis Zoo and the Indianapolis Children's Museum through two-way video conferencing to learn about exhibits and interact with educational personnel. Such uses of video conferencing allow students to experience resources at remote locations without having to travel to the locations.

Some universities have experimented with the use of video conferencing as a tool for supervising practicum students at a distance (Pemberton, Tyler-Wood, Pérez Cereijo, Rademacher, & Mortensen, 2001; Sharpe, Hu, Crawford, Gopinathan, Moo, & Wong, 2000) and for conducting teacher professional development (McDevitt, 1996; Welch & Sheridan, 2000). Although it was not initially an objective of our project at Purdue, several faculty members experimented with the use of video conferencing for observing practicum students, i.e. student teachers, at a distance. Initial pilot projects led to an internal grant from the university that funded the acquisition of additional equipment to support faculty members wishing to use the technology for remote supervision and other connections to schools.

Video conferencing can also support a form of virtual field experience in which pre-service teachers can not only observe classrooms but, thanks to the two-way audio and video, also interact with students and teachers at the school site. For example, McDevitt (1996) described the use of two-way video conferencing to allow pre-service teachers to observe professional development school sites and interact with teachers about the observed lessons. This approach gave pre-service teachers the opportunity to observe expert teachers in action and talk with them about their teaching, and it also aroused the pre-service teachers' interest in using the technology themselves. Edens (2001) discussed the advantages and limitations of using videoconferencing to link a university teacher education class to first-grade and fifth-grade classrooms for, among other things, question and answer exchanges between the pre-service teachers and the elementary students. Howland and Wedman (2003) discussed the use of videoconferencing as a way to help pre-service teachers experience various forms of diversity, including cross-cultural learning through video conferencing connections with overseas schools. Most of the initial efforts in our project explored similar uses of video conferencing technology to provide opportunities for teacher education candidates to observe and interact with K–12 students and teachers in partner school districts that included diverse, urban schools unlike those near to the campus (Lehman, Richardson, Malewski, & Phillion, 2005; O'Connor, 2003; Phillion, Johnson, & Lehman, 2003-04).

Description of the Project

This project was one part of a Preparing Tomorrow's Teachers to use Technology (PT3) implementation grant conducted from 2000 to 2004. The overarching goals of Purdue's PT3 grant were to (1) prepare pre-service teachers to demonstrate fundamental technology competencies, using technology as a tool for teaching/learning, personal productivity, communication, and reflection on their teaching, and (2) prepare teacher education faculty to teach pre-service teachers in technology-rich environments, modeling approaches that future teachers should use themselves. The project addressed its goals via several complementary components including the creation of technology-enabled field experiences through video conferencing linkages with partner K-12 schools.

For colleges of education in rural locations, like Purdue, it can be difficult to place students in field settings that provide important experiences such as interaction with diverse student populations. As one way to address this problem, the PT3 project made use of two-way video conferencing to link pre-service teachers and teacher education classes with K-12 students and teachers at distant school locations that included urban centers with diverse student populations. This pilot initiative was designed to explore models for enhancing teacher preparation through these linkages between the university and participating K-12 schools.

Two types of video conferencing were used to enable diverse field experiences for students using technology. At the outset of the project, we planned to use an intrastate fiber optic video network called Vision Athena, managed by the Center for Interactive Learning and Collaboration (http://www.cilc.org), a partner in our project. While we used that network on a limited basis to link to some of our partner schools, IP-based video conferencing equipment from Polycom (http://www.polycom.com) emerged during the early stages of the project as a better way to meet most of our needs. This technology supports good quality video and audio over the Internet, is relatively affordable, and is very flexible because a standard H.323 Internet video conferencing connection can be established between any two locations with access to a reasonably fast (128 Kbps or better) connection. IP-based video conferencing does not require special distance education rooms or video studios; connections can be established from classroom to classroom.

We used two main types of Polycom video conferencing equipment. Room-to-room video conferencing was supported by equipment such as the Viewstation SP (point-to-point) or Viewstation FX (multipoint) unit. (Today, Polycom's VSX series provides this capability.) These units have an integrated camera with panning and zooming capability that can be controlled remotely. One can be attached to any available video monitor and plugged into an Ethernet jack for Internet connectivity. Educational prices start at about $2,500 for a point-to-point unit capable of handling a classroom; two units are needed, one on each end of the connection. For person-to-person or small-group-to-small-group connectivity, we used the Polycom ViaVideo computer-based desktop video conferencing unit connected to a Windows PC. (Today's model is the Polycom PVX.) While the smaller desktop video camera is of lesser quality and lacks the panning and zooming capability of the larger Viewstation units, this inexpensive (about $400) unit provides basic person-to-person connectivity while adding the ability to share computer applications during video conferencing. For basic observations by one or two individuals, a desktop unit can be used on one end of the connection linking to a room-based unit on the other end. While the costs of these video conferencing units are not trivial, they are substantially less than video conferencing costs of just a decade or so ago, and the costs must be weighed against the savings in travel time and expense that can be realized from the use of video conferencing.

With the assistance of PT3 project staff, faculty members interested in using the equipment to connect with schools made contacts with teachers in the partner schools. Tentative plans for some sort of video connection were made between the faculty member and the participating K-12 teacher in consultation with the PT3 project staff, school officials, and technical support staff. The project provided equipment to support the activity to the remote school site. Technical support staff in Purdue's College of Education then worked with the technical support staff in the school to set up, test, and maintain the video linkage between the university and the school. The chief obstacle in establishing the connection was creating the necessary point of entry through the school's Internet firewall, which otherwise would block the use of the equipment. This typically required some reconfiguration of the school's firewall to allow the Polycom equipment to function properly.

Several ways of using the video conferencing connections to link teacher education candidates and faculty with K-12 classrooms were explored in our project. Although there were a number of variations, three

main types of interactions emerged: (1) short-term class activities, typically involving only one or two video connections, that focused mainly on having pre-service teachers observe a classroom in action and perhaps interact with the teacher about the lesson; (2) longer-term class activities, with regular video connections stretching over a period of weeks, in which pre-service teachers had the opportunity to interact with and actually teach lessons to the students in the remote classroom; and (3) remote observations of student teachers in the classroom by university faculty members.

In one example of a short-term class experience, a faculty member in consumer and family science education had her class of pre-service teachers spend a class period observing a pre-school, housed in a high school in an urban center in the state, to learn more about its operation. The pre-service teachers were able to observe the center and interact with the teacher about its operation. In another short-term experience, a faculty member in mathematics education had her mathematics education college students spend two class periods observing mathematics problem-solving activities in an elementary school classroom. Using the ability to control the camera in the classroom, the college students were able to zoom in on selected groups of elementary students to observe how they interacted with one another during the problem-solving activities.

The longest running pilot project involved multiple interactions between a class of pre-service teachers and a diverse elementary school classroom in an inner city Indiana community. Guided by the faculty member in charge of the course, a section of pre-service teachers in their first teacher education course connected to the elementary classroom once per week for about one to two hours throughout most of a semester. This activity took the place of a traditional early field experience in which the pre-service teachers would have been assigned to various classrooms for two hours of observations per week. In the video conferencing experience, the pre-service teachers initially observed the classroom remotely but gradually expanded their efforts to eventually teach lessons to the school children at a distance to complement the teacher's curriculum. This project was described in a video program produced for WHRO-TV by Soundprint Media for the *Teaching Now!* video series (available online at http://teachingnow.org/watchTV.php?id=30). The interaction between a section of the teacher education course and the elementary school was repeated over the course of several semesters.

Remote observation of practicum students, i.e. student teachers, was added in the final year of the project. Faculty members in both science education and consumer and family sciences education experimented with remote observation of student teachers as a substitute for some but not all of the normal in-person observations. The video conferencing allowed the faculty supervisors to unobtrusively observe student teachers in the classroom without having to travel to the school site.

Each of these pilot uses of video conferencing offered potential benefits, but also had drawbacks. The intent of this study was to examine participants' perceptions of the benefits and limitations of these uses of video conferencing for observations and virtual field experiences. Data from pre-service teachers, university faculty members, and classroom teachers were analyzed to identify perceived benefits and limitations of this approach.

Methods and Data Sources

Two primary sources of data were utilized in this study. First, pre-service teachers who participated in the long-term video conferencing experience, in which an introductory teacher education class connected to an elementary classroom once per week throughout most of a semester, were surveyed following their experiences. These surveys were administered to two separate groups of pre-service teacher participants (n=21 each) in each of two semesters of the project during an academic year. Surveys consisted of Likert-like and open-ended items designed to elicit candidates' perceptions of the video conferencing field experiences. Surveys were administered online, and were completed by students after they had participated in multiple video conferencing experiences with participating K-12 students and teachers. Data were compiled, including mean responses to Likert-like items and common responses to open-ended items.

Second, to gather more in-depth qualitative data, interviews were conducted near the end of the project with seven faculty members and five classroom teachers who participated in the video conferencing experiences and analyzed using a qualitative-interpretative research paradigm. Semi-structured interviews were employed to gather information about the nature of the video conferencing activities and participants'

perceptions of them. Interviews were transcribed and constant comparative analysis (Strauss & Corbin, 1990) was employed to identify common themes related to benefits and limitations of the video conferencing experiences.

Results

Pre-service Teachers

Pre-service teachers' responses to the Likert-type survey items about the video conferencing experiences are summarized in Table 1. These data suggest that the pre-service teachers who participated in this experience had relatively positive responses to it; mean responses clustered near a response of "agree." The pre-service teachers tended to agree that they were comfortable with the technology, found it easy to use, learned how to use it as a result of the experiences, and found it to be of value to the class. They also tended to agree that the experience made them more comfortable in their ability to use technology for teaching and learning and in their ability to understand and work with diverse learners. Although there were some minor differences, the pattern of responses across the two different groups was similar.

Table 1
Summary of Pre-Service Teachers' Responses to Likert-type Survey Items

Likert-type Survey Item	Group 1 Mean (n=21)	Group 2 Mean (n=21)
By the end of the class, I felt comfortable with video conferencing equipment that we used.	3.90	3.71
The video conferencing in this class was easy to use.	4.00	4.00
I learned how to use video conferencing in education from this class.	3.95	3.67
I believe that the use of video conferencing was a valuable addition to this class.	3.95	3.33
Because of the experience in this class, I feel more comfortable in my ability to use technology for teaching and learning.	3.90	3.62
Because of the experience in this class, I feel more comfortable in my ability to understand and teach diverse learners.	3.90	4.14

Note: means on scale of 5 = strongly agree, 4 = agree, 3 = undecided, 2 = disagree, 1 = strongly disagree

The pre-service teachers' comments in response to open-ended survey items provided further insight into their perceptions of the experience. One of the key advantages cited by the pre-service teachers was the ability to observe a classroom at a distance. One pre-service teacher noted, "We got to watch the students more in their element (because they couldn't see us, so they did not act as different)." Another commented, "I think it was nice to be able to watch the students without being right in the classroom. We were able to see them at the end with them practically forgetting we were there." Another pre-service teacher liked the approach because, "We did not have to all be placed in different schools, and we did not have to leave campus on a weekly basis to go to a local school. We got a chance to see a classroom without actually being there."

A second advantage cited by the pre-service teachers was learning to use the technology itself. One pre-service teacher reported, "I have learned how to use video conferencing to some degree." Another wrote, "I think that I am comfortable with using technology in the classroom." Another future teacher summed up the advantage nicely by saying, "Not only did we get to observe a classroom but we also got to learn how to use new technology to do this. I think it was very good to learn this because it most likely will be beneficial for us in the future."

A third advantage cited by the pre-service teachers related to their exposure to diversity. As one pre-service teacher reported, "I think the diversity of the class that we taught was the biggest advantage." Another pointed to, "The opportunity to get to experience a multicultural diverse classroom was a unique experience that fit nicely with our block one coursework. It was interesting to view how different their world is compared

to the world in which we grew up in." A third commented that it was an advantage, "Being able to see a very diverse classroom and how that is handled by an experienced teacher."

The limitations cited by the pre-service teachers fell into two basic areas, technical problems/limitations and not being present in the classroom. One pre-service teacher commented, "Sometimes the connection could not be completed and when it was at times it was blurry and slow." Another noted, "There were definitely disadvantages to this too. We could never fully interact with the students because you couldn't see them, hear them." A third remarked, "At times the technology didn't work and was a distraction to the students." The issue of the lack of personal presence was noted by a Purdue student who wrote, "I felt that it was a disadvantage that we were not in the classroom in person." Another put the issue succinctly saying, "There was not a personal relationship built up between us and the students because there were TVs between us."

University Faculty

Through our interviews with university faculty members who participated in these video conferencing linkages with the schools, we explored their perceptions of benefits and limitations as well. Several themes emerged from the analysis of these interviews, and many of these themes mirrored the perceptions of the teacher education students.

One of the themes that emerged from the faculty interviews as an advantage of this approach was the ability for students to see a classroom and an experienced teacher in action. Professor Keith (a pseudonym), who had her English education students observe a high school classroom, saw an advantage for her students by

Allowing them to see that real world connection… Seeing an experienced teacher actually doing some of the things that we were talking about in class as being good things to do, I think lends those strategies the credibility that sometimes, if were talking about something in class and didn't see that actually in the high school class, that they might not certainly believe that it was a good thing to do.

Professor Bates, who had her mathematics education students observe elementary school students doing problem solving, commented that it is

very very hard, almost impossible, to find elementary school classes that teach mathematics as the national curriculum reform would like… So it's a chance for them to see a real teacher and believe it could happen and then see how he/she conducted the class. Very important, they don't have many models that they have a chance to see what this might look like… And this is an excellent example actually too, not just of a classroom like that, but someone who is really really good at teaching. That, I think, was a big benefit.

Professor Jones, who integrated observations into her beginning teacher education course, commented on the insights the experience provided for her about her teacher education students and their observational skills, saying

Through sitting in one room with these students and all observing the same teacher teach, and debriefing and having discussions around that, I realized that they didn't see the same things at all that I see. Because as an experienced teacher you learn to view, for example, student-teacher interaction in a different way than someone who's seeing it from a student perspective.

Like the pre-service teachers, the faculty members also saw benefits in exposing the university students to the relatively new technology of video conferencing. Professor McDonald, who required his students in a beginning teacher education course to observe a middle school classroom, identified learning about technology as one of his goals, saying, "I wanted to get my students to experience the technology, and get them to think critically about how they would use it in their programs as a teacher." This exposure to technology benefited not just the students but some of the faculty members themselves. Professor Jones, who also used the video conferencing in a beginning teacher education course, commented,

I'm not into technology. I don't use much technology. So one of the objectives was to bring myself a little more into the world of technology. It's also part of the mandate for [the course] that students will be exposed to exemplary uses of technology, and that students will see or model use of technology, and that they'll learn about technology that they could use with their students. So that's one of the reasons I wanted to do it.

Use of the equipment itself afforded certain advantages. Professor Grant used the technology to observe student teachers at a distance. She commented

It's really kind of neat, because you could adjust the camera to scan the whole room, actually zoom right in to what the high school students were preparing. Very different in the sense that I could zoom in, see what's going on, and not be distracting to them. Whereas if I was there in person, I would've had to get up and walk away from where I was sitting, to see what they are doing.

She also commented on her own use of the technology, noting

The equipment was really much easier to use, that's a part of my skepticism because I was not familiar with it. But you know, really a low level of background, I had a low level of background, and it didn't matter. I was able to learn what I needed very easily.

Professor Hawkins also used the technology for remote student teacher supervision. He reported

I feel the most beneficial was the ability to make extra visits without driving over there, and I think to observe in another way was beneficial. I also liked the fact that I could, you know, I would dial in before school started, we could talk, or if the kids were there for special, I could talk to the teacher.

Exposure to diversity was another important theme identified by several of the faculty members. Professor Evans used video conferencing in the context of a teacher education class on multiculturalism in education. He remarked, "Purdue students do not have much exposure to the types of diversity that I value. That will be race, class, gender types of differences. I found it beneficial they connected with students, to have some exposures to those issues." He went on to observe

They began to see how the reading, the theoretical stuff they are doing in multicultural education, applies to school. They see a curriculum of a teacher working in a multicultural, multilingual school and multilingual classroom. They can actually see the things they read about laid out in the teacher's classroom.

Professor Jones, whose beginning teacher education course shared a field experience with the multiculturalism course, found that connecting to a classroom in an urban, diverse school gave her teacher education students some much-needed perspective on the students in such schools. She explained

The opportunity to have my students interact with children different than children they had grown up with was something that I decided would be very valuable for them. The opportunity to work with teachers who are committed to working with these kids. These teachers are absolutely awesome teachers who work with all sorts of children (ESL, bilingual, low SES), and they treat them like they're not deficient. My students think they come from single parent or poor families, whatever, and are going to have these deficits. And actually they think that this would impede their learning. They start to observe a classroom like that, and teach these students over the Internet, and start to realize that these children are not deficient; they're bright. One of my students said to me, "I don't know how am I going to be able to teach kids like this; they're just so smart."

The faculty members also saw benefits of the project for other participants. Professor Grant found the teachers she worked with to be open to this new approach, saying "All three teachers were very willing to try something new, even though they had not done this type of videoconferencing. They were all aware and knew it was out there." Professor Jones saw benefits for the teacher she worked with, noting, "There are benefits for the teachers too. [The teacher I worked with] is using this for National Board Certification, she won a Crystal Apple Award here, she won best teacher… I'm not saying it's just this that just did that, but it's part of a recognition that she's a really great teacher who's trying things." Professor Jones also felt that the school children benefited from their interaction with Purdue students. She explained,

I think it's good for the kids… They don't have maybe anyone in their family who has gone to college or even talked about college. And suddenly they're talking to college kids on a weekly basis, and they say things like "What do you guys eat?" My students will say "We eat pizza and hamburgers." "Oh, you can eat pizza and hamburgers at college?"… I don't know what they think a university is, but it's somewhat demystified. Maybe I'm Pollyannish, but I think that all those connections count. I remember one student saying that no one in her family had gone to college, and one day she came on a field trip to

Purdue, and then that changed her whole life. She realized that university wasn't what she thought. I'm hoping that some of those kids can think that maybe I can go to college too. And they just love, they call them, their Purdue friends, buddies. They love just being connected to university students.

Although the faculty members saw a number of clear benefits of the video conferencing linkages, they also recognized problems and limitations. The technology, while generally working fairly well, did have problems. Professor Keith noted, "The control of the camera was a little awkward." She also observed, "I think [the pre-service teachers] found the quality of the video interaction a little bit more bothersome than what I did. I don't think they were sure of what the real purpose of it was to be honest." Professor Hawkins commented on the poor connection to one site, saying, "It was disappointing at the elementary because, in many instances, the teacher had to unplug their email. There is only one plug, so they had to unplug their computer, plug in the Polycom. It was slow, and it wasn't a good picture. Sometimes, you couldn't tell who was the teacher, who was student teacher." Professor Jones said, "I thought the technology would be better than what it was. There were quite a few problems." She continued, "The imperfection of the technology, and the fact that they're not in a real classroom is a problem. You're looking at the kids in the Internet, on a TV screen. That is not the same as being right there where you can see every nuance of their facial expression."

Nearly all of the faculty members cited logistical problems and the work involved in conducting virtual sessions as a limitation. Professor Keith observed, "It was really hard to schedule because of time." Professor McDonald echoed this concern, saying, "Schedules create a big barrier." Professor Grant said,

I think another surprising aspect to me is that it does take a lot of coordination, a lot practices, a lot layers when I started creating it, all those pieces facilitating success. There really is team effort. I'm not sure that surprised me, but it certainly, it really like does take several people working together to make this happen.

Professor Jones commented, "I think it is too labor intensive to do this kind of project. It takes a huge amount of time." All agreed that technology support was crucial for success. Professor Grant said, "The key factor… is good technical support." Professor McDonald stated, "If I hadn't had the technical support, I would have been discouraged from doing it. The technical support are really people who deserve the congratulations for a job well done. It wouldn't have happened without them."

Despite the limitations, the overall sense among most of the faculty participants was fairly positive. Professor Keith said, "I really don't think there was anything bad about it. It was just I needed to work more in terms of my curriculum… If I would have to do it again I'd like to more fully integrate it into my course plan." Professor Evans commented, "The response overall is supportive. They really like the experience of connecting with [the school site]." Professor Jones captured these mixed sentiments, noting

At the end [the pre-service teachers] would be fairly happy with what they've accomplished and what they've done, but they also indicate some regret around not having been in a regular classroom… So it's a continuum of responses from "I don't like this technology thing, I wish I'd been in a real classroom" to "This was fantastic, I'd like to try this in my class" and kind of anything between the two depending on the students. Overall, it had to be positive enough for me to continue doing this.

K-12 Teachers

A sample of the participating K-12 teachers was also interviewed about the benefits and limitations of the video conferencing approach. As a group, they had less to say than the pre-service teachers and university faculty members. However, their comments echo many of the themes reported previously.

The teachers were generally positive about their experiences. One teacher remarked, "Me and the class all enjoyed it. Overall it was a very positive… The questioning and answering was good." Another teacher reported, "It was very positive experience. Had virtual tour. Did question and answer… It was fascinating process to use technology in that way. I think it's a positive experience for us all." She continued on to say, "First of all, I guess I was a little skeptical about how the technology would work. The technology worked more successfully than I thought. The college students were well-prepared and had questions. It worked better than I thought."

Several comments from the teachers supported the diversity theme mentioned by both the pre-service teachers and university faculty members. One of the teachers commented

> I think it's a valuable tool for multicultural classes. Instead of just talking about it in class, they can go where these children live. Students should go to culturally diverse classes so that they can become more sympathetic and understanding of these children.

Another expressed similar feeling by saying

> I teach in a culturally diverse school. By connecting to Purdue, the college students can see different things than they can in the schools of Lafayette area. We celebrate our diversity. We see it as our strength. It's an advantage to use media to see such diversity. College students can gain some insights of the diverse classroom.

The limitations cited by the teachers included the technical problems cited by other groups. One teacher commented, "Some technical glitches were a bit frustrating, but not much." Another noted that "When the screen was pixelating, or with the whole group setting, the attention did waver." A few of the teachers expressed initial discomfort at having their classrooms opened to observations. One of the teachers explained, "At first I was a bit nervous, because I didn't want to be judged. I've been teaching 20 years, and it feels a bit uncomfortable when suddenly many students are watching you." Finally, for some of the teachers, there was little benefit for participating in the experience. One teacher said, "I think it was beneficial for the Purdue students, but not really for us." Another echoed this comment, saying, "Happy to do it. But no particular advantages for my class to do that."

Conclusions and Implications

This study examined the benefits and limitations of the use of video conferencing as a tool for linking teacher educators and pre-service teachers with K-12 teachers and students at a distance. Different models for making connections between one university's teacher education program and participating K-12 schools were explored. Pre-service teachers, university faculty members, and participating K-12 teachers shared their perceptions of this innovative project.

There was agreement across the groups of participants that this use of video conferencing offered certain benefits. Among the most compelling benefit was the ability to expose pre-service teachers to examples of classroom diversity that might otherwise be difficult or impossible for them to experience. University faculty, classroom teachers, and pre-service teachers themselves all agreed that the ability to observe and interact with diverse classrooms was a positive outcome of the project. For colleges of education located in rural areas, such as Purdue, video conferencing offers one means to allow pre-service teachers, who themselves are often from rural and homogenous communities, to have experience with and so come to better understand the diversity that increasingly characterizes America's classrooms. This understanding is a first step toward learning how to teach in culturally responsive ways (Gay, 2000; Ladson-Billings, 2001).

These video conferencing linkages also provided pre-service teachers with examples of classroom practice that they might not otherwise get a chance to observe. Theyhad the opportunity to observe expert teachers in action, and they had the opportunity to observe specific kinds of classrooms and classroom activities (e.g., diverse and multilingual classroom, reform-oriented mathematics problem-solving, in-school child care facility) that often are unavailable near the university. While recorded video of such settings might suffice in some circumstances, the live video connection offered interactivity and hence a dynamism that recorded video lacks. As Professor Jones commented in her interview, "Some people say 'Why not just tape the teacher and show it to everyone?'. That's not it. Passively watching a tape is not the point. It's to be part of the experience… Without that interactive element, it would be something I wouldn't have used at all."

Of course, this approach also helped the pre-service teachers, as well as the faculty and teachers, learn about and use a cutting-edge technology. Technology integration and use, after all, was the central focus of the PT3 initiative in which this project took place. Through the project, the pre-service teachers began to see the technology as a tool that could be used for teaching and their own and others' learning. As the cost of video conferencing equipment continues to decline, and as network capacity expands, it is likely that this technology will become much more widespread in the future. Thus, by exposing prospective teachers to the technology today, we plant the seeds for what may be more and more effective use in the schools of the future.

Despite these benefits, there are clear limitations that must be weighed when considering any potential implementation of this approach. The technology itself, while pretty good, is far from perfect. All three groups of participants cited technical difficulties that ranged from a complete failure to connect on some occasions to pixelation (video break-up) and slowed transmission to the inability to clearly see and hear participants on the far end of the connection. These problems can limit, sometimes severely, the utility of video conferencing as a tool for real-time communication between universities and schools. However, as Professor Bates observed, "The equipment is awkward. The technology is awkward. But, it's going to get better." We can expect the technical problems to diminish as the technology itself matures.

Other limitations, however, are likely to continue to be issues. For the pre-service teachers, the video conferencing experiences lacked some of the authenticity of an actual field experience. The physical distance also created some psychological distance, such that it was difficult for the university students to create relationships with the K-12 students. As the one pre-service teacher so aptly put it, "there were TVs between us."

For the university faculty members and school teachers, the time and effort involved in working out the logistics of making video conferencing connections was an issue. Schedules had to be aligned, class activities planned, and communication techniques practiced. This added a significant extra burden to their preparations, and this occurred despite the fact that during the project PT3 and IT staff members assisted in working out the logistics of the connections. Without this added support, it would be very difficult for faculty members and teachers to work out video conferencing connections on their own.

Finally, an important issue for the teachers and schools is the benefit of being involved in this sort of activity. Two of the teachers interviewed after the project felt that the project was worthwhile for the teacher education students but not particularly of value to themselves or their students. This may not have been true in every case. Professor Jones reported that she felt there were benefits both for the teacher and for the K-12 school children with whom her class worked. However, it probably is true that these experiences are of more benefit to the pre-service teachers than to the other participants. Therefore, universities must consider how best to craft such experiences so that mutual benefits accrue to the K-12 teachers and students.

This study suggests that technology-enabled field experiences may be a viable option for some types of student observations and for interactions between teacher education candidates and K-12 students and teachers. Video conferencing over the Internet is a new tool that expands the options available to teacher preparation programs to help future teachers develop their knowledge and skills. If the limitations of this approach are acknowledged and appropriate steps are taken to minimize the shortcomings, this approach may give teacher education program more flexibility in addressing the field experience needs of their pre-service teachers.

When we consider all factors these virtual field experiences seem to be a worthwhile way to expose pre-service teachers to experiences they might not otherwise get. Our teacher education program has at its core emphases on early and continued field experiences, on developing technological skills, and on understanding diverse learners. Virtual field experiences through video conferencing offer promise as a way to expand the options for linking pre-service teachers with K-12 teachers and students. While we do not advocate replacing traditional field experiences with virtual field experiences, these experiences do offer a way to augment the experiences of prospective teachers in university teacher preparation programs.

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The Current Status and Future Prospects
of Corporate e-Learning in Korea

Cheolil Lim, Hyeonmi Hong, Eunkyoung Yeon
Seoul National University

The corporate e-learning in Korea has grown rapidly over the previous six years (2000-2005). This study argues that the main cause of this heightened interest in corporate e-learning in Korea was not that companies needed to provide high-quality training programs through the Internet but that the government took initiative to transform the state into an information-based society. The policies for quantitative growth with minimum levels of quality and uniformity have been dominant and have resulted in the lack of diverse e-learning types for authentic practices in workplaces. This paper suggests that in order to cope with the new competency requirements of employees, corporate e-learning should be guided both by governmental support and by company initiative.

Keywords: Corporate e-Learning, Korea

I. Introduction

Open and distance learning in Korea had not been fully implemented and discussed prior to 2000. Until then, since 1972, systematic formal education for adult learners who did not have the opportunities to enter more traditional colleges had only been provided at such a *mega* university as Korean National Open University (KNOU). Traditional, face-to-face education had been the dominant mode of teaching, while distance learning made up only a small portion of the Korean educational system. However, nine cyber universities, which were established in 2001, and the new Internet correspondence training policy for corporate e-learning by the Ministry of Labor in 1999 initiated profound changes in the Korean educational system (Lim, 2003). Now many Korean adult learners can pursue an education through the various learning technologies of distance learning. Online college courses are delivered via printed material, radio, television, MP3, PMP (portable multimedia player), and the Internet. Also, at present, distance corporate training programs are delivered by mail and online as e-learning.

The unprecedented growth of corporate e-learning in Korea has been a major feature of distance learning since 2000. The Ministry of Labor reported that the growth rate of Internet correspondence training participants was 6,281% over the past six years (19,653 in 1999 and 1,254,066 in 2005) (Ministry of Commerce et al., 2006). While this astronomical figure can be explained in many ways (Lee, 2006) with positive results, its negative effects on corporate e-learning and distance learning have also been noted.

This study intends to discuss the causes and effects of the rapid growth, as well as explore directions for future research and practice with regard to corporate e-learning in Korea. To determine the current issues, the study focuses on the significant developments implemented by a government-funded research center, the Korean Research Institute for Vocational Education & Training (KRIVET), over the past six years (2000~2005). KRIVET impact on the development of corporate e-learning can hardly be overstated (Lee, 2006). The causes of those developments and various resulting problems are examined in this paper. Finally, based upon this analysis, future directions are suggested.

II. Current developments in corporate e-learning in Korea: 2000 – 2005

Corporate e-learning in Korea developed in earnest following the implementation of a new government policy in 1999 on Internet correspondence training. Since then, the development of the field can be measured in five ways: *rapid quantitative growth, government initiatives, dominance of the tutorial mode, quality assurance, and high adoption rate among large corporations*. These will be discussed in turn.

Rapid quantitative growth

One of the salient features of corporate e-learning in Korea over the past years has been its rapid quantitative growth. In Table 1, it may be observed that the number of employees who participated in the Internet correspondence training program or e-learning greatly increased from 19,653 in 1999 to 1,254,066 in 2005 (approximately 63.8 times more). In 1999, only 2.5% of the total number of trainees participated in the Internet correspondence training. But in 2005, that ratio increased up to nearly half of the total number of trainees (46.4%) in 2005.

<Table 1> Number of Trainees Supported by Employment Insurance Act(1999 -2005)

Year	Internet-Based		Postal-Based		Classroom-Based		Total		Internet Training Rate (A/B*100)
	Trainees (A)	Increase rate	Trainees	Increase rate	Trainees	Increase rate	Trainees (B)	Increase rate	
1999	19,653	-	85,055	-	676,700	-	781,408	-	2.5%
2000	137,712	600.7%	161,825	90.3%	920,797	36.1%	1,220,334	56.2	11.3%
2001	406,159	194.9%	199,242	23.1%	950,001	3.2%	1,555,402	27.5	26.1%
2002	543,320	33.8%	197,045	-1.1%	843,958	-11.%2	1,584,823	1.9	34.3%
2003	629,930	15.9%	193,570	-1.8%	838,478	0.7%	1,661,978	4.9	37.9%
2004	929,771	47.6%	283,338	46.4%	790,354	-5.7%	2,003,463	20.6	46.4%
2005 *	1,254,066	34.9%	339,645	19.9%	1,171,630	48.2%	2,705,341	35.0	46.4%

Source: Ministry of Commerce et al. (2006). *E-learning White Paper 2005-2006.*
 * The number of trainees in 2005 is projected on the data from the Ministry of Labor in Oct. 2005.

The high growth was due to the expansion of the *Employment Insurance Act*, which earmarked financial support for e-learning programs. The law allowed the Ministry of Labor to begin in 1999 providing institutional support. Thus, the number of corporations and workers that participated in e-learning increased rapidly over the previous 5-6 years. Moreover, corporations took advantage of e-learning, giving more employees access to educational opportunities at relatively low cost. The large corporations quickly adopted the e-learning systems and invested money to develop programs.

The rapid growth of corporate e-learning in Korea can be also attributed to an increase in theoretical studies on corporate e-learning. One of the leading journals on corporate training in Korea is the *Journal of Corporate Education*. This academic journal published its first volume in 1998 in the area of training methods, focusing especially on the applications of different technologies and programs. Not surprisingly, the journal has discussed e-learning with regular frequency since 1999. Of the 13 volumes of the journal, 26 of 79 articles (33%) have dealt directly with the subject of corporate e-learning. Considering the plethora of educational methods and issues in corporate training that could be discussed, devoting over 30% of the journal articles to e-learning is doubtlessly a testament to the rapid quantitative growth of the field as well as the high level of theoretical interest it has garnered in Korea.

Government initiatives on corporate e-learning

The Korean government, especially the Ministry of Labor, has played a significant role in developing the field of corporate e-learning. In accordance with the government's strategic plan hatched in the mid-1990s to transform the country into a knowledge-based information society, the Ministry of Labor has been the primary driving force behind the implementation of e-learning for corporate training since 1998. That year the Ministry of Labor initiated a pilot project that tested e-learning based training courses, a project which led to the conclusion that correspondence training should include both Internet correspondence training and postal correspondence training and resulted in expansions the following year. This decision caused both corporate e-learning and distance learning for adults to grow rapidly in Korea in 2000 (Table 1). Furthermore, as alluded to previously, the Ministry of Labor established a special division, the *e-Learning Center* at KRIVET, to monitor the quality standards of the e-learning institutes and of the Internet correspondence training program as well as to establish a new support system and make recommendations.

In addition to these early initiatives of the Ministry of Labor, subsequent measures and policies have also been effected since 2000 to boost corporate e-learning (Lee, 2006). In order to support corporate e-learning on a long-term basis, the Ministry of Labor and the e-Learning Center at KRIVET developed the *Corporate E-Learning Mid-Period Development Plan, 2004 -2008*, which proposed strategies covering various aspects of e-learning such as servicing and maintenance of the system, infrastructure construction, cultivation of human resources, standardization, and quality control. Recently, Internet correspondence training regulations have also been revised to incorporate 'blended learning' and a scaled training fee structure, based on an analysis of the quality of the e-learning institutes. Lastly, the worker's tuition support system has been modified as well so that individual workers can receive financial support when they register independently for e-learning programs.

Dominance of tutorial e-learning

Most corporate e-learning courses in Korea are in tutorial format in which major points are supplemented with elaborations and examples ('Intro' and 'Lesson' in Figure 1) followed by practice problems ('Activity' in Figure 1). Various design strategies have been applied—for example, Keller's ARCS (Attention, Relevance, Confidence, Satisfaction) model has been adopted to enhance effectiveness and for animated presentations advanced technologies such as Flash have become standard authoring tools.

[Figure 1] An example of e-Learning: Tutorial type

Table 2 shows that nearly 90% of all e-learning content in 2005 were tutorials in either *HTML*[1] or *Lecture-on-Demand* (LOD) format. The remaining 10% were simulations that honed technical skills. As these two types—tutorials and simulations—became so ubiquitous over the past three years in the field of corporate e-learning, the government's *Employment Insurance Fund* eventually dropped support for other types of e-learning programs.

<Table 2> e-Learning Program Proportion by Types from 2003 to 2005
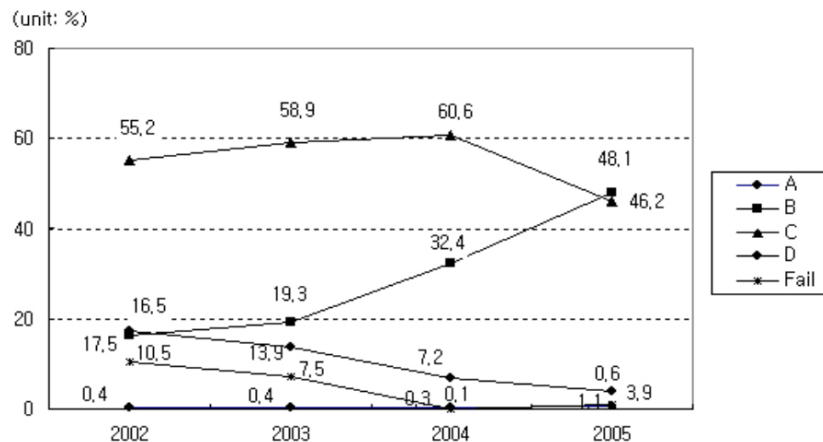
Types		2003		2004		2005	
		Self developing	Outsourcing	Self developing	Outsourcing	Self developing	Outsourcing
Tutorial	HTML	545 (88.0)	1,086 (79.3)	738 (88.0)	1,005 (68.6)	742 (79.7)	1,082 (80.8)
	LOD	26 (4.2)	212 (15.5)	33 (3.9)	315 (21.5)	83 (8.9)	138 (10.3)
Simulation		48 (7.8)	72 (5.3)	68 (8.1)	146 (10.0)	106 (11.4)	119 (8.9)
Total		619 (100.0%)	1,370 (100.0%)	839 (100.0%)	1,466 (100.0%)	931 (100.0%)	1,339 (100.0%)

Source: Lee, S. et al. (2006). *Evaluation of Internet Correspondence Training Institutes, Year 2005.* Seoul: KRIVET

Quality assurance

The government, the Ministry of Labor in particular, has tried to assure e-learning quality over the previous few years. In 2002, the e-Learning Center at KRIVET launched an assessment system to judge the appropriateness of Internet correspondence training programs. All e-learning programs supported by the *Employment Insurance Fund* were required to be evaluated by the Center. As seen in Figure 2, the B level grew annually from 16.5% in 2002 to 48.1% in 2005, demonstrating that instructional design and content quality were indeed improved. Conversely, the proportion of D and F level steadily decreased from 27.5% in 2002 to 5% in 2005. The quality of the e-learning programs was successfully improved by implementing the assessment system.

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[1] HTML in this Table refers to Web-based instruction, in which text, graphics, and some animated objects are displayed in HTML format. LOD(Lecture-on-Demand) refers a type of e-Learning in which lectures by an instructor are recorded and delivered through the Internet at learner's convenience.

[Figure 2] e-Learning Program Assessment Results(2002 – 2005)
Source: Ministry of Commerce et al. (2006). *E-Learning White Paper 2005- 2006.*

High adoption rate in large companies

Participation in corporate e-learning programs has not been evenly distributed across the corporate sector. The employees of larger corporations comprise the largest proportion of Internet correspondence training system participants. Table 3 shows that in 2004 just 8% of training participants from the assembly line in small and medium companies participated in Internet correspondence training programs, while nearly 30% of those from large companies did so.

<Table 3> The Proportion of Training Types for Assembly Line Workers by Company Size

(Unit: number, person)

Company Size	Classroom Training		Internet Training		Postal Training		Small & Medium Company Consortium		Field training		Total	
	Programs	Trainees	Programs	Trainees	Programs	Trainees	Programs	Trainees	Programs	Trainees	Programs	Trainees
Small and Medium	1,847 (71.3%)	14,432 (63.27%)	432 (16.8%)	1,877 (8.2%)	300 (11.6%)	6,386 (28%)	3 (0.1%)	22 (0.1%)	8 (0.3%)	90 (0.4%)	2,590	22,807
Large	4,561 (69.4%)	68,565 (58.5%)	1,145 (17.4%)	34,294 (29.2%)	865 (13.2%)	14,401 (12.3%)	1 (0.02%)	1 (0%)	4 (0.1%)	6 (0%)	6,576	117,267

Source: Ministry of Labor, *Unemployment insurance DB,* 2004.

Table 4 further shows that the implementation ratio decreases significantly in relation to smaller company size. In small companies (less than 50 employees), only 10.3% of workers participated, whereas 52.4% of employees did so in large companies (140-299 employees) (Jang & Yoo, 2006).

<Table 4> e-Learning Program Proportion Change by Company size in 2006

Category		Company size			total	difference
		Less than 50 Workers	50 Workers to Less than 149 Workers	150 Workers to Less than 299 Workers		
e-Learning Program	Yes	8 (10.3)	15 (24.6)	22 (52.4)	45 (24.9)	x^2=23.938 $p<.01$
	No	70 (89.7)	46 (75.4)	20 (47.6)	136 (75.10)	
total		78 (100.0)	61 (100.0)	42 (100.0)	181 (100.0)	

Source: Jang, M. H., & Yoo, S. J. (2006). E-Learning Needs Analysis for the Employees of Medium and Small Companies. *Journal of Vocational Education & Training, 9(3),* 175-202.

The Internet correspondence training system appears at first glance to provide broader access to educational opportunities in Korea. It seems to put training within reach of those employees who would not otherwise have such an opportunity. However, in realty, it fails to achieve that goal. Assembly line workers and those employed by small- or medium-sized companies have not received equal opportunities for the Internet correspondence training.

III. Issues in corporate e-learning in Korea

Although there have been great developments in corporate e-learning in Korea over the past six years, there remain certain key problems in the field: *moderate quality, uniformity and controlled growth, limited evaluation criteria, and unevenly distributed adoption rates*.

Moderate quality of corporate e-learning

The quality of corporate e-learning has become an issue that has only been compounded by the rapid growth rate. As mentioned, since the 1999 introduction of e-learning in Korea two formats have emerged as preeminent: one is LOD(Lecture-on-demand) in which the presentation of a lecturer is recorded in motion picture, and the other is Web-based instruction in which text, graphic, and some animated objects are displayed on Web pages as the learners click to progress. LOD has become a dominant format because not only it was easy and relatively cheap to develop but it also conformed to expectations of what training should be (i.e. *lecture delivery at learners' convenience*). A small percentage of e-learning was developed as web-based instruction and most of this type were just copies of printed materials without learners' active participation. These problems were partially remedied when the new assessment system was introduced in 2001. As Table 5 illustrates, growth stalled in 2002 (the number of total institutes decreased from 110 to 93) with the introduction of governmental regulations, of which the assessment system was a key provision. The system succeeded in upgrading the quality of tutorial-type e-learning programs at the expense of other formats. The quality issue will be discussed in more detail in the latter portion of the *quality assurance* section.

<Table 5> Number and Increasing rate of Corporate e-Learning Institutes in Korea(2001 – 2005)

Year	Self-developing		Outsourcing		Total	
	Institutes	Increasing rate	Institutes	Increasing rate	Institutes	Increasing rate
2001	56	-	54	-	110	-
2002	57	1.8%	36	-50.0%	93	-18.3%
2003	55	-3.6%	33	-9.1%	88	-5.7%
2004	53	-3.8%	55	40.0%	108	18.5%
2005	68	22.1%	80	31.3%	148	37.0%

Source: Ministry of Commerce et al. (2006). *E-learning White Paper 2005-2006.*
Notes: 1. If a company provides both intra-company and outsourcing programs, it will be estimated as outsourcing training.
2. The number of companies conducting more than one training per year.

Uniformity and controlled growth

The government initiative on corporate e-learning in Korea has yielded unexpected results. Although it stimulated the quantitative increase of corporate e-learning programs in a short period of time, one mode of e-learning, tutorial, dominated the e-learning landscape. While the *Evaluation System for Contents and Design Quality of e-Learning* by the e-Learning Center (Table 7) succeeded in upgrading the basic quality of the tutorials, it failed to encourage the development of diverse modes of e-learning programs beyond simple tutorials, and also neglected to support new ideas and studies to help e-learners become self-regulated or self-directed(Lim, 2005). Many e-learners did not successfully complete the e-learning programs in which they had enrolled; they dropped off early on or midway through because they were not self-motivated.

Although tutorial is an effective instructional type for certain objectives, it cannot support some essential objectives and activities, including teaching problem-solving skills, creative thinking skills, and self-directed learning. Yet these are the very skills and experience expected of workers in Korea's knowledge-based society. However, corporate e-learning in Korea currently has not successfully promoted different e-learning models such as Problem-Based Learning, Goal-Based Scenario, and Case-Based Learning (Kang et al., 2006).

In addition, the government, by virtue of their initiative, regulated the growth of e-learning in a way that stifled spontaneous innovation. Most companies assumed a passive role in designing and developing other types of e-learning. The rapid growth of e-learning was achieved without autonomous efforts from the corporate sector. For instance, the possibility of integrating e-learning with the knowledge management system in a company (Rosenberg, 2001) or with long-term blended learning strategies has not been systematically examined, in spite of the high demand.

On the other hand, some alternative designs have been explored from a theoretical standpoint. *The Journal of Corporate Education* in Korea has treated many topics related to *course design*, and secondly, to *learner support* and *cost issues* when those articles from the journal were analyzed by an analytical framework of Rha and Han (2002)[2](Table 6). As this journal mainly focuses on the educational methods in corporate training, especially from the perspective of *educational technology*, this is not an unexpected result. The course design topics covered in the articles included 'strategies for learning motivation in e-learning,' 'design strategies for Goal-Based Scenarios,' 'blended learning strategies', and 'A design model for e-learning.' On the other hand, as e-learning is relatively new to adult workers, learner support issues have been widely discussed. The issue of cost has also been examined because the corporate sector has been particularly interested in determining whether e-learning is cost-effective.

<Table 6> The Topics of e-Learning Studies in Korea (1998 -2006)

Topics	Frequency	Ratio
Course Design	11	42.3%
Learner support	6	23.1%
Cost	4	15.4%
Learner participation	3	11.5%
Learning Contents	1	3.8%
Other	1	3.8%
Total	26	100.0%

Note: The articles from *the Journal of Corporate Education* in Korea were selected for examination

In addition to the *Journal of Corporate Education* other academic journals and periodicals have also discussed topics related to e-learning design. *The Journal of Educational Technology* in Korea, for example, has dealt with issues of corporate e-learning from the perspective of educational technology, notably, issues such as tutoring (Cho & Lee, 2004) and supporting self-regulation (Lim, 2005) have been areas of recent focus.

Limited evaluation criteria

It can be argued that the current perception of quality of corporate e-learning can be attributed to the narrow and ambiguous evaluation criteria. Table 7 shows the current evaluation criteria for e-learning programs. It consists of five dimensions: *instructional design, interaction, evaluation, instructional support design, and technology*. Whereas the dimensions and the sub-criteria do cover important quality aspects of e-learning programs, some problems still exist. First, they focus too narrowly on evaluating the tutorial type of e-learning, virtually assuming that the tutorial format is the only one to assess; other types of e-learning programs such as Case-Based Learning or simulation have not been easily evaluated under these criteria. Second, they do not provide specific guidelines for each criterion. The criteria were ambiguous and judgment could vary depending on the evaluator. More specific guidelines in a rubric format should be developed to make the evaluation more objective and effective for future e-learning programs.

<Table 7> The Evaluation Criteria for e-Learning Programs

Dimensions	Criteria
Instruction Design	Content presentation strategy and method relevancy
	Suitability for supplementary & advanced learning resources
Interaction	Appropriateness of learner-instructor interaction
	Appropriateness of learner-learner interaction
	Appropriateness of learner- contents interaction

[2] The framework suggests *course design, learner support, cost, learner participation, and learning contents* as the major components of e-Learning. *Course design* includes 'the systematic use of instructional strategies', 'the flexible design and change of course', 'active interaction'. *Learner support* deals with 'easy admission and graduation', 'counseling system', and 'stable infra structure and technology'. *Cost* involves such areas as 'low tuition fee' and 'cost-effectiveness'. *Learner participation* examines 'learner involvement', 'learner satisfaction', and 'free choice of course'. Finally, learning contents deals with 'interesting content', 'easiness to accessing information', and 'usefulness of content'.

	Appropriateness of learner-program manager interaction
Evaluation	Appropriateness of method
Instructional Support Design	Appropriateness of help function
	Connectivity of navigation (Interface)
Technology	Technical stability

Source: e-Learning Center in KRIVET (2006)

Unevenly distributed adoption rates

As noted previously, the implementation of corporate e-learning in Korea has mostly been confined to larger companies. Employees of small- and medium-sized companies have not yet fully experienced e-learning programs. To overcome this shortfall, the Ministry of Labor's worker's tuition support system has been recently revised to provide financial support for these underserved workers (Lee, 2006). Further consideration in terms of more access to Internet correspondence training system is needed in order to improve corporate e-learning in Korea.

From a theoretical vantage point, selected studies in the *Journal of Vocational Education & Training* by KRIVET have discussed the issue of supporting medium and small companies, such as by beginning with an e-learning needs analysis of these companies (Jang & Yoo, 2006) and an assessment of e-learning course selection criteria (Kwon, Lee, Rha, & Lim., 2006). These studies were mainly conducted to come up with political implications for the future of e-learning implementations at the national level.

IV. Conclusions: Future directions and prospects

The current development of corporate e-learning in Korea was examined in terms of five aspects: *Rapid quantitative growth, government initiative, dominance of the tutorial mode, quality assurance,* and *high adoption rate among large corporations*. Each one of these also has a corresponding weakness: Rapid quantitative growth has meant that quality has at best been moderate. Government initiative has fueled complacency as companies have hesitated to develop their own e-learning programs for specific purposes such as problem-solving or creative thinking skills. The dominance of the tutorial mode has kept other types of e-learning from being actively designed and implemented. Quality assurance measures have used evaluation criteria so narrow and ambiguous that other types of e-learning contents could not be easily evaluated and the evaluation was susceptible to subjective influence. And finally, the *high adoption rate among large corporations* has translated into workers of small and medium companies not having equal opportunities.

Nevertheless, corporate e-learning does seem to have had a great impact on the recent development of life-long education and distance education in Korea. While the ratio of participants in life-long education in Korea has been relatively low among OECD countries (OECD, 2000), corporate e-learning has played an important role in increasing the rate of participation rate in a short period of time. This increase was mainly due to the government initiative to transform the state into an information-based society where all the aspects of government, including education and training systems, rely on information infrastructure and environments. The Ministry of Labor was no exception, and it took advantage of the *Employment Insurance Fund* to achieve its goal for contributing to the information-based society. Companies were permitted to ask for government subsidy as long as they provided e-learning programs for their employees. Implemented in 2000, this allowance had a significant effect on the growth of corporate e-learning.

In this respect, corporate e-learning in Korea has a unique distinctive. The main impetus for its rapid growth has not been that companies needed to provide high-quality training programs to more workers but that the government took initiative to transform the nation into an information-based society. Most e-learning programs were tutorials that could be made easily, and their common objectives were for acquiring knowledge or understanding content(Lee et. al., 2006). Companies wanted to ensure that employees could do their work competitively or show competency in new areas. They did not want any more workers who just understand basic, factual knowledge. However, competency-related e-learning or performance-based e-learning has not been fully examined yet.

Corporate e-learning can be improved in two ways. First, it should be dynamic rather than static, serving the new requirements of companies and employees. If it remains confined to traditional modes of education or schooling where understanding knowledge can be acceptable as an educational goal, it will be criticized and eventually phased out. It should be responsive to demands for new skills, competencies, or performance, training objectives that can improve employee effectiveness and efficiency. Therefore, the current government e-learning initiative should be changed into one that is directed by both *government* and *companies*, one in which companies play an active, executive role and have a vested interest. Each company should be encouraged to develop and implement advanced and authentic programs autonomously, programs such as an e-learning version of Problem-

Based Learning or Case-Based Learning (Kang & Oh, 2006). And the evaluation criteria should become more inclusive and go beyond examining the components of the tutorial. It should stimulate new trials and developments of corporate e-learning programs.

Second, corporate e-learning is a kind of distance learning. Theoretically this provides more possibility to help adult learners access education and training opportunities. Corporate e-learning can provide training to employees who might otherwise never have had the opportunity to train because of their time and space constraints. The initial implementation of corporate e-learning was geared toward large corporations such as Samsung, LG, and SK. These were relatively eager to adopt the program because they considered e-learning to be cost-effective and to provide more training for their employees(Jang & Yoo, 2006). Yet small- and mid-sized companies were not able to offer these programs due to financial constraints. Moreover, they did not recognize the value of e-learning for their workers. To solve this inequality problem, the government should play a key role in encouraging the implementation of e-learning. The Bureau of Small- and Mid-Sized Companies in the Ministry of Labor must come up with effective strategies to mitigate the imbalance, while the consortium of affected companies should take ownership of implementing e-learning. And, government and companies should collaborate to provide leadership aimed at providing opportunities for the disadvantaged employees of these companies.

As mentioned, the unequal access to e-learning should be acknowledged and countermeasures to provide more equal opportunities should be devised, especially for employees for whom e-Learning is relatively new (Piskurich, 2003; Lim, 2005). Considering their schooling experience that focused on passive learning, it is easier to see how it may be difficult for such employees to manage their independent learning, or exercise appropriate self-direction or self–regulation(Lim, 2005) in learning. Providing facilitator intervention or even a new learning management system to encourage and support learner's self-regulation systematically are steps that could mitigate the problems. This issue in terms of supporting learner's self-direction or self–regulation should be studied and examined in further research.

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A Qualitative Study of Collaborative Learning in a Wikibook project: Implications for Design and Implementation

Hong Lin, Ph.D.
Oklahoma State University

Kathleen D. Kelsey, Ph.D.
Oklahoma State University

Abstract

Wikis, when used as an open editing tool, can have profound and subtle effects on students' collaborative learning processes. Do students feel comfortable editing each others' wiki articles? How are collaborative learning outcomes impacted when students communicate using wikis? This study addressed these issues using qualitative methods, including multiple semi-structured interviews and student reflective journals for analysis. The findings challenge idealistic hypotheses that wiki work, without careful design and implementation, is naturally beneficial. It was also found that collaborative writing and learning were the exception rather than the norm among participants. It is recommended that instructors provide highly supportive learning experiences to teach students how to use wikis and how to work collaboratively when implementing wikis to maximize the benefits of this emerging tool.

Introduction

Wikis have been lauded in the literature as being an ideal tool for collaborative learning because learners are able to write, edit, version, and discuss next to the content. According to Holmes, et al. (2001) theory of communal constructivism, wikis can be used to move learners toward a state of *communal constructivism*, where students and teachers are not simply engaged in developing their own information but actively involved in creating knowledge that will benefit others, hence, constructing knowledge for the community, not just the self.

Given the promise of wikis for open editing and collaborative learning, the question remains: do students take full advantage of the collaborative features inherent in wikis, which are not available in e-mail and discussion boards? Many authors have discussed the functionality of wikis (Dèsilets, Paquet, & Vinson, 2005; Fuchs-Kittowski & Köhler, 2005; Schaffert, et al. 2006); however, little explicit attention has been paid to the human interactions surrounding students' use of the collaborative features of wikis to maximize learning outcomes. How do students interact, communicate, and collaborate to achieve learning goals in wikis?

This study addressed the need for empirical evidence regarding student interactions when working collaboratively in a wiki by qualitatively exploring the evolving phases of using wikis to complete class assignments. The purpose of this study was to investigate 1) how students communicated in wikis, 2) students experiences in writing and editing collaboratively in an open writing environment, and 3) if students learned collaboratively.

Review of the Literature

Computer-Mediated Collaborative Learning

Brandon and Hollingshead (1999, p. 54) defined collaborative learning as "an activity that is undertaken by equal partners who work jointly on the same problem rather than on different components of the problem." Moallem (2003, p. 84) stated that "While learning is ultimately an individual enterprise, the support of a group with a common learning objective can produce a synergistic facilitation of learning by

each member of that group." Similarly, Holmes, et al. (2001, p. 1) considered that collaborative learning was "an approach to learning in which students not only construct their own knowledge as a result of interaction with their environment but are also actively engaged in the process of constructing knowledge for their learning community." A meta-analysis (Johnson, Johnson, & Smith, 1991) of the comparative effects of collaborative learning and individual learning concluded that college students improved their higher order thinking skills such as reasoning, idea generation and solutions, more in a collaborative environment than working solo.

With the increased use of the Internet in educational settings, computer-mediated collaborative learning has attracted much attention. Computer-mediated collaborative learning takes advantages of Internet resources and online communication tools (e.g., discussion board, e-mail, conferencing systems, videoconferencing, and chat rooms) to facilitate communication and collaboration. In such environments, students can access sufficient and just-in-time resources, reorganize their thinking, present new forms of knowledge, and be exposed to multiple views from groups (Uribe, Klein, & Sullivan, 2003).

Empirical studies that have investigated the effectiveness of computer-mediated collaborative learning in classrooms have proliferated in the literature. A meta-analysis (Lou, Abramin, & d'Apollonia, 2001) study examined 122 studies and found that small groups learning with technology outperformed individuals learning with technology. In addition, researchers examined whether certain instructional methods worked effectively in a computer-mediated environment. Johnson and Chung (1999), Mergendoller et al. (2000), and Uribe, Klein, and Sullivan (2003) found that computer-mediated environments were not only suitable for project-based learning but also contributed to higher order learning. Similarly, Jonassen, Prevish, Christy, and Stavrulaki (1999) and Murphy and Collins (1997) investigated whether using case studies in a collaborative environment helped learning transfer from a face-to-face environment to computer-mediated environment. Their results support the hypothesis that case studies work well in a computer-mediated environment and enhance higher order learning.

The social dimensions of learning at a distance have also been investigated and were found to be vital to learning, and yet often the missing element in distance education courses (Berge, 1999; Moore & Kearsley, 1995; Spitzer, 2001). These authors argued that if online interaction is not an integrated and expected component of online learning, students probably will not use the available communication tools.

In general, research has provided evidence that a computer-mediated environment supports collaborative learning and enhances learning outcomes. Along these lines, educators place greater expectations on the potential role of wikis as a recent computer-mediated communication tool to enhance collaborative learning in education than the research can support.

Pedagogical Claims of Wikis

Wikis have been credited with increasing democracy within groups by focusing on the community rather than the individual, thus, increasing students' skills in collaborative work (Holmes, et al., 2001). Collaboration is considered beneficial because learners must consider multiple perspectives, can rely on each other to reduce uncertainty during complicated activities, and increases participation in the learning activity. By using wikis, students' learning is extended over time, across collective environments and people, and through open-natured projects that create public goods (Ciffolilli, 2003). Wikis have the potential to maximize writing, reflecting, reviewing, and witnessing cumulative results (Fountain, 2005; Hammond, 2005). Fuchs-Kittowski and Köhler (2005, p. 2) reported that wikis support "cooperative community knowledge generation" by allowing users to create and maintain a "community knowledge base, offering a quick, simple way to produce and review information that can be gathered and linked to other wiki pages."

While researchers and educators laud the use of wikis for supporting collaborative and inquiry-based learning (Engstrom & Jewett, 2005), improving critical thinking skills, and "empowerment of the individual in terms of life-long learning" (Freeman, Holmes & Tangney, 2001, p. 1271), little empirical research has been conducted to test the pedagogical promise of wikis (Edwards, 2002; Freeman, Holmes & Tangney, 2001; Hammond, 2002). The majority of the literature surrounding the use of wikis in

educational settings is based on "speculative and aspirational stances rather than strong theoretical or empirical grounds" (Edwards, 2002, p. 1).

Applications of Wiki in Classrooms

Engstrom and Jewett (2005) studied 400 students with 11 teachers who used wikis for an inquiry-based project in a professional development teacher-preparation program. They found that students posted and edited insufficiently in their small research groups, which primarily reflected surface-level learning in the inquiry process and that the teachers did not model or facilitate an exchange of ideas, questions, or provide feedback to students required to build wiki pages. The study suggested that project developers model the wiki practice that prompts interaction, critical thinking, and thinking from multiple perspectives. Wang et al. (2005) investigated students' editing behavior and their performance in wiki. They explored the effects of students' frequency of editing usage in wikis on their final exam performance and found that students with low usage on the wiki performed better than those with high wiki usage on the final exam.

Other studies investigated factors such as online environment and anonymous writing that affected effective collaboration. Bold (2006) incorporated wiki in a Master's online courses to support collaboration. Although the study did not survey students on wiki use specifically, it investigated whether the use of wiki facilitated online interaction. The study indicated that wiki put students in charge of jointly posting, editing, reporting, maintaining work without burdening individual students as project coordination. In this manner, students reported that the use of wiki increased their sense of connection in the online setting. Chong & Yamamote (2006) investigated a group of 20 people who had not met prior to the study, yet felt comfortable in exchanging ideas in a wikis writing project. Their study suggested that anonymous writing gave students' a private space, therefore, collaboration between strangers could facilitate independent thinking, clear understanding of the team members, thus contributed to high quality outputs.

Hewitt and Peters (2006) asked their 15 students to construct wiki pages on an array of topics in a graduate-level distance education course. They found that the students considered building a knowledge base in a wiki project was not only an authentic task for themselves but also a value-added activity to future classes. Coutinho and Bottentuit (2007) asked 16 students in a Master's program to build an enormous collaborative repository that could help future students with their dissertation. Their findings were inclusive. On the one hand, students enjoyed working with they group. On the other hand, they did not think team work has a better quality or helped them learn more than if they worked by themselves. Similarly, Plowman (2007) provided his students with a wiki environment where they built a social justice forum. Through the very interactive forum, the participants went through the circle of construction – deconstruction – reconstruction several times so that their knowledge building experience was not linear. In contrast, Blank, et al. (2004) reported students' territorial needs prevented true collaborative work in a wiki environment.

These studies lay the groundwork for this study, which addressed the gap in the literature regarding how students communicated, whether communication affected their wiki writing, and whether the potential of wikis – effective collaborative learning – had been achieved.

Methodology

Context of the Study

The study was situated in a graduate level course about adult education, offered at a major land-grant university in the mid-west. The instructor built the shell for a wikibook using Mediawiki® software (www.mediawiki.org) and posted it online, purposefully public and accessible.

Students (*n*=5) were required to write four articles using wiki as the writing and presentation tool. Students were to work individually on two chapters, collaboratively on two chapters, and were asked to edit another student's article for the fifth assignment. In addition, students were given a detailed rubric for completing the assignments along with face-to-face instruction about the project. Students could create a

chapter under the instructor-defined headings or create a new article. Moreover, the teams were assigned by the instructor to increase heterogeneity in regard to culture, age, and discipline. The instructor met with student teams weekly to access progress and cohesiveness of the team.

Instrumentation

An original semi-structured interview protocol was created and reviewed by three researchers. Interview questions were developed based on Holmes et al. (2001) theory of communal constructivism.

Data Collection

Data were collected from four sources: the contents of the wiki, student interviews, students' weekly reflective journals, and meeting notes taken by the researchers in the classroom. Specifically, a total of eight interviews were conducted face-to-face, three of which were team interviews after two collaborative wiki articles were completed. The rest of the interviews were conducted one-on-one after students submitted their individually created wiki articles and finished the edits of one wiki article created by others. In addition, meeting notes taken by the instructor and the researchers as well as students' reflective journaling of their learning experiences were also part of the data set and were analyzed qualitatively.

Validity, Reliability and Objectivity

To ensure the reliability and accuracy of the findings, the researchers followed Lincoln and Guba's (1985) framework of trustworthiness. Internal validity was achieved by insuring congruence between the findings and reality. A synthesis of each interview was prepared and sent to all the participants for content verification (member checking the data). In addition, multiple interviews were conducted and served to verify previous statements (triangulation). External validity was achieved by transferability of research findings to other situations. Thick (detailed) description of structures and processes were revealed by the data and articulated for adaptation (audit trials).

Reliability, or replication of research findings is not a goal of qualitative studies, but detailed field notes and memos were maintained throughout the process and serve as an audit trial to verify findings. In addition, students' reflective journals were collected and analyzed for triangulation purposes. Objectivity was achieved by creating a research team (course instructor and external interviewer and researcher) for peer examinations purposes. Data management and transcribing process were carefully maintained. Interviews were transcribed verbatim, and write-ups of process notes and interview summaries were documented and verified by the research team.

<center>Results</center>

Phase 1: Exploration (A Crisis of Authority)

Communication. The participants indicated that using an open editing tool such as wiki was difficult at the beginning of the project because it challenged their notions of group work. The primary difficulty involved ineffective communication within the group such as not knowing what to communicate to each other, frequency of communication, or how to use the wiki discussion board to communicate with. Participants 1 noted, (Excerpt 1) "the first chapter was chaotic. We had the technology problems because things wouldn't get posted in time, and because we didn't know how to post it. We had to view the discussion board and there was a lack of communication because we weren't all on the same page." Participant 2 said (Excerpt 2) "at first it was hard to get it right. I didn't know how to write [in the wiki]."

A lack of communication resulted in students doing separate work for a supposedly collaborative project. Participant 1 said (Excerpt 3) "for the first group project, our group didn't communicate as much as we should have. When we got together, we just showed everybody our work." Participant 6 said (Excerpt 4) "I can just do the chapter on Word, but to put it in the wiki format. It took a while for me to know [how

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to use the wiki]." Thus, students created work individually, then put their writing together at the end of the project rather than the idealized co-writing that leads to improved critical thinking.

Writing. When asked about the impact of writing in the wiki in terms of increasing learning outcomes participant 1 said (Excerpt 5), "when developing this chapter, I'm not sure I learned a lot. It was mostly compiling all the information we had learned over the semester into a practical and useable format." When asked if they felt comfortable about changing and editing other students' work, all the participants were unanimous. They all said "not really" after the first project was completed. Participant 3 said (Excerpt 6) "I don't know if I would like to change another person's work. I could do some editing, but I would want to go over things with them first. I figure that I should go to the individual person quietly first [before editing]." When asked further what made them uncomfortable, participant 1 stated, (Excerpt 7) "because it's their work, because it's their tasks, and you've been taught to work on your own work. And it's hard to kick that habit."

The participants' comments indicate that they were hesitant in editing others' articles when the project began. The discomfort resulted from a feeling of a lack of ownership in the article and they needed time to explore feelings prior to editing, indicating a *crisis of authority in co-creating a joint article*. Students saw the assignment as pieces of a pie to be delegated and reassembled after the fact, rather than a whole pie in which they would all take credit for.

Collaboration Compared with first generation web tools such as e-mail and discussion boards, wikis are considered superior second generation web-based social tools because of the increased capacity for collaborative work. Collaboration; however, did not occur in the first phase of the project where students were asked to co-write an article in wiki. Rather, students divided the assignment into smaller parts, completed their part, and cut and paste the article together after it was written individually. The wiki was used as a presentation tool rather than as a writing tool and the results were awkward at best. Participant 1 said (Excerpt 8), "at first, I didn't really want to use wiki. It really intimidated me, and so I did everything outside of it and just cut and paste [my finished article into wiki]. Participant 6 notes that (Excerpt 9) "you can feel the rough transition between each part [because it was created as separate pieces and merged at the end]. There's not a good flow in the chapter."

None of the students had used a wiki prior to this assignment. During the early phase of the assignment the participants had difficulty communicating with each other in a timely manner. The participants also felt high anxiety and uncertainty about authorship issues and feared editing their classmate's work, even when they knew it was unacceptable. The students felt territorial about their work and respected the boundaries of other's work when presenting their content in the wiki. The wiki was not used as a collaborative writing tool. These findings do not support the literature that wiki encourages team writing and editing.

Phase 2: Adaptation (A Crisis of Relationship)

Communication After the first wiki article was submitted and the work was found to be of poor quality, the instructor provided more guided instruction on how to co-write in wiki, including using the discussion board for communication. New teams were established and a new article was required. Participants began to communicate with their team members more effectively. The discussion board feature in wiki was adopted by the teams as well as face-to-face meetings. Participant 1 stated that appropriate communication with the discussion board in wiki increased her comfort level with her peers. She said (Excerpt 10) "I think that not being familiar with what to do was really what came at the beginning, not being comfortable. Once we used the discussion board on wiki to communicate, we all got on the same page. I think basically my comfort level [with using wiki] made a big difference." Participant 6 described how communication took place in her group and how it affected the relationship among team members (Excerpt 11). "We had to be sure that we had at least two meetings for the team. First of all, we had to work well with each other. It's their timing and my timing. It's like any group project, how to fit and how to work well with the team to get a good product."

The first article gave students experience in working in teams and working in wiki. The second article allowed students to practice communication skills, both face-to-face and using the wiki discussion board. It is argued that such communication helped enhance the relationships among the team members. The improved communication positively affected students' writing quality.

Writing Students moved from experiencing high anxiety and uncertainty in the first article to improved communication and relationships in the second article. Participant 2 explained, (Excerpt 12) "at first it was hard to get it. As I've gotten better at it, I like it more."

When asked about territorial boundaries when using the wiki as a collaborative writing tool, participant 1 said (Excerpt 13) "if I changed a whole bunch [of text on the article], I posted something about it on discussion board. If they didn't like it, they could change it. It didn't matter really." Participant 1 continued to explain (Excerpt 14), "I think you are more inclined to edit everybody's work on the wikis. It's just there on the screen so I think the project would be a little bit better quality when it was in the wiki [because of open editing]." Participant 6 described the pleasant connection when seeing wiki projects when searching Google. She said (Excerpt 15), "now, when I go to any search on Google and find wikis, I feel that is something I know. So it is nice for me. It is always nice to know more." A better writing experience with wiki emerged during the second article assignment due to increased skill in using wiki and more explicit expectations regarding the quality of the articles.

Collaboration. Participants continued to test and adjusted their relationship with their peers when working on the second article. In this manner, they became more familiar with using wiki and the collaborative writing process. They reported an improved experience with communication, writing, and collaboration. Participant 4 said (Excerpt 16), "the first time, I had a hard time. After that I got some information from my team members, I learned and I started to like [using wiki]." Participant 1 said (Excerpt 17) "not understanding the wiki, we wanted to get everything situated before we posted it. I guess it's just the mentality that when you post it on there and that's the final product, so you get it done. As we've learned more about wikis, we're able to do everything in wikis." These comments indicate that when communication channels open, writing is less stressful as collaboration was improved by knowing how to use wiki more effectively.

Phase 3: Collaboration (A Resolution of Crisis)

Communication. During the course of the semester students were asked to write four wiki articles, two solo and two in teams. The researchers documented that the participants' communication moved from minimal, either via e-mail or discussion board on wiki to maximum communication via the wiki discussion board and face-to-face meetings. Once students learned how to use the wiki, how to edit and co-write, and how to communicate with each other more effectively they enjoyed using the wiki to complete the course assignments. Participant 4 said (Excerpt 18), "we don't spend all the time talking, but totally collaborative writing. We can exchange our writing through e-mail or via wiki. We have talked a lot on the discussion board about what we are going to do, what our views are, and what categories we want to write our stuff in. I think that's collaborative."

Participants 6 and 5 compared communicating via the discussion board in wikis with e-mail and Blackboard® discussion board. Participant 6 said (Excerpt 19), "we used the discussion board in wiki, it was like we are online and we can do it faster than email." Participant 5 said (Excerpt 20), "comparing with wiki, Blackboard®, the course management system, just has the discussion function. It's just like talking in class. You can't really go back and change your answers. With wikis, however, you can keep adding to it."

As identified by the participants, communicating with the discussion board on wiki became not only an addition to face-to-face meetings, but also an integral part to the group assignments.

Writing As a result of smoother communications, participants resolved the crisis of authorship and relationship, which was observed in the initial phases. Two participants summarized their writing experience from the first project to the last. Participant 6 said (Excerpt 21), "after doing 5 chapters in Wiki, I'm confident to add and write [in wikis]." Participant 3 said (Excerpt 22), "With the first article, it really

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intimidated me so I did everything outside of it and just cut and paste. The second article I got more in the wiki and started typing in the actual wiki. I did a lot more in the third article. So it was just a matter of getting comfortable using the system, a big thing that I think affects whether you like it or not. I've enjoyed it as I've learned more."

At the end of the course participants were asked if they felt comfortable editing others' work. Participant 1 said (Excerpt 23), "editing has become interesting to do. Editing someone else's work was not hard in the wiki. I didn't feel it was another's work; it was just a web page that I felt I could add something to." The participants indicated that they felt confident about writing and editing in wiki. To this end, wiki helped them gain a deeper understanding of the article topic.

Collaboration Given the promise of wikis for open editing and collaborative learning, the researchers continued to investigate whether the students took full advantage of the wiki to learn personally and collaboratively. Participant 3 said (Excerpt 24), "I think that it's really better than in class because it actually forces you to choose a research topic. I think I learned a lot better because you are actually forced to go out there and search for materials and then by letting your classmates know via wikis." Participant 6 compared the unique collaborating experience in wiki with other tools such as encyclopedias. She said (Excerpt 25), "the idea of cooperation in wiki allows everybody else to read it online, and they are welcome to edit it. No other encyclopedias have this feature."

Two participants pointed out that group collaboration helped generate ideas and enhance creativity. In addition, it was mentioned that different viewpoints and backgrounds were beneficial for the learning. Participant 1 said (Excerpt 26), "in the group you're going to have more ideas because you have more people, different viewpoints, and different backgrounds. I think I tend to be less creative working on a project individually. I don't spend as much time generating ideas. I just go with what I know." Participant 5 said (Excerpt 27) "I thought it was great to see people from different backgrounds. It added new ideas."

The results suggest that using wiki as a collaborative tool became more productive and constructive for the participants over time as they learned how to use wiki and the elements of a high quality article. The findings enrich discussions in the literature that wikis can be used to move learners toward a state of communal constructivism, where participants are not simply engaged in developing their own information but actively involved in creating knowledge that will benefit others (Holmes, et al., 2001). If the initial phases of using wiki as a collaborative tool are underrepresented in the literature, the last phase began to unearth the promise of writing in an open environment constructively.

Discussions

This study reported that when writing and editing wiki articles collaboratively, students experienced a crisis of authority and feared editing their peer's work, even when the same grade was assigned to every member of the team, regardless of individual effort. This situation was especially evident during the initial phase of creating and editing a wiki article.

At first, the participants were not comfortable communicating and writing in wiki. In particular, they felt uncomfortable editing their peers' articles in that they believed their peers had devoted a tremendous amount of time and effort on a particular topic while they did not. They experienced a crisis of authority. They indicated that until they did their own reading and became very familiar with the material, they should not edit other's work to ensure individual accountability of their editing. As indicated by the students, this crisis of authority in the first phase directly resulted from not knowing the functionality of the wiki tools and a lacking of effective communication among team members. Not surprisingly, little collaboration occurred in phase 1; adjustment was dominant.

In the second phase, as the participants overcame the functionality of wiki, communication increased. Free editing behavior increased but it was not common. In fact, the participants were not comfortable editing their peers' articles before they knew their team members' working styles, reaction to interdependence, and attitudes on territorial limits. They experienced a crisis of relationship. In this phase, communication was improved, collaborative writing in wikis was visible, and collaborative learning emerged.

In the third phase, once trust and rapport were established within the student teams, the frequency of communication and co-writing increased. Positive interdependence occurred rapidly. Students experienced a resolution of crisis. Furthermore, the participants indicated that they usually would consult with the original author of the wiki chapters to ensure that the changes were pertinent and value-added, add a crisis of negotiation. At this phase, they positively viewed writing in wikis as pair-share, peer-teaching, and peer-collaboration, which aligns with the promise that wikis hold for enhancing collaborative learning.

In summary, students' communication and writing changed over the life of the course. The idealistic hypotheses that wiki work is naturally beneficial and contributes to collaborative learning did not occur. Instead, students worked through the crisis of authority and relationship, to resolution through negotiation. Such changes were influenced by their estimation of territorial boundaries and interpersonal interactions while working in small teams. The following session reflects on the design and implementation practices of using wikis in this course.

<div align="center">Implications for Design and Implementation</div>

Wikis are a new computer-mediated communication tool that holds much promise for collaborative writing projects in the educational setting. Even though students may have been exposed to other tools such as email, blogs, course management systems, and e-portfolio, we found that they experienced a steep learning curve and did work effectively on the first wiki article assignment. The learning curve included technical operation of the software as well as knowing how to truly write collaboratively (Brandon & Hollingshead, 1999). Our students were anxious and uncertain about editing others' writing initially, and required a paradigm shift to overcome a crisis of authority.

Consistent with the literature on using wikis (McKay & Headley, 2007; Qian, 2007), we suggest that the instructors design a practice article at the beginning of the course to teach students how to use the software and to encourage re-writing others' text. Many wikis contain a sandbox, but further coaching may be necessary to resolve the crisis of authority among groups who have been long taught to not interfere with other's work. A practice article will not only allow students to become familiar with wiki functionality, but will model the practice of interacting with peers on the wiki. Instructors are also encouraged to model collaborate writing to prompt students' critical thinking and decision-making skills (Engstrom & Jewett, 2005).

Repeated wiki assignments were also necessary to obtain the benefits of collaborative writing in wiki. This course required five articles, 4 original (2 solo, 2 in teams), and 1 edited. The benefits of using wiki as a collaborative writing tool were not realized until the third or fourth article assignment. It is recommended that instructors use several wiki assignments to reinforce the skills of collaborative writing infused with feedback on quality expectations of the articles.

As more educators explore and adopt the use of Wikis, we hope that this study lays the groundwork for further study on team editing behavior to advance the artifact evaluation of human interactions within a wiki environment, other than its technical interaction. As Perkins, a pioneering thinker about computers as learning tools, concluded, the importance of innovative technologies is not "what you can do that you could not before," rather, the important question to ask is "what difference will computers *really* make" to a person's higher-order thinking skills such as decision making, reflection, reasoning, problem solving, and peer collaboration (Perkins, 1986, p. 11).

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Distance Learning Content Rating and Filtering Products and Models Survey

Yang Lin
The Department of Curriculum and Instruction
University of Minnesota – Twin Cities
125 Peik Hall, 159 Pillsbury Drive SE, Minneapolis, MN 55455

Abstract

This study investigates content rating and filtering products and models in distance learning. Three distance learning content rating and filtering systems (time-based, space-based and functional factor-based) are described at the beginning. Then different distance learning content rating and filtering products are examined and categorized into the functional factor-based system. Finally six popular distance learning content rating and filtering models are discussed and compared in detail.

Keywords: distance learning, rating, filtering, products, models

Introduction

Nowadays the popularity of harmful content on the Internet has become one of the most serious global concerns in distance learning systems. In order to deal with this challenging problem, different kinds of distance learning content rating and filtering products and models have been developed.

The purpose of the study is to examine the following questions: 1. How to understand distance learning content rating and filtering systems? 2. How to compare and categorize different kinds of distance learning content rating and filtering products? 3. What are the advantages and disadvantages of the popular distance learning content rating and filtering models?

The contribution of this study to the literature is twofold. First, different distance learning content rating and filtering products are examined and categorized to exhibit a complete concept map in this issue. Second, the popular distance learning content rating and filtering models have been discussed in detail to figure out their advantages and disadvantages, the useful reference for future improvement.

Three Distance Learning Content Rating and Filtering Systems

Usually there are three distance learning content rating and filtering systems (time-based, space-based and functional factor-based. The time-based system (Figure 1) reveals the process that distance learning content should be labeled with rating result before it can be filtered to learners. Generally both labeling and filtering are based on the same rating standard.
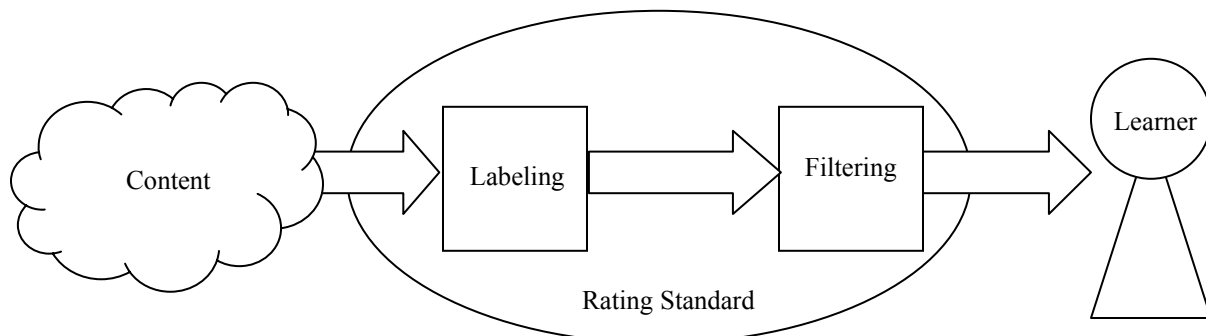

Figure 1   The Time-based System

Second, the space-based system (Figure 2) describes distance learning content rating and filtering in broader scope. According to the spaced-based system, distance learning content rating and filtering is not just a technological issue. The other important parts include legal and social regulations, and information literacy education. The three parts interact with each other and contribute to the system in different ways.
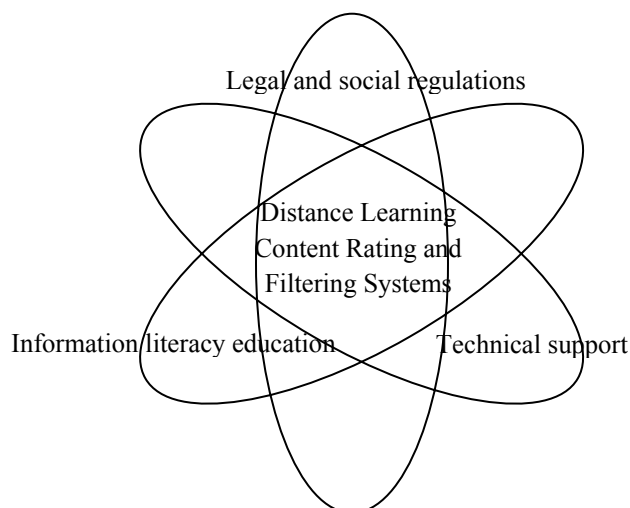
Figure 2   The Space-based System

Third, the functional factor-based system (Table 1) gives more detail in technical analysis, which consists of rating terminology, rating entity, rating establishment, rating transmission and filtering implementation.

The rating terminology includes descriptive ratings terminology and evaluative rating terminology. For example, "too much violence" belongs to descriptive ratings terminology, while "unsuitable for 6-year-old or younger children" is evaluative rating terminology. Generally, descriptive ratings terminology is simple and easily used but it lacks detailed information about the content, while evaluative rating terminology provides content description but it is not as user-friendly as descriptive ratings terminology.

The rating entity can be content developers, content packagers, third-parties or learners. It is possible for content developers to rate their own content products based on rating standards, such as ICRA and SafeSurf, while content packagers, such as portal websites and databases, can also possibly rate and edit the content they buy or search from content developers. Third-parties include governments, NGO (Non-Governmental Organizations) and companies. For example, many companies, such as Cyber Snoop, Click & Browse Jr., AME, Cyber Patrol, SurfWatch (the name now has been changed to SurfControl), invite parents, instructors and IT experts to set up working groups to rating online content. Sometimes learners are also responsible for the rating.

The rating establishment can be described as authoritative and democratic. The authoritative rating establishment means the rating can only be implemented by authorized institutes, while the democratic rating establishment means the rating implementation should be shared by all the stakeholders, including voting, investigation and auto-rating based on open standards, such as Net Shepherd.

The rating transmission can be keywords or meta-information. Meta-information is an abstract description about a webpage, a picture or a movie. For example, W3C develops PICS (Platform for Internet Content Selection), a HTML rating and labeling specification, so a PICS rating result of a webpage can be embedded in the HTML heading of the webpage. When client software identifies the PICS label in the webpage, it can decide if the webpage should be filtered.

The filtering implementation is more complex. In relation to the filtering location, the filtering implementation can be upstream filtering or downstream filtering. In line with the filtering method, the filtering implementation can be "hard" filtering, which means content has been rating-labeled and filtered without learners' consent, or "soft" filtering, which informs learners about content rating-label and it is learners who decide if the content should be filtered or not, such as Yahooligans!, American Library Association's "Great Sites", CyberYES list, The Internet Kids & Family Yellow Pages.

From the analysis of the above three distance learning content rating and filtering systems, it can be found that there are too many complex factors in the issue, so emphasizing or deemphasizing any of these factors will result in low efficiency of the whole system.

Table 1   The Functional Factor-based System

Rating terminology	descriptive ratings terminology		
	evaluative rating terminology		
Rating entity	content provider		
	content packer		
	third party		
	learner		
Rating establishment	authoritative		
	democratic	voting	
		investigation	
		auto-rating based on open standards	
Rating transmission	content name		
	content meta-information		
Filtering implementation	location	upstream	
		downstream	
	method	"hard"	destroy
			screen
		"soft"	recommendation
			supervision
			warning

Six Distance Learning Content Rating and Filtering Models

There are six popular distance learning content rating and filtering models. The first one is the keyword-based model. For example, we can use the keyword "too much violence" to rate a picture. This model is simple, user-friendly, highly flexible but less accurate since it is difficult for this model to figure out the difference between sex business and sex education. The second model is called greenlist and redlist model. Here greenlist means the recommended website list, while redlist means blocked website list. Both of the website lists are set up manually, so the lists can only cover very few websites on the Internet and they need a long period to update. The walled garden model is the third one, which means a restricted online community where content providers should be responsible for its content. It's very safe for learners but sometimes learners have to pay the service fee and they can only access the content within the online community. The fourth one, called the Internet top domain name model, which is proposed by ICANN (Internet Corporation for Assigned Names and Numbers) to help learners figure out adult websites by the Internet top domain name (such as .sex, .red and .xxx) of the websites, but many adult websites refuse to adopt this plan. The fifth one, the learner authentication model, asks learners to provide age information to an authentication server before they can access content, but many content providers don't take it into consideration. The last model, called MPLRM (multi-party labeling & rating model), requires content providers to label content based on rating standard firstly, then client software can identify the rating label in the meta-information of content, but the globally accpeted rating standard is not available now. The six distance learning content rating and filtering models are compared at Table 2 and Figure 3, which indicate that advantages and disadvantages are available in all the models. However, MPLRM is generally the best choice since its flexibility-accuracy area is the biggest according to Figure 3. In other words, MPLRM keeps a good balance between the flexibility and accuracy.

Table 2   Advantages and Disadvantages of Six Models

Model	Advantage	Disadvantage
Keyword-based model	highly flexible	lowly accurate
Greenlist and redlist model	highly accurate	little Internet coverage low updating speed
Walled garden model	highly accurate	little Internet coverage service fee
Internet top domain name model	highly accurate	depending on content providers
Learner authentication model	highly accurate	depending on content providers
Multi-party labeling & rating model	accurate and flexible	depending on content providers

1. Keyword-based model
2. Greenlist and redlist model
3. Walled garden model
4. Internet top domain name model
5. Learner authentication model
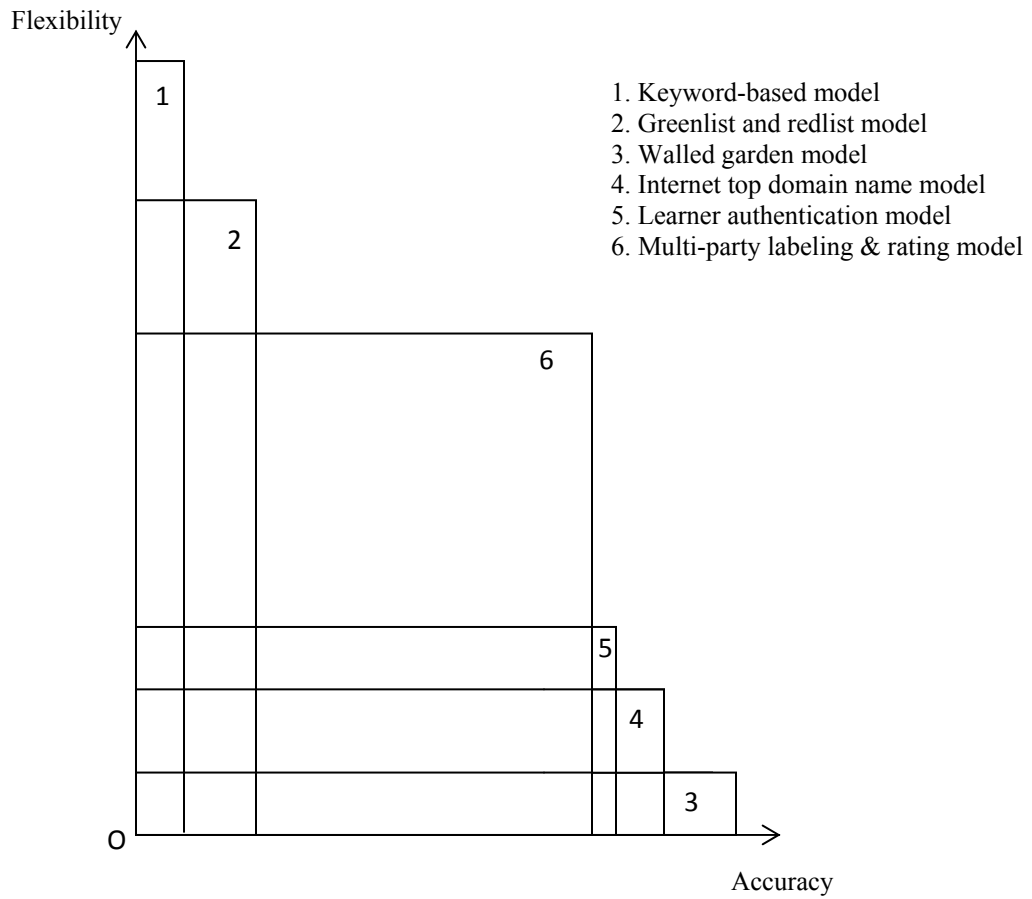6. Multi-party labeling & rating model

Figure 3   Advantages and Disadvantages of Six Models

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Double Face Model:
Developing Age and Content-based E-learning Content Rating Standards

Yang Lin

The Department of Curriculum and Instruction

University of Minnesota – Twin Cities

125 Peik Hall, 159 Pillsbury Drive SE, Minneapolis, MN 55455

Abstract

This study examines the strengths and weaknesses of two currently popular kinds of e-learning content rating (age-based and content-based) standards to construct a new e-learning content rating standard developing strategy called Double Face Model (DFM), which combines age-based rating and content-based rating at the same time but in different dimensionalities.

Keywords: e-learning, standards

Introduction

The Internet has been widely accepted as the important learning platform for learners in recent decades. Despite the educational benefits of the Internet, however, there are risks associated with its use, such as exposure to inappropriate material, physical danger and unwanted advertising towards e-learners. Nowadays the harmful content on the Internet has become one of the most serious global concerns in e-learning systems. Therefore, many governments and international professional organizations, such as Internet Content Rating Association (ICRA, 2003), have published online content rating standards to deal with this challenging problem.

The purpose of the study is to examine the following questions: 1. What are the strengths and weaknesses of two currently popular kinds of e-learning content rating (age-based and content-based) standards? 2. Why doesn't the high content accuracy of e-learning content rating standards equal users' highly positive attitude to these standards? 3. Is it possible for us to design a new e-learning content rating standard developing strategy to change the embarrassing situation?

The contribution of this study to the literature is twofold. First, the strengths and weaknesses of two popular kinds of e-learning content rating (age-based or content-based) standards are not typically examined by the current literature. This study contributes to the existing literature by the comparison of two kinds of e-learning content rating standards, which reveals the high content accuracy of e-learning content rating standards doesn't equal users' highly positive attitude to these standards. Second, this study constructs a new e-learning content rating standard developing strategy called Double Face Model (DFM), which combines age-based rating and content-based rating at the same time but in different dimensionalities to deal with this problem.

Problem

E-learning content rating standards in this study is defined as the specifications for judging the relative quality of e-learning content for e-learners. According to e-learning content rating standards, the e-learning content is labeled with specific rating result, which helps e-learners judge if they should access the content by indicating the relative quality of the e-learning content.

Currently so few content rating standards are specifically designed for e-learning and most e-learning systems apply the common content rating standards, which are developed in two different ways: age-based or content-based. The age-based content rating standards indicate the relative quality of content by age-related labels, such as "suitable for children ages 3 and older" (ESRB, 2003), while the content-based content rating standards indicate the relative quality of content by key-word description, such as "explicit or crude language" (RASCi, 2003).

In the pre-Internet age, people usually focus on content rating in broadcasting, television, movie and electronic game, so the rating standards in this period are simply based on age without flexible rules (Table 1). That is to say, according to their age, people can only choose to accept or reject the content, but they can't choose when and where to accept or reject the content.

Table 1　Age-based Content Rating Standards

Age（year）	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
MPA[1]	■	■	■	■	■	■	■	■	■	■	■	■			■	■	■	■	■	■
MPAA[2]	■	■	■	■	■	■								■	■	■				
ESRB[3]	■		■	■	■	■	■	■	■	■	■	■					■	■	■	■
B.C.[4]	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
U.K.[5]	■	■	■	■	■	■	■	■	■	■	■				■	■	■			
H.K.[6]	■	■	■	■	■	■						■	■	■	■	■				

1：MPA: the abbreviation for rating standard of Motion Picture Association.

2：MPAA: the abbreviation for rating standard of Motion Picture Association of America.

3：ESRB: the abbreviation for rating standard of Entertainment Software Rating Board.

4：B.C: the abbreviation for rating standard of Province of British Columbia in Canada.

5：U.K: the abbreviation for rating standard of United Kingdom.

6：H.K: the abbreviation for rating standard of Hong Kong S.A.R. of P.R.China.

With the rapid development of information technology, nowadays people focus on developing new content rating standards for the Internet. Although content rating standards based on age still prevail in the pre-Internet age, new standards grounded on content are needed at this time. On the one hand, there are two new characters of harmful content on the Internet: First of all, it spreads so fast that people can get such content in seconds from the other side of the Earth by simply clicking a mouse button. Second, there is no national border, and there are no resting hours either, therefore people can search whatever they want in 24 hours globally, including harmful content. These new characters make it impossible to insist on content rating standard development strategy for pre-Internet age. On the other hand, supported by the emerging information technologies, people are beginning to adopt new strategies based on content to develop more flexible rating standards, which are different from the index of prohibited books prevailed in middle age or rating standards based on age for the pre-Internet age. More information can be gotten from Table 2, which compares several well-known standards in the Internet age, including Cyber Patrol, SurfWatch, RSACi and CYBERsitter.

Table 2　Content-based Content Rating Standards

Option	Cyber Patrol	SafeSurf	RSACi	CYBERsitter	ICRA
sex/nudity	●	●	●	●	●
violence	●	●	●	●	●
profanity	●	●	●		●
satanism	●			●	
discrimination	●	●	●	●	
drug	●	●			●
tobacco/ bibulosity	●				●
gambling	●	●			●
others	●			●	

Comparing the two kinds of content rating standard, we can find the following differences between them (Table 3): First, age-based standards are amazingly similar despite their different social, economic and cultural background, but content-based standards have their own specific rating characteristics and they have often been changed. Second, age-based standards are more stable, while content-based standards are more flexible. Third, E-learning content providers prefer content-based standards because they are familiar with the content, while e-learners often choose age-based standards since age is a much simpler indicator for them compared with content description. Neither of the two kinds of rating standards can work satisfyingly for both e-learning content providers and e-learners at the same time. That's the reason why the high content accuracy of e-learning content rating standards doesn't equal users' highly positive attitude to these standards.

Table 3 Comparison of Age-based and Content-based Content Rating Standards

Standards based on age	Standards based on content
simple	complex
similar	different
stable	flexible
mainly for e-learning content providers	mainly for e-learners

Method

Double-face model (DFM) combining the strength of age-based and content-based e-learning content rating standards is proposed in this study as a possible solution to deal with this dilemma, which includes two dimensionalities: dimensionality A and dimensionality B. That is to say, there are two rating results for the same e-learning content. The rating result from dimensionality A aims at e-learning content providers, while the rating result from dimensionality B is for e-learners. DFM provides a mapping mechanism for combining dimensionality A with dimensionality A, so two rating results based on dimensionality A and dimensionality B respectively can be converted into each other. Furthermore, the transformation is "transparent" to e-learning content providers and e-learners. (Figure 1)
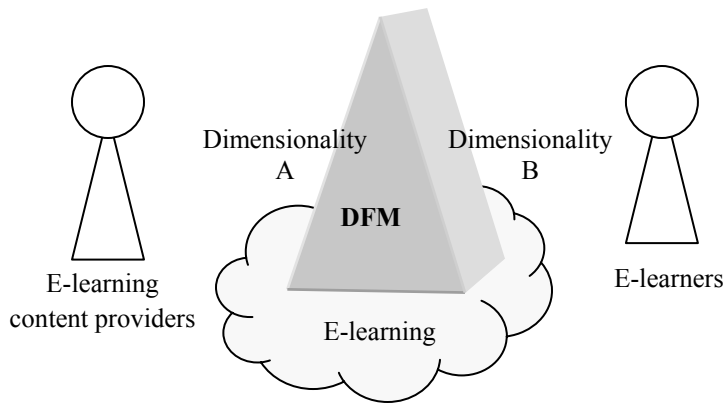

Figure 1 Double-face Model

Dimensionality A, which is based on content, provides two content categories: recommended and blocked. Each content category is divided into several content options, and each content option can be further divided into several grades (Table 4).

Table 4 Dimensionality A

Label	Option	Sub-option	Grade
A	recommended	excellent educational content	0-4
B		educational content suitable for special age	0-4
C		undefined content	0-4
D	blocked	bad language	0-4
E		tobacco, bibulosity, drug	0-4
F		rumor	0-4
G		terror	0-4
H		violence	0-4
I		wizardry	0-4
J		gambling	0-4
K		militarism, extremism, terrorism	0-4
L		discrimination	0-4

M		nudity, sex	0-4
N		Satanism, cult	0-4
O		racialism	0-4
P		endangering the national security	0-4
Q		endangering the Internet safety	0-4
R		other illegal issues	0-4
S		undefined content	0-4

The rules of description based on dimensionality A are as follows: According to given e-learning content, we can choose grades labeled from 0 to 4 for each sub-option. 0 means null for this sub-option and 4 means the strongest. Each sub-option with its grade is divided by "-". For example, if there is a webpage which propagandizes violence, its rating result based on dimensionality A is: A0-B0-C0-D0-E0-F0-G0-H4-I0-J0-K0-L0-M0-N0-O0-P0-Q0-R0-S0, which complies with W3C PICS.

Dimensionality B provides eleven sub-options (Table 5), and each sub-option can map to some sub-options in dimensionality A. (Table 6 -11)

Table 5　Dimensionality B

Label	Definition
Blc-All	Unsuitable for all e-learners
Blc-18older	Only suitable for 18 year's old or older e-learners
Blc-12older	Only suitable for 12 year's old or older e-learners
Blc-Un	Block reserved
Rec-All	Recommended for all e-learners
Rec-1517	Recommended for 15-17 year's old e-learners
Rec-1214	Recommended for 12-14 year's old e-learners
Rec-711	Recommended for 7-11 year's old e-learners
Rec-6younger	Recommended for 6 year's old or younger e-learners
Rec-Un	Recommendation reserved
Default	not recommended

Table 6　The Mapping between Dimensionality A and Dimensionality B

Table 7   Rec-All

Grade	excellence educational content	educational content suitable for special age	undefined content
4	▨		
3	▨		
2	▨		
1	▨		
0			

Table 8   Rec-6younger

Grade	excellence educational content	educational content suitable for special age	undefined content
4	▨	▨	
3	▨		
2	▨		
1	▨		
0			

Table 9   Rec-711

Grade	excellence educational content	educational content suitable for special age	undefined content
4	▨		
3	▨	▨	
2	▨		
1	▨		
0			

Table 10   Rec-1214

Grade	excellence educational content	educational content suitable for special age	undefined content
4	▨		
3	▨		
2	▨	▨	
1	▨		
0			

Table 11   Rec-1517

Grade	excellence educational content	educational content suitable for special age	undefined content
4	▨		
3	▨		
2	▨		
1	▨	▨	
0			

DFM provides a mapping system to combine dimensionality A and dimensionality B (Figure 2). For example, there is a webpage which propagandizes violence. According to dimensionality A, the rating result that e-learning content providers get is:

A0-B0-C0-D0-E0-F0-G0-H4-I0-J0-K0-L0-M0-N0-O0-P0-Q0-R0-S0

Then the e-learning content provider sends the result to RFC (rating & filtering center) for registration. RFC is an abstract concept, which can be implemented as software, web service, etc. RFC finishes the mapping between dimensionality A and dimensionality B and gets the mapping result: Blc-All. That is to say, it's unsuitable for all e-learners. At the same time, an e-learner adjusts age setting on his client software, which sends the e-learner's age information to RFC. Finally, RFC finds that the webpage is unsuitable for this e-learner according to the mapping result, so RFC blocks the webpage automatically.

mapping

H4 ⟺ Unsuitable for all e-learners

RFC

submit result based on dimensionality A

confirm   confirm

submit result based on dimensionality B

H4：

violence

X

blocked

user age：10

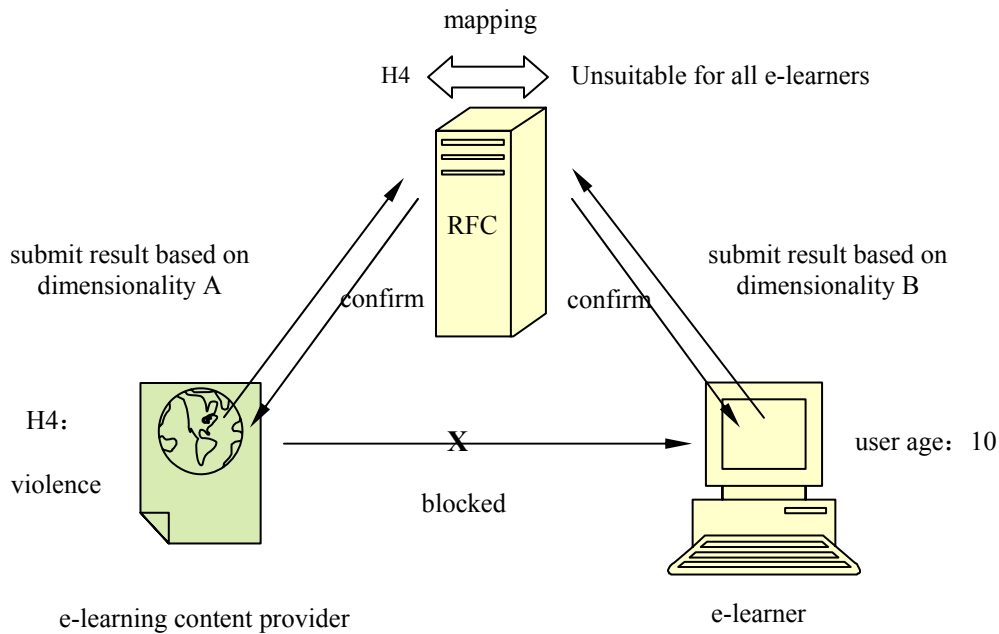e-learning content provider

e-learner

Figure 2   The Mapping System between Dimensionality A and Dimensionality B

Conclusions

First, DFM provides the transparent mapping mechanism between dimensionality A and dimensionality B, so the two rating dimensionalities can be converted into each other conveniently. Second, DFM provides the "recommended" content options, which are not available in other e-learning content rating standards. Finally, there are reserved content rating options in DFM such as "content suitable for special age" and "undefined content", purposely designed to satisfy some e-learners' specific needs such as religious or local culture emphasis.

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Shanghai's High School Students' Cognition and Attitude towards Online Pornography

Yang Lin

The Department of Curriculum and Instruction

University of Minnesota – Twin Cities

125 Peik Hall, 159 Pillsbury Drive SE, Minneapolis, MN 55455

Abstract

This study examines Shanghai's high school students' cognition and attitude towards online pornography. In order to obtain a comprehensive perspective of this issue, three comparisons have been conducted in this study: between teachers and students at Shanghai high schools, between male students and female students at Shanghai high schools, and between Shanghai's high school students and Taiwan Province's high school students.

Keywords: students, cognition, attitude, online pornography

Introduction

The survey from CCYL (China Community Youth League, 2002) indicates the Internet has become an important learning platform for Chinese young learners in recent decades. Despite the educational benefits of the Internet, however, there are risks associated with its use, such as online pornography towards e-learners, which is demonstrated by many other related surveys. For example, the survey from Yesite.com (2002) indicates that more than 60% Chinese young people access online pornography. Another investigation from Sina.com (2002) indicates that more than half of two million Chinese students access online pornography. It's widely recognized that the overwhelming pornography on the Internet has become one of the most serious social concerns in China nowadays.

The purpose of the study is to examine the following questions: 1. What are the differences of cognition and attitude towards online pornography between teachers and students at Shanghai high schools? 2. What are the differences of cognition and attitude towards online pornography between male students and female students at Shanghai high schools? 3. What are the differences of cognition and attitude towards online pornography between Shanghai's high school students and Taiwan Province's high school students?

The contribution of this study to the literature is listed as follows. First, the differences of cognition and attitude towards online pornography between teachers and students at Shanghai high schools provide reference for high school teachers to set up effective conversation with students in this issue. Second, the differences of cognition and attitude towards online pornography between male students and female students at Shanghai high schools demonstrate we should take the gender factor into consideration when designing instruction related to this issue. Third, the differences of cognition and attitude towards online pornography between Shanghai's high school students and Taiwan Province's high school students reveal the social and cultural influence in this issue.

This study designed a questionnaire about cognition and attitude towards online pornography for teachers and students in Shanghai high schools. In 2003, this study collected a total of 1,206 qualified questionnaires from 1,245 Shanghai high school students in and a total of 34 qualified questionnaires from 40 Shanghai high school teachers. Based on the questionnaire survey results and the data from the high school student online survey in Taiwan Province (2002) about their cognition and attitude towards online pornography, this study completed the following comparisons.

The Differences between Teachers and Students at Shanghai High Schools

First, the students and the teachers access the Internet at different locations. a majority of the students often surf the Internet at Internet cafés (54%) , while many of the teachers choose to access the Internet at school (56%) or at home (44%). None of the teachers in the survey go to Internet cafés.

Second, the average time (2.6 hours) which the students spend on the Internet every day is much longer than the teachers' (0.9 hours), which is a possible reason why students have much more Internet experience and skills compared with the teachers.

Third, 62% of the students access online pornography, intentionally or unintentionally, but the number for teachers is only 4%. 44% of the teachers are not familiar with online pornography. 49% of the teachers just hear it from others and 44% don't realize pornography is possibly accessible on the Internet.

Fourth, 60% of the students who access online pornography find it from search engines or friends, while 41% of the teachers who access online pornography find it from friends.

Fifth, 78% of the students and 44% of the teachers think online pornography is most popular on web pages. At the same time, 36% of the students and 47% of the teachers think it can also be found easily at online chat rooms. It demonstrates nowadays popular information technologies used at their schools doesn't provide effective protection against online pornography. In addition, 84% of the students and 62% of the teachers think people can access online pornography most easily at Internet cafes.

Sixth, 64% of the students and 53% of the teachers think "accessing online pornography doesn't matter" and even 42% of the students feel "curious" about online pornography.

Seventh, 76% of the students and 88% of the teachers have never received the concept about media education. Only 30% of the students got limited media guidance from their parents before. However, the parents have little information technology skills compared with their children, which cannot guarantee the effectiveness of their guidance.

Finally, the students and the teachers have different answers for the question about how to deal with online pornography. 49% of the students believe the self-regulation is the best way to deal with the problem, while 45% of the teachers think legal enforcement is more important. Furthermore, 64% of the students and 82% of the teachers are not familiar with online content rating standards or products, but both the students (81%) and the teachers (79%) think information literacy education in high schools should be improved.

The Differences between Male Students and Female Students at Shanghai High Schools

First, 71% of the male students and 47% of the female students access online pornography. They are interested in porn articles, porn photos and porn chat rooms, but what they are most interested in is porn photos. Among them, 69% of the male students and 67% of the female students choose to access online pornography at Internet café, and the time is usually from 6pm to 12am.

Second, in response to the question why access online pornography, 48% of the male students choose "curiosity" and 16% of the male students think "if I don't access it, I will be laughed by my friends". However, 85% of the female students choose "other reasons".

Third, the male and female students access online pornography in many different ways. 62% of male students and 33% of female students in the survey find online pornography by search engines, while 33% of male students and 22% of female students find it from friends or classmates.

Fourth, among the students who access online pornography, 95% of male students visited it before and 28% of male students often visit it. For female students, the percentages are 60% and 48% respectively.

Fifth, 55% of the male students access less than 5 pornography websites and 15% of the male students access more than 20 pornography websites. However, only 34% of the female students access less than 5 pornography websites and 3% of the female students access more than 20 pornography websites.

Sixth, among the students who visited online pornography, 69% of male students and 67% of female students choose Internet cafés as the first choice to visit online pornography. Furthermore, 26% of the male students also choose home as their second choice, while 31% of the female students also choose friends' house as their second choice. Most of the male and the female students choose to visit online pornography from 6p to 12a.

Finally, more than half of the male students love to discuss online pornography with their friends, but most of the female students don't tell anyone, even their close friends. Moreover, both male students (73%) and female students (49%) think "accessing online pornography doesn't matter".

The Differences between Shanghai's High School Students and Taiwan Province's High School Students

First, 85% of the high school students in Taiwan access online pornography compared with 83% of the high school students in Shanghai. 41% of the high school students in Taiwan access online pornography compared with 62% of the high school students in Shanghai.

Second, the high school students' online pornography visiting frequencies are different. Among the high school students who visited online pornography, 23% of Shanghai students often visit, 41% of Shanghai students sometimes visit and 36% of Shanghai students rarely visit; while 13% of Taiwan students often visit, 31% of Taiwan students sometimes visit and 56% of Taiwan students rarely visit.

Third, 62% of the high school students in Taiwan choose to visit online pornography at home while 68% of the high school students in Shanghai choose to visit it at Internet café.

Finally, 73% of the high school students in Taiwan feel "curious" about online pornography compared with 42% of the high school students in Shanghai.

Conclusions

First of all, the percentages of both of male and female high school students who access online pornography in Shanghai are very high. Therefore, it is important to implement necessary guidance at Shanghai high schools. Second, the high school students and teachers in Shanghai visit the Internet at different locations and different times, so the teachers cannot provide effective guidance to the students. Third, the high school students in Shanghai access online pornography for varied reasons, so the individual guidance plans are necessary for different students. Fourth, the Shanghai high school teachers know less about online pornography than the high school students. This embarrassing situation should be changed by new learning modules in the teacher's professional training program. Finally, the differences between Shanghai high school students and Taiwan high school students reveal the social and cultural influence in this issue, which indicates more related researches could be done in the future.

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The Effect of Instructor Behaviors in Different Online Learning Environments

Schutt Maria
San Diego State University/University of San Diego

Allen Brock
San Diego State University

Abstract

Several studies in traditional classroom settings examined instructor immediacy (the measure of the psychological distance which an instructor puts between himself and his students) and reported that instructor verbal and nonverbal immediacy behaviors are associated with learning outcomes, satisfaction, and motivation. The purpose of this study was to examine the effect of instructor immediacy behaviors on student perception of instructor immediacy and social presence (the degree to which a person is perceived as "real" in mediated communication) in two online, computer conferencing environments: (a) video and audio with text chat and (b) audio with text chat. Using an experimental design the researchers tested the effects of instructor immediacy behaviors (high vs. low) and delivery modality (audio vs. video) on student perception of instructor immediacy, perception of social presence, and learning outcomes measured by immediate posttest scores. The results yielded statistically significant difference in student perception of instructor immediacy and social presence among the high-immediacy and the low-immediacy groups. The results also showed that there was a significant difference in learning outcomes as indicated by immediate posttest scores between students in the high-immediacy audio group and the low-immediacy video group. A correlation analysis revealed a significant positive relationship between perceived instructor immediacy and perceived instructor social presence. Finally, a regression analysis revealed that instructor immediacy significantly predicted social presence. The findings have significant implications regarding the use of instructor immediacy behaviors in computer conferencing settings and lay the groundwork for future research in this area.

Currently, the number of students enrolling in courses offered online is increasing at a much faster rate of growth than the overall higher education population (Sloan Consortium, 2005) and computer-based tools have been widely embraced for online learning. With the prevalence of computers in online distance education, there is an increasing need to exploit the differences among the plethora of computer-based tools, such as synchronous and asynchronous text chat tools, discussion boards, computer audio and video conferencing, and so forth, regarding their impact on the mediated learning transaction and the learning outcomes. What is the effect of the behaviors projected by the instructor when using different types of online computer-conferencing tools? Unfortunately the central role of the instructor and the impact of his or her behaviors have received little attention in the distance learning research. The current study examined the effect of immediacy behaviors employed by the online instructor in two computer-based learning environments.

Instructor Immediacy and Social Presence

Research in conventional classroom settings has examined instructor immediacy, the measure of the psychological distance which a communicator puts between himself and the object of his communication (Wiener & Mehrabian, 1968). Researchers have identified verbal and nonverbal communicative behaviors which may be employed by instructors to reduce student perceptions of psychological distance and enhance closeness and interaction. For example, nonverbal behaviors include eye contact, body posture, gestures, facial expressions, and vocal qualities (Andersen, 1979; Richmond, Gorham, & McCroskey, 1987). Relevant verbal behaviors include using students' names, feedback, praise, and humor (Gorham, 1988). Research on instructor immediacy has shown that when instructors employ verbal and nonverbal immediacy behaviors students demonstrate increased learning outcomes, motivation, and satisfaction (Andersen, 1979; Christophel, 1990; Gorham, 1988; Gorham & Christophel, 1990;

Gorham & Zakahi, 1990; Kearney, Plax, & Wendt-Wasco, 1985; Kelley & Gorham, 1988). While these findings received a lot of attention in the communication literature, most of the studies have been conducted in traditional face-to-face, non-mediated settings and very few studies have examined instructor immediacy in the context of distance education classroom, primarily in the televised classroom (Freitas, Myers, & Avtgis, 1998; Guerrero & Miller, 1998; Hackman & Walker, 1990). Consequently, some of the verbal and nonverbal behaviors that have been described to enhance instructor immediacy in face-to-face interaction might not be feasible or relevant in distance education settings. However, existing research has reported notable effects of instructor immediacy on student learning outcomes. Considering the increasing number of students enrolled in courses offered through the Internet, there is a noticeable gap when it comes to investigating how students perceive instructor immediacy when learning occurs online, through various computer conferencing tools.

While there is little research on immediacy in the context of online learning, several studies in distance education and communication have examined the concept of social presence, the degree of salience of the other person in a communication transaction (Short, Williams, & Christie, 1976) or as it has been widely interpreted, the degree to which a person is perceived as "real" in a mediated communication. Researchers investigating social presence suggest that the construct of social presence is closely related to the construct of immediacy. Findings in this area of research suggest that student perception of social presence can increase student satisfaction and perceived learning outcomes (Gunawardena & Zittle, 1997; Picciano, 2002; Richardson & Swan, 2003). However, social presence is partially determined by the objective qualities of the medium used in the mediated interaction; thus selecting the appropriate communication medium for an instructional instance could affect the student learning outcomes of the mediated interaction (Tu & McIsaac, 2002).

Methodology

The purpose of this study was to investigate how students perceive instructor immediacy and social presence in computer conferencing sessions. The study focused on two widely employed combinations of computer conferencing tools that allow synchronous computer communication: video and audio with text chat and audio with text chat. In addition, the study sought to determine whether the use of different computer conferencing environments would result in differences in learning outcomes when the instructor manipulates the level of immediacy behaviors. Finally, the study examined the relationship between perceived instructor immediacy, perceived social presence, and learning outcomes in each of the two combinations of computer conferencing environments and instructor immediacy behaviors.

The study examined the following research questions:

RQ1: How does the level of immediacy behaviors projected by the instructor and the computer conferencing environment influence perceived instructor immediacy?

RQ2: How does the level of immediacy behaviors projected by the instructor and the computer conferencing environment influence perceived instructor social presence?

RQ3: How does the level of immediacy behaviors projected by the instructor and the computer conferencing environment influence learning outcomes?

RQ4: Within the context of the different computer conferencing environments—(a) video and audio with text chat and (b) audio with text chat—what is the relationship between perceived instructor immediacy and perceived instructor social presence?

RQ5: Within the context of the different computer conferencing environments—(a) video and audio with text chat and (b) audio with text chat—what is the relationship between perceived instructor immediacy and learning outcomes?

To explore these issues, the researchers recorded four versions of an online synchronous session to reliably manipulate the level of instructor immediacy behaviors while using the two different computer conferencing environments (video and audio with text and audio with text). To experimentally compare students' perception of instructor immediacy and social presence in the two computer conferencing environments, the instructor engaged students in each of the two environments in a typical lecture discussion with identical content and activities, while manipulating the level of verbal and nonverbal immediacy behaviors. The high- and low-immediacy conditions were established using existing immediacy behaviors derived from immediacy research and the sessions were recorded. The participants for this study were sampled from two sections of an undergraduate course in psychology at San Diego State University. Combined, the two sections provided a sample of 989 subjects which were randomly assigned to one of

four groups and were asked to view a version of the lesson (see Table 1). Of those students, 433 participated in the study.

Table 1. *Subject Groupings*

Conditions	Groups	
	Video-Audio-Text (VAT)	Audio-Text (AT)
High Immediacy (Hi)	Group 1: High Immediacy – Video-Audio-Text (Hi-VAT)	Group 2: High Immediacy – Audio-Text (Hi-AT)
Low Immediacy (Lo)	Group 3: Low Immediacy – Video-Audio-Text (Lo-VAT)	Group 4: Low Immediacy – Audio-Text (Lo-AT)

Findings

Overall, the findings of this study show that when instructors employ behaviors which can reduce psychological distance, students perceive the instructors as more immediate, caring, empathetic, disclosing personality, and expressing emotions. Research question one asked how the level of immediacy behaviors projected by the instructor and the computer conferencing environment influence perceived instructor immediacy. To answer this research question the data were submitted to one-way ANOVA analysis which yielded significant results ($F(3, 433) = 97.972$, $p = .000$). Figure 1 shows that students who viewed the high-immediacy sessions (Group 1 and Group 2) indicated higher perception of instructor immediacy than students who viewed the low-immediacy sessions (Group 3 and Group 4). Specifically, students assigned to Group 1 (Hi-VAT) indicated the highest perception of instructor immediacy, followed by Group 2 (Hi-AT), Group 3 (Lo-VAT) and Group 4 (Lo-AT). The findings suggest that video-enabled computer conferencing tools can facilitate the projection of more immediacy behaviors; however instructors can project immediacy behaviors with the use of audio alone.
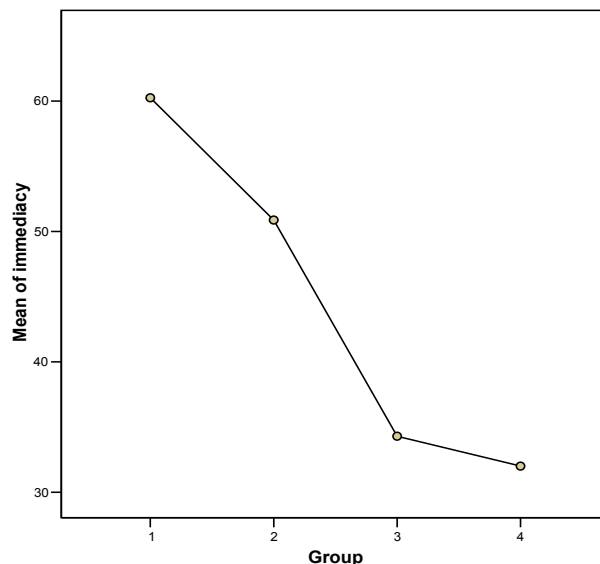

Figure 1. Means plot for instructor immediacy.

The second research question two asked: *How does the level of immediacy behaviors projected by the instructor and the computer conferencing environment influence perceived instructor social presence?* The one-way analysis of variance detected a significant overall $F(3, 433) = 154.337$, $p = .000$. Figure 2 shows that Group 1 (Hi-VAT) indicated the highest perception of instructor social presence ($M = 36.33$, $SD = 6.018$), followed by Group 2 (Hi-AT) ($M = 35. 81$, $SD = 7.006$), Group 3 (Lo-VAT) ($M = 21.56$, $SD = 7.945$), and Group 4 (Lo-AT) ($M = 20.47$, $SD = 7.967$). These findings are also supported by an open-ended

question which asked students to indicate if they perceived the instructor as a real person. Real person was defined as a person who is caring, empathetic, disclosing personality, and expressing emotions, in accordance to the social presence scale used in this study. More students in Group 1 (98 out of 107 students) perceived the instructor's social presence, followed by Group 2 (66 out of 100 students), Group 3 (64 out of 115 students), and Group 4 (56 out of 112 students).
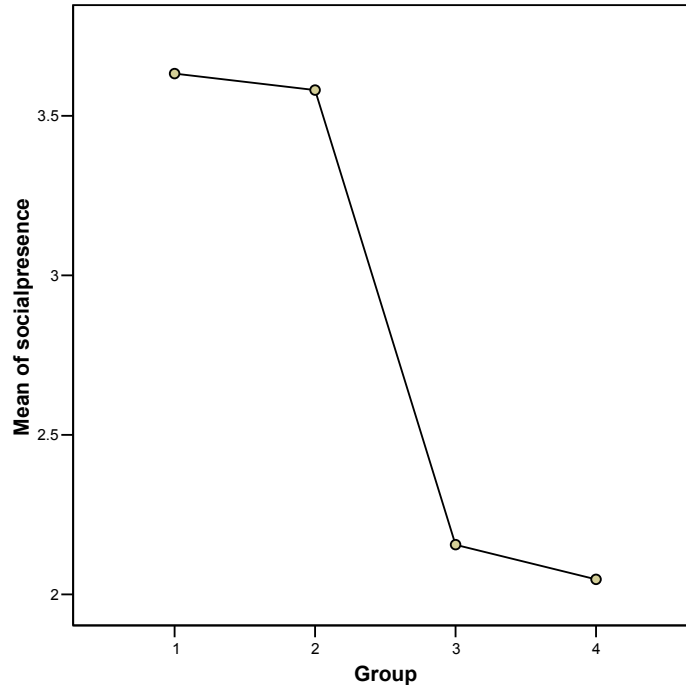

Figure 2. Means plot for instructor social presence.

Contrast tests showed that students who viewed the high-immediacy sessions indicated significantly higher perception of instructor social presence than the students who viewed the low-immediacy sessions ($p = .000$). However, there was no significant difference in perception of instructor social presence between students in the two high-immediacy groups (Hi-VAT and Hi-AT). Similarly, there was no significant difference in perception of instructor social presence between students in the two low-immediacy groups (Lo-VAT and Lo-AT). These findings suggest that the level of instructor immediacy projected by the instructor influenced students' perceptions of instructor social presence; however, the use of video or not did not significantly affect whether students perceived the instructor as a real person.

Similarly, research question four asked if there is a relationship between perceived instructor immediacy and perceived instructor social presence. The correlation analysis displayed in Figure 3 showed a significant relationship between perceived instructor immediacy and perceived instructor social presence ($r(433) = .844$, $p = .000$). In addition, a regression equation was developed to see if immediacy is a predictor of social presence. Instructor immediacy significantly predicted social presence ($F(1, 433) = 1067.567$, $p = .000$). Table 3 shows that the adjusted R squared value was .712. This indicates that 71.2% of the variance in social presence can be predicted by perception of instructor immediacy.

Table 3. *Model Summary for Immediacy*

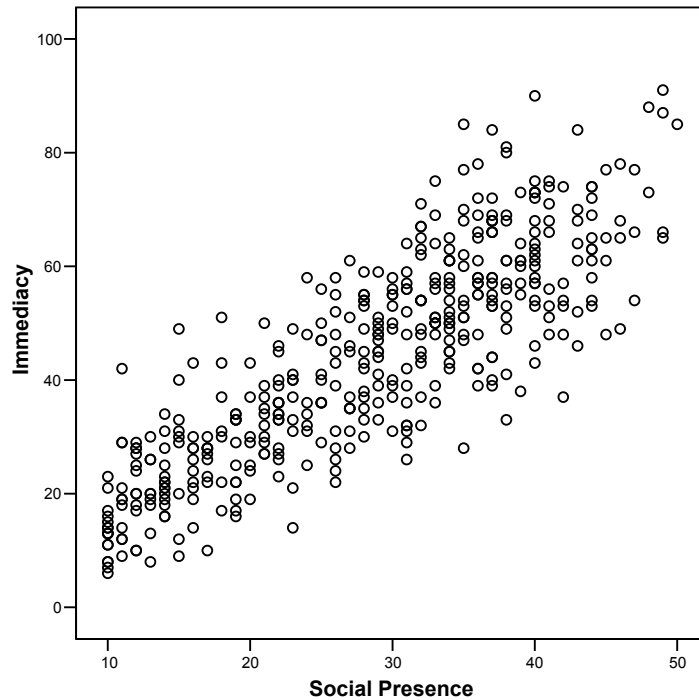| Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.844(a)	.712	.712	5.624

a Predictors: (Constant), Immediacy

Figure 3. Correlation of social presence and immediacy.

Research question three asked if the combination of immediacy behaviors projected by the instructor and the learning environment resulted in differences in the learning outcomes in the four groups. It was hypothesized that students who viewed the high-immediacy sessions (Group 1 and Group 2) would indicate higher learning outcomes than the low-immediacy groups, with Group 1 (Hi-VAT) indicating the highest learning outcomes. Learning outcomes were measured with an immediate and a delayed posttest. A one-way analysis of variance demonstrated a significant difference between the groups on the learning outcomes as measured by the immediate posttest scores ($F(3, 433) = 2.736$, $p = .043$) but no significant difference was detected on the delayed posttest scores($F(3, 433) = .964$, $p = .410$). Students assigned to Group 2 (Hi-AT) achieved the highest test scores ($M = 5.40$, $SD = 1.206$), followed by students in Group 4 (Lo-AT) ($M = 5.28$, $SD = 1.409$), Group 1 (Hi-VAT) ($M = 5.22$, $SD = 1.499$), and Group 3 (Lo-VAT) ($M = 4.87$, $SD = 1.617$). Contrast tests showed that the only significant difference in learning outcomes as measured by posttest scores was between Group 2 (Hi-AT) and Group 3 (Lo-VAT) ($p = .008$). Furthermore, research question five asked: Within the context of the different computer conferencing environments—(a) video and audio with text chat and (b) audio with text chat—what is the relationship between perceived instructor immediacy and learning outcomes? The hypothesis was that there is a positive relationship between perceived instructor immediacy and learning outcomes. The correlation analyses used to examine research question five did not reveal a relationship between perceived instructor immediacy and learning outcomes as indicated by the immediate ($r(433) = - .003$, $p = .945$) or delayed posttest ($r(433) = - .014$, $p = .774$).

The last part of the survey asked students to indicate whether they perceived the instructor as a real person (caring, empathetic, disclosing personality, and expressing emotions). Most students (98 out of 107 students) in Group 1 (Hi-VAT) and about two thirds of the students (66 out of 100) in Group 2 (Hi-AT) indicated that they perceived the instructor as a real person. Significantly fewer students reported perceiving the instructor as a real person in Group 3 (Lo-VAT) (64 out of 115 students) and Group 4 (Lo-AT) (56 out of 122 students). Students reported that some of the factors that influenced their perception of the instructor as a real person included the instructor encouraging students to ask questions, answering questions and providing feedback, using gestures, using examples, calling students by their first name, and not using monotone voice. Table 4 summarizes the aspects of the lesson that made students feel like the instructor was not real in the four groups. Table 5 presents the categories summarizing the students' opinions about the aspects of the lesson that made the instructor seem real.

Table 4. *Aspects of Lesson That Made Students Feel Like Instructor Was not Real*

Group 1	Group 2	Group 3	Group 4
Boring	Did not move-No video	Monotone Voice-	Did not move-No video
Seemed rehearsed	Robotic	Boring	Monotone Voice-
		Showed no emotion	Boring
		Seemed like he was	Showed no emotion
		reading notes	Seemed like he was
		Seemed like a 'robot'	reading notes
		Not involved	Seemed like a 'robot'

Table 5. *Overall Aspects That Made Instructor Seem Real*

Aspect of the Lesson	Number of Responses
I could see him-Video	100
Responded to student comments and questions	86
I could hear him	76
Interacted with students	52
Asked questions	33
Changing voice pitches-tone of voice-no monotone	32
Spoke about his family and shared personal information	31
Called students by their first name	30
Encouraged students to ask questions	26
Used gestures-moved head-body when he was talking	27
I could see his picture	22
Seemed knowledgeable	21
Showed personality-Expressed how he felt	20
Used examples	18
Caring-Seemed to care about students' understanding	16
Offered office hours-Asked students to come and see him-talk to him	14
Conversational tone with students	14
Used visuals-power point slides	13
Used humor-Told jokes	8
Made sure the students were involved	6
Did not seem like he was reading	3
Allowed students to call him by his first name	2

Discussion

Congruent with previous research examining instructor immediacy (Gorham & Zakahi, 1990) the findings of this study indicate that the use of instructor immediacy behaviors impacts how students perceive the instructor suggesting that instructors can monitor their behaviors based on the immediacy literature. The findings showed that video-enabled computer conferencing tools can facilitate the projection of more immediacy behaviors than audio-enabled computer conferencing tools; however instructors can project immediacy behaviors with the use of audio alone. Therefore, the findings of the present study have prescriptive value for training faculty to utilize the information identified in the immediacy literature not only for teaching face-to-face but also for teaching students at a distance. Regardless of the online computer conferencing environment instructors could be trained to utilize relevant immediacy behaviors such as encouraging students to ask questions, using humor, calling students by their first name, answering questions and providing feedback, sharing personal information, and so forth.

Furthermore, the findings showed a strong, positive relationship between perceived instructor immediacy and perceived instructor social presence. The availability of video-enabled tools could enhance student perception of instructor immediacy, which according to the current study will also increase perception of social presence. However, in the absence of video, instructors can still project several immediacy behaviors and increase perception of social presence.

Finally, the results of the learning outcomes question is aligned with Gorham and Zakahi (1990) who point out that the relationship between cognitive learning and instructor immediacy is difficult to explain and that the relationship is non-linear. More specifically, in studies where cognitive learning was assessed as a test or course grade the relationship between immediacy and cognitive learning was not supported (Gorham & Zakahi, 1990). Many factors such as the characteristics and attitudes of the students, the length of the lecture, and the topic of the lecture might have affected the variance in the findings of this and previous studies examining learning outcomes in different learning environments.

Overall, this study sheds light on the importance of the role of the instructor in the online classroom. Understanding the implications of instructor behaviors and instructional tools could elucidate future directions for both distance learners and on-campus learners. As different types of computer conferencing tools continue to evolve further research must be conducted to explore the impact of these tools. From a practical perspective, the choice of the communication tool may have potentially wide implications for leaders of educational institutions concerned with the various pedagogical and financial issues associated with the selection of a particular course delivery option. While social presence can increase student satisfaction, instructor immediacy has been shown to affect student cognitive, affective and behavioral learning as well as motivation. Understanding how immediacy affects social presence in online learning contexts may guide the design of more interactive and successful distance education courses.

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Effects of practice in a linear and non-linear Web-based learning environment

Florence Martin and Jeremy Tutty

Instructional elements remain the foundation of current instructional design practice. Practice is the instructional element provided after learners have been given information required to master an objective and Navigation is the non-instructional element guides the learner on the sequence of instruction. Linear Navigation can be referred to as program control where the learners do not have control over sequence and Non-Linear Navigation can be referred to as Learner control over sequence of instruction.

The purpose of this study was to investigate the effect of practice with feedback, navigation type on achievement, attitude, and time when students use a web-based instructional program and the interaction between practice and navigation type. 240 students from a large south western university participated in four different web based environments. Significant differences were found for practice main effect, but not for navigation main effect. There was no interaction between practice and navigation.

There were significant differences for attitude items, I learned a lot from this program and the program gave me enough opportunity to practice between the treatments who received practice and those who did not. This study reinforces on the importance of practice and has implications for the design and development of web-based, multimedia instruction.

Introduction

Instructional elements

Forty years ago, Robert Gagné published the first edition of his book *The Conditions of Learning* (1965) in which he proposed nine events of instruction that provide a sequence for organizing a lesson. These events remain the foundation of current instructional design practice (Reiser & Dempsey, 2002; Richey, 2000). They represent desirable conditions in an instructional program and increase the probability of successful learner achievement (Gagné, 1965, 1985, 1988; Gagné, Briggs & Wager, 1992). Other authors cite similar elements of instruction that promote student learning from an instructional program (Dick, Carey, & Carey, 2005; Sullivan & Higgins, 1983). Some of the instructional elements that have been suggested by Gagne (1985) and Dick et al. (2005) to promote learning are objectives, practice with feedback, examples and review. Each of these instructional elements is described in the following paragraphs.

Practice and Feedback

Practice involves eliciting performance from learners (Gagné, 1985; Gagné et al., 2005). It is often provided after learners have been given information required to master an objective. Practice provides an opportunity for learners to strengthen new knowledge by internalizing it so they can recall and use it (Foshay, Silber, & Stelnicki, 2003). It helps to confirm correct understanding and repeated practice increases the likelihood of retention (Klein, Spector, Grabowski & de la Teja, 2004; Kruse & Kevin, 1999). Practice is effective when it is aligned with assessment and with the skills, knowledge and attitudes reflected in the objectives (Merrill, 2002; Reiser & Dick, 1996).

Feedback can be defined as "knowledge of one's performance provided" (Delgado & Prieto, 2003, p. 73). Practice provides an opportunity for feedback that confirms the student's answer as being correct or indicates that it is incorrect. Feedback strengthens the probability of correct responses and reduces the probability of subsequent incorrect responses (Philips, Hannafin & Tripp, 1988). Kulhavy & Stock (1989) define feedback as information consisting of two components: verification and elaboration. Verification is the simple, dichotomous judgment that an initial response was right or wrong. Elaboration consists of all substantive information contained in a feedback message.

Researchers have found that practice has a significant effect on performance. Hannafin (1987) reported a significant difference between practiced and non-practiced items on the learning of cued and uncued information presented via computer-based instruction. Phillips et al. (1988) found a significant difference favoring practice over no practice in an interactive video in which practice items were embedded questions. Hannafin, Philips, Rieber & Garhart (1987) noted that practice effects were more pronounced for facts than for applications in computer-based instruction. Participants who received intellectual skills practice in a cooperative learning environment performed significantly better than those who received verbal information practice (Klein & Pridemore, 1994).

Practice provides an opportunity for feedback that confirms the student's answer as being correct or indicates that it is incorrect. This feedback strengthens the probability of correct responses and reduces the probability of subsequent incorrect responses. (Philips et al., 1988). Simple forms of feedback are effective when learners are able to answer items correctly. More elaborate forms such as providing and explaining the correct answer and explaining why a wrong answer is incorrect are helpful when learners answer incorrectly (Kulhavy, 1977). Simple forms of feedback are most effective for simple verbatim and verbal information types of learning (Kulhavy, White, Topp, Chan & Adams, 1985).

Non-Instructional elements

Apart from the instructional elements which Gagne (1985), Dick et al. (2005) have proposed and many researchers have researched on, there are the non-instructional elements such as usability, navigation type, learner control that also influence learning. Researchers have examined the effects of these non-instructional elements such as navigation type (Su & Klein, 2006), personalization (Ku & Sullivan, 2002), animated agents (Atkinson, Mayer & Merrill, 2005) in student achievement and attitudes. As Hannafin (1987) noted, some design strategies may have positive effects when used in isolation that are diminished or negated when these strategies are used in combination with more powerful techniques. The effects of these instructional elements could be enhanced or diminished when used in combination with other variables such as different navigation types, media types.

Linear and Non-Linear Navigation

Linear Navigation can be referred to as program control where the learners do not have control over sequence and Non-Linear Navigation can be referred to as Learner control over sequence of instruction. Hypertext has been defined as an approach to information management in which data is stored in a network of nodes connected by links. Shneiderman defines hypertext as "a database that has active cross-references and allows the reader to "jump" to other parts of the database as desired" (Shneiderman & Kearsley, 1989). Much of the previous research on the effects of navigation tools look at efficiency and effectiveness of hypertext environment (Boechler & Dawson, 2002; Dee-Lucas & Larkin, 1995; Dias & Sousa, 1997; McDonald & Stevenson, 1998). Efficiency measures are based on speed and the number of steps taken to complete an information search. Effectiveness measures focus on the user's search accuracy and the users understanding of the structure of the document (Boechler & Dawson, 2002).

Many of the instructional programs designed to test in computer based instruction were built with Hypercard and Tool book initially and now it is built with Director, Authorware, Dreamweaver and Flash. In general these programs have been linear in format (Freitag & Sullivan, 1995; Schankenberg, Sullivan, Leader & Jones, 1995; Martin, Klein & Sullivan, inpress). These programs do not allow learners to navigate to any screen of their choice except in a linear format. But with the advent of web and the hypermedia structure, programs are now built with the feature such that the users can trace the path they like to within these computer based programs.

Learner control generally increases effectiveness, efficiency, and motivates learners (Reigeluth & Stein 1983). There are no disadvantages against using learner control as long as the control option does not confuse the learners. There are only arguments for and against the degree of learner control. Depover & Quintin (1992) mention that the degree of learner control depends on variables like age, previous knowledge, learning progress, complexity of material and familiarity with the subject. Some of the other variables that influence the degree of learner control are prior knowledge, student strategy and ability, learning progress, complexity of material and familiarity with the subject (Depover & Quintin, 1992; Hannafin, 1984; Milheim & Martin, 1991; Steinberg, 1989).

Purpose of Current Study

In the previous studies conducted by the author (author, (2007); author, inpress), the learners did not have control on the sequence of the instruction in the program and had only linear navigation (program control). Hence in order to answer the questions of the effects of the instructional element practice with feedback when learners had control (non-linear navigation) and learners had no control (linear navigation), this study was proposed. The IPSO instructional program with the same instructional content but with the changes to the navigation links was used in this study.

The purpose of this study was to investigate if a) the presence or absence of practice in a web based lesson had significant effect on student achievement, attitude and time b) if the navigation types which provided control over sequence of the instructional element (Linear, Non-Linear) had a significant effect on student achievement, attitude and time and c) if there was any interaction between practice and navigation type. The elements investigated in the study, practice with feedback, and linear and non-linear navigation type were combined into four different versions of web based programs in a manner that permitted investigation of the effectiveness of the program when practice was present and absent for both linear and non-linear navigation types.

The primary research questions for this study are listed below.
1. What is the effect of practice with feedback on achievement, attitude, and time when students use a web-based learning environment?
2. What is the effect of navigation type (linear and non-linear navigation) on achievement, attitude, and time when students use a web-based learning environment?
3. Does practice and navigation type (linear and non-linear navigation) interact to influence achievement, attitude and time?

The researchers anticipated that the combination of practice and linear navigation would have higher student achievement while practice with non-linear navigation would have higher student attitude.

Method

Participants

Participants were 240 freshman and sophomore undergraduate students enrolled in a computer literacy course at a large Southwestern University. 60 students participated in each treatment. The students enrolled in this course had varied background knowledge on computers and were from different majors including education, communication, journalism and others. Students participated in this study as part of the course requirement and the score in the post test was part of their course grade.

To avoid the variation in treatments with in the class (practice, no practice, linear navigation, and non-linear navigation), the students from were assigned to the treatments by classes and not by individual. The classes were randomly assigned to one of the four treatments based on the pretest average scores. It was a quasi-experimental study due to this nature of assignment to the treatments. This was one of the limitations to the study but helped to avoid differences in content, attitude or time spent on the program between the students enrolled in the same class.

Materials

Four different versions of a web-based lesson on the topic *Input, Processing, Storage and Output of a Computer (IPSO)* were developed using Dreamweaver. IPSO explains the primary operations of the computer which are Input, Processing, Storage and Output. An introduction section was included before the primary operations were explained in detail. This section introduced what a computer is and classified it based on size, power and generation. It also explained the IPSO cycle. The next four sections described the concepts of the Input, Processing, Storage and Output operations in a computer and explained the function of the different components associated with that operation. The content used in this study was part of the required content for the course. The web-based lesson was pilot tested with five students before it was used in the study.

The four different versions of instructional program were as follows:
1. Program with Practice and using Linear Navigation (Program control)
2. Program with Practice and using Non-Linear Navigation (Learner Control over Sequence)
3. Program without Practice and using Linear Navigation (Program Control)
4. Program without Practice and using Non-Linear Navigation (Learner Control over Sequence)

Practice Screens.
      The first two programs had practice screens in the program and it provided students with an opportunity to practice the content they were learning. There were a total of five practice screens, each of which contained five four-choice multiple-choice questions. The student received immediate feedback after each response to a practice item. Students had the option to practice until they got the right answer. One practice screen was presented after each information screen. One example from the five items on a practice screen is shown in Figure 1 and Figure 2.
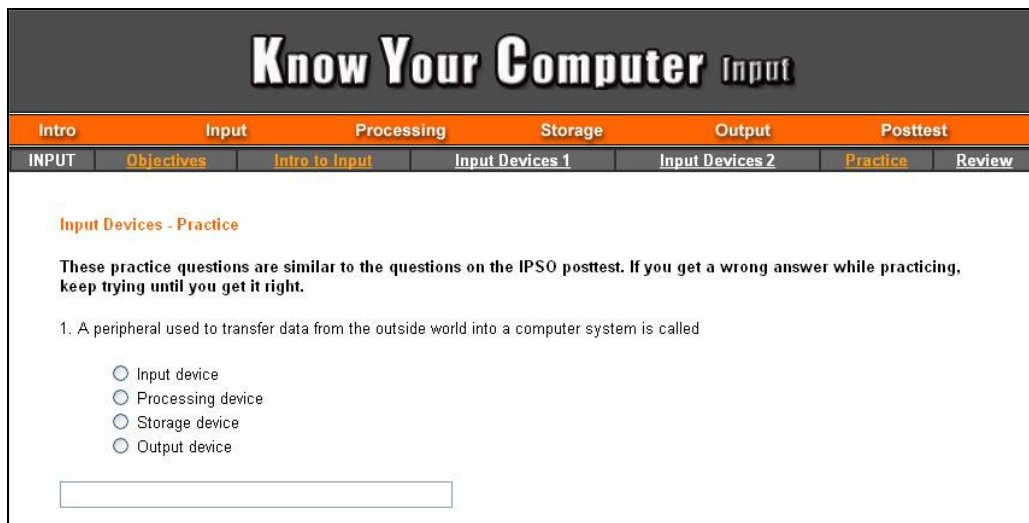

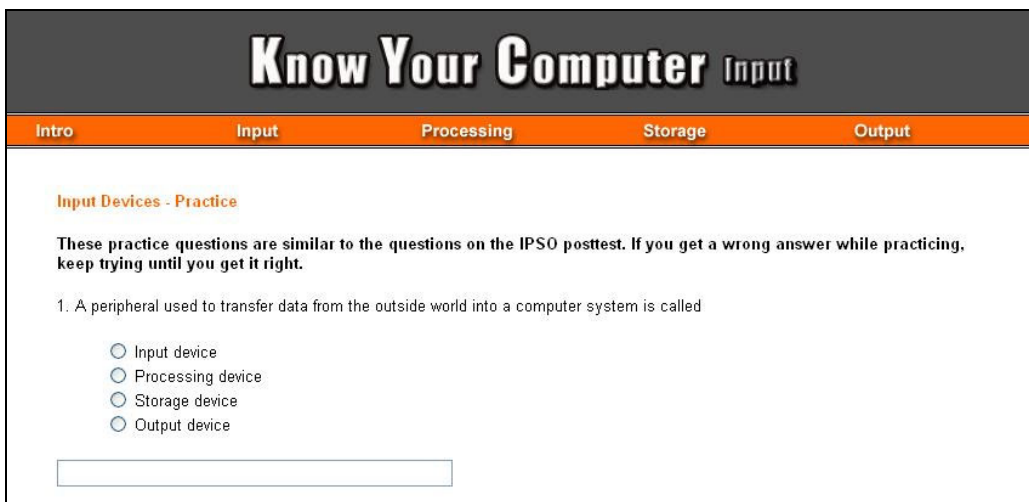Figure 1: Practice screen in the non-linear navigation program

Figure 2: Practice screen in the linear navigation program

Procedures

      Eighteen sections of students (n = 240) enrolled in the computer literacy course were blocked by classes and randomly assigned to the four treatment groups. The pretest, which took approximately 15 minutes to complete,

was administered a week prior to the study. The classes were blocked into four groups based on their mean pretest scores, and one class within each block was assigned to each of the four treatments.

The participants used the web-based IPSO lesson during the sixth week of the semester. Participants met in a regular computer lab for instruction and were directed by the instructor to the web address for the instructional program. Each class was routed directly to its treatment version of the program. Students worked through the program at their own pace, averaging approximately one hour. Then they took the posttest and the attitude survey online. All six treatment groups followed the same procedure. Thus, the experimental differences in treatments occurred exclusively in the materials themselves and not in the procedure.

Criterion Measures

The criterion measures consisted of a posttest and a student attitude survey. In addition, a pretest was used to assess subjects' knowledge of the content prior to the instruction.

Pretest. The pretest consisted of 20 multiple-choice questions covering the content with four response choice questions. The overall mean score on the pretest was 8.38 or 42%, indicating that participants were not very knowledgeable about the content prior to instruction.

Posttest. The posttest consisted of the same 20 multiple-choice questions that were on the pretest. The reliability of the posttest was .65. The item analysis done on the posttest revealed that question 17 was the most difficult with a difficulty level of .42, question 3 was at .60, followed by question 1 and 2 at .62 and .63. The rest of the questions difficulty level varied between .70 and .99.

Attitude Survey. The attitude survey assessed student attitudes towards the instructional program and the presence or absence of the instructional events. The survey included 12 Likert-type questions that were rated strongly agree (scored as 4) to strongly disagree (scored as 0). The survey also included two open-ended questions that asked the participants what they liked best and least about the program. The survey was administered after the lesson and the posttest were completed. The reliability of the attitude survey was .83.

Data Analysis

A 2X2 analysis of variance (ANOVA) test was conducted on data obtained from the achievement posttest and on the total time spent on the program. The attitude survey results for the Likert type items (Items 1-6) was analyzed using a 2X2 ANOVA. All analyses revealed significant differences.

Results

Achievement

The first research question investigated the effects of practice and navigation type on student achievement. Table 1 shows the mean scores and standard deviations for achievement on the pretest and posttest by treatment. The average pretest score was 8.46 (SD = 2.26) and posttest score was 15.91 (SD = 2.92). Participants who received practice and linear navigation scored the highest on the posttest (M=17.14) and those who received no practice and had non-linear navigation scored the lowest (M=14.78) on the posttest.

A 2X2 ANOVA conducted on the pretest data revealed no significant difference for practice main effect, navigation main effect or interaction. 2X2 ANOVA conducted between the treatment groups on the posttest revealed a significant practice main effect, $F_{(1, 196)} = 22.388$, $p < 0.01$. Thus, there was a significant difference between the groups that received practice and no practice. Those who had received practice (M=16.84) performed significantly higher on the posttest compared to those who did not receive practice (M=14.98). However, there was no significant difference for those who had control over the instruction using the Linear navigation (M= 15.66) and Non-Linear navigation (M=16.16). There was also no significant interaction between practice and navigation type.

Table 1: Means and Standard Deviations (SD) for Posttest scores by treatment

Treatment	Pretest			Posttest		
	Linear Navigation Mean (SD)	Non-Linear Navigation Mean (SD)	Total	Linear Navigation Mean (SD)	Non-Linear Navigation Mean (SD)	Total
Program with Practice	8.24 (2.75)	8.50 (2.32)	8.37 (2.53)	17.14 (1.92)	16.54 (3.42)	16.84 (2.77)
Program without Practice	8.62 (2.60)	8.48 (2.21)	8.55 (2.40)	15.18 (2.81)	14.78 (2.77)	14.98 (2.78)
Total	8.43 (2.66)	8.49 (2.25)	8.46 (2.26)	16.16 (2.59)	15.66 (3.22)	15.91 (2.92)

Attitude

The next research question dealt with the effects of practice and navigation type on student attitudes. Table 2 shows means for responses to the 6 Likert-type items on the attitude survey. The items were rated on a 5 point Likert scale from strongly agree (N= 4) to strongly disagree (N=0).

Table 2 Means for Attitude survey by treatment

Treatment	Program with Practice			Program without Practice		
Attitudes Items	Linear Navigation Mean (SD)	Non-Linear Navigation Mean (SD)	Total	Linear Navigation Mean (SD)	Non-Linear Navigation Mean (SD)	Total Mean (SD)
1. I learned a lot from this program.	3.32 (.587)	3.22 (.648)	3.27 (.617)	3..06 (.620)	3.12 (.659)	3.09 (.637)
2.The overall quality of the program was good	3.36 (.525)	3.26 (.600)	3.31 (.563)	3.26 (.600)	3.22 (.507)	3.24 (.553)
3. I would recommend this program to other students	3.22 (.648)	3.10 (.678)	3.16 (.662)	3.04 (.676)	2.94 (.586)	2.99 (.631)
4. I would enjoy using other computer programs like this one in future lessons	3.00 (.736)	3.04 (.755)	3.02 (.742)	2.96 (.735)	2.94 (.712)	2.95 (.720)
5.The program gave me enough opportunity to practice what I was learning	3.20 (.639)	3.26 (.694)	3.23 (.664)	2.56 (.760)	2.40 (.782)	2.48 (.772)
6.The program gave me enough control to move around the program.	3.22 (.616)	3.36 (.663)	3.29 (.640)	3.12 (.718)	3.30 (.544)	3.21 (.640)
Total	3.22	3.21	3.21	2.99	2.99	2.99

A MANOVA conducted on the overall attitude data revealed a significant difference on the 6 attitude questions, $F_{(18, 535.06)} = 4.33$, $p < 0.01$. Follow-up 2x2 ANOVA conducted on the attitude data indicated significant differences for items 1(I learned a lot from this program) and 5 (The program gave me enough opportunity to practice) between the treatments who received practice and those who did not. No items showed

significant difference for the navigation type (linear versus non-linear navigation). There was no interaction between practice and navigation type on the attitude data. For both the above items that had practice main effect, the participants who received practice had rated it significantly higher than those who did not receive practice.

The attitude data also showed that participants who used the program with practice had higher attitudes and had rated higher on all the six items compared to those who did not receive practice. Item 2 "The overall quality of the program was good" was the rated the highest (M = 3.28) by both the practice and no practice group. Those who did not receive practice recognized the absence of practice in their programs and rated item no 5 "The program gave me enough opportunity to practice what I was learning", the lowest (M = 2.48). There weren't much difference in attitudes of the participants when comparing the navigation method they received and were almost equivalent in their ratings based on navigation.

The attitude survey also included two open-ended questions that asked the participants what they liked the best and least about the program. The four most frequent responses for what participants liked the best in the program were (1) the practice questions (n=65) (2) clear navigation and structure (n=45) (3) the review section (n=43) (4) graphics, animations and visuals (n=34) (4) Highly informative (n=30). The most frequent response for what parts liked the least were (1) Very long program (n= 36) (2) Lot of information (n=23).

Time

Table 3: Means and Standard Deviations (SD) for Time spent in minutes by treatment

	Time		
Treatment	Linear Navigation Mean (SD)	Non-Linear Navigation Mean (SD)	Total
Program with Practice	35.98 (13.59)	35.14 (18.84)	35.56 (16.34)
Program without Practice	31.00 (13.15)	31.66 (16.19)	31.33 (14.68)
Total	33.49 (13.53)	33.40 (17.56)	33.44 (15.64)

On calculating the time spent in the program, there were no significant differences between the groups based on practice and navigation. Those who received practice spent more time on the program (M = 35.56) than those who did not receive practice (M = 31.33), but there were no significant differences. Both the navigation types, linear (M=33.49) and non-linear (M=33.40) spent about the same amount of time in the program.

Discussion

This study examined the effects of Practice and Navigation type (Linear and Non-Linear) on achievement, attitude and time. College students enrolled in a computer literacy course used a web-based lesson delivered on the web to learn about input, processing, storage and output of a computer (IPSO). The computer based lesson included multiple choice practice items and two types of navigation (Linear, Non-Linear). Linear navigation directed them from one page to the next where as in Non-Linear navigation they had the freedom to navigate in any path. They had control over the sequence of instruction. Results indicated that there was a significant difference between the groups that received practice and no practice, but there was no significant difference in Linear and Non-Linear navigation. There was no significant interaction between practice and navigation type.

Achievement

Practice resulted with a significant difference both in achievement and in attitudes. Practice provides an opportunity for learners to confirm their correct understanding, and repetition increases the likelihood of retention of new knowledge (Kruse & Kevin, 1999). In this web-based lesson, participants who received practice were also given feedback which confirmed the student's answer as being correct or indicated that it was incorrect. This feedback strengthens the probability of correct responses and reduces the probability of subsequent incorrect responses. (Philips, Hannafin & Tripp, 1988). The confirmation of the answer during practice increased the likelihood of retention of the content. Presence of practice results in interaction between the lesson and the learner. It is effective in performance when it is aligned with the assessment in the form of a posttest and with the skills, knowledge and attitudes reflected in the objectives (Reiser & Dick, 1996). In this web-based lesson, practice was directly aligned with the posttest and with the information presented. The findings of the current study is consistent with previous research on computer based instruction that found practice had an effect on learning (Hannafin, 1987; Hannafin & Tripp, 1988).

Navigation types (linear, non-linear) did not result in a significant difference. This could have been due to the fact that even though the non-linear treatment had the flexibility to take any path that they decided, the computer based lesson was well structured and organized. The lesson was designed using all the instructional elements and was instructionally aligned from objectives to assessment. The results could have been different, if the instructional material was not well structured and did not have the other instructional elements or instructional alignment. Though there was no significant difference, participation of the linear navigation program scored higher than the participants of the non-linear program.

Participants who received practice and linear navigation scored the highest on the posttest and those who received no practice and had non-linear navigation scored the lowest on the posttest. When enough of structure is provided and the instructional material is well designed, the students do better when the navigation is linear and they are forced through every screen where they learn from every instructional element such as objective, practice, feedback and review. The absence of the instructional element practice and non-linear navigation resulted in the lowest posttest scores.

Attitude

The attitude survey had 6 Likert-type items. Participants who received practice in their computer lessons had higher attitudes compared to those who did not receive practice. Those who received practice had an opportunity to interact with the web-based lesson and it helped them perform better and have higher attitudes. Higher attitudes of the participants who received practice could have been due to the feedback they received during practice, which strengthened the probability of correct responses and reduced the probability of subsequent incorrect responses. The attitude results remained consistent with the achievement results.

Item 1 "I learned a lot from this program" and Item 5 "The program gave me enough opportunity to practice what I was learning" resulted with significant differences between the treatments which received practice and which did not receive practice. The significant difference on item 5 (The program gave me enough opportunity to practice what I was learning) reveals that the participants realized the presence of practice in their computer based lessons. And also on item 1 (I learned a lot from this program), those who received practice had higher attitudes that they had learned a lot from the program. The presence of interactive well aligned practice items, which provided feedback and corrected their understanding of the concepts, must have been the reason for them to state that they had learned a lot from this program. Item 6 "The program gave me enough control to move around the program" which is about the navigation aspect of the program did not result in significant differences. Thus both in attitudes and achievement, there was significant differences for the presence of practice but not for navigation type.

In the open ended section, practice topped the list for what the participants liked the best about the program and was followed by the clear structure and navigation. It can be noted that participants realized that practice made a difference in the program. We may not have had a significant difference in the navigation types, but from the open ended question it is shown that students were aware of the structure and navigation used in the program and had rated it as the second best feature in the program.

Time

Time did not result in any significant difference for both practice and navigation type. Though the participants in the practice treatment spent longer time in the program, it was not significantly different from the treatment who did not receive practice. But the time spent by both the navigation types were almost the same. Participants in the linear navigation treatment spent (M=33.49) minutes and those in the non-linear navigation treatment spent (M=33.40) minutes. This shows that the different navigation types did not matter in regard to time spent.

Conclusion

This study has once again reinforced the importance of practice in web based/computer based lessons. It once again confirmed Practice to be effective in help in student achievement and attitude. If the lesson is instructionally sound with important instructional elements such as practice then irrespective of the non-instructional element such as navigation type, learners have high achievement and attitudes. It also showed that when the lesson is well structured then the effect of navigation is not seen.

This study has implications to the design and development of web-based instructional material. Practice is an effective instructional element for enhancing student achievement. This suggests that it should be included in web-based instruction especially when students are tested using items aligned with the objectives and practice items. We also recommend including different types of practice items. In this study, multiple choice practice items with immediate feedback to students were included. Also, the content was more on learning facts and concepts. Future research should focus on variation in the instructional content and the type of practice and feedback involved. Additional research should examine how instructional elements in computer-based instruction influence outcomes such as problem solving and complex learning tasks. As was done in this study, research in these settings should include measures of student achievement, attitudes and time. Further studies can be conducted to test the effectiveness of the other instructional elements such as objectives, examples, and review along with the different non-instructional elements such as intelligent agents and other usability elements including navigation types. It will be helpful to measure the practice scores and their correlation to the posttest scores. Studies of this nature will continue to inform designers about the influence of instructional elements on learning and performance.

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Open and Distance Learning Opportunities
and e-Learning Services in Turkey

M. Emin Mutlu

Abstract

This study analyzes the open and distance learning opportunities at various levels starting from primary education to bachelor's education offered to individuals having needs for education and tries to determine the potential for using e-Learning in the Turkish open education system as a whole evaluating the e-learning experiences at Anadolu University Open Education System between 1999-2007.

Key Words: open and distance education, e-learning

Introduction

Open education is one of the ways of offering equal opportunity in education to people who cannot find the opportunity to get face-to-face education for different reasons. People may prefer open education because they are working, they have physical disabilities, they are imprisoned, they cannot leave their home because there maybe people they are responsible for caring, they do not meet the age criteria put by traditional universities, they are doing their military service, or because of low income. In addition, housewives, the ones who would like to get a second degree, and the ones who live abroad prefer open education.

Since students at open education system may not participate in traditional face-to-face education, the most frequently used teaching method that is used in the open education is 'distance education'. The distance education was based on teaching via letter and newspaper many centuries ago, and technologies such as telephone, radio, and cinema were also used in this century. Education via television made Open Education famous today, and new distance education establishments were created in 1980's in many countries using the experiences of the Open Education of England, which was opened in 1960's.

Turkish National Education System

The Turkish National Education System is composed of four steps as the pre-school teaching for 0-6 age group, primary education for 6-14 age level, high school for 14-18 age group and higher education for the age of 18 and above. The primary education, which lasts five years, was obligatory to 1997, and since 1997 the length of the obligatory education has become eight years for 6-14 age level. The length of high school was increased three years to four years in 2006 (OSYM, 2007) (Fig. 1).

Institutions Offering Open and Distance Education in Turkey

The open education system in Turkey has been started by the Anadolu University as a central application in Higher Education in 1982. In the first year, 29.000 students were enrolled in two programs, and today, students are accepted to 15 associate degree and 7 graduate level programs on the basis of students' grades in the open education system. 1.100.000 students are enrolled in the Anadolu University Open Education system, and more than 900.000 of those students are active. More than 45% of those students study in the Anadolu University.

The right to offer open education in Turkey at associate and bachelor's level in from a specific center has been given to Anadolu University. Anadolu University offers this service via three faculties and a center (AU, 2007).

- Open Education Faculty (Open Associate and Open Bachelor's Degree)
- Faculty of Business Administration (Open bachelor's education)
- Faculty of Economics (Open Bachelor's Education)
- Applied Research Center for Continuous Education (Open e-Certificate Education)

The Open Education High School system was started in 1992 by the Ministry of National Education (MNE) for students who are above the secondary education age. Today, the open high school has more than 300.000 students and more than 275.000 of them are active. The Open Primary School system was started by the Ministry

of National Education in 1997 for the ones who could not complete their primary education and adults who are above the compulsory primary education age level so that they can receive education everywhere and in all circumstances through distance education principles and techniques. The Open Primary School has more than 250.000 students, of which more than 100.000 are active. The basic instructional materials in the Open Primary School and Open High School that depend on the Ministry of National Education are the course books and television/radio programs. The Vocational Open Education High School that use distance education and face-to-face education methods has been started by the MNE in 2006 and today more than 78.000 students are enrolled in Industrial Vocational High Schools, Imam and Preachers' High School, Vocational Girl's High School and Trade Vocational High School. The MNE Vocational and Technical Open Education School was established in 1974 and offers distance education for certificate. Nearly 70.000 individuals graduated from the Vocational and Technical Open School have been given a document stating that they are authorized to work as electricians (MNE, 2005, 2007).

Figure 1. Turkish National Education System
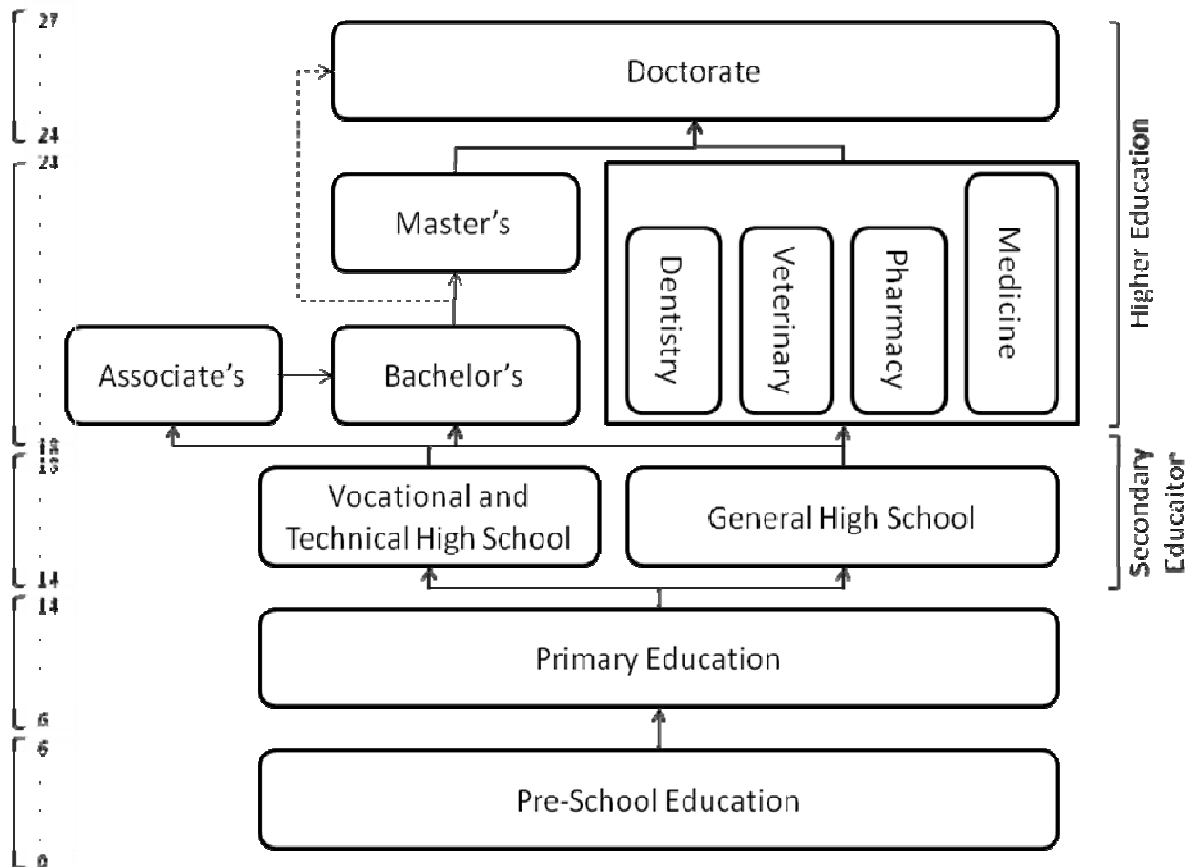
The open education institutions within the MNE are conducted by the General Directorate of Educational Technologies (EGITEK, 2007) (Fig. 2).

The aim of the Turkish National Open Education System is to offer education from primary education to bachelor's education mostly to individuals who could not be involved in the on-campus education system or who were excluded from the system.
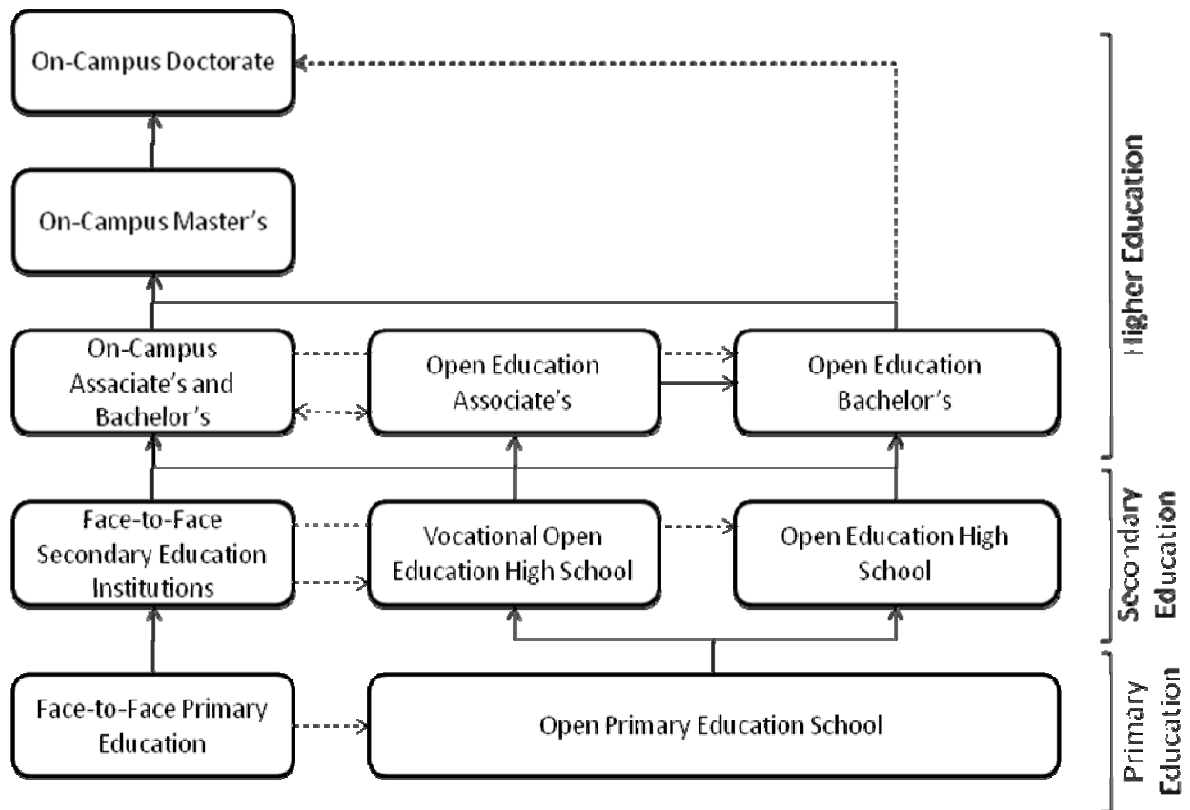
Figure 2. Turkish National Open Education System

Other than the Open Education System, 8 universities in Turkey have Internet-based associate degree, bachelor's degree, and master's degree programs. Those schools are inspected by the Distance Education Commission within the Higher Education Council. Since the acceptance terms for those programs are the same as the acceptance terms for face-to-face programs and the education is offered according to the laws for face-to-face education, they cannot offer a real open education. Therefore, they are not included in the scope of this study.

- Anadolu University (1 Associate, 3 Master's programs)
- Middle East Technical University (1 Master's programs)
- Sakarya University (5 Associate, 1 Master's programs)
- Mersin University (4 Associate programs)
- Çukurova University (1 Associate program)
- Gazi University (2 Associate programs)
- Maltepe University (3 Associate, 1 Master's programs)
- Bilgi University (1 Master's program)

Options for Entering to the Open and Distance Education

In Turkey, individuals are offered open education at primary, secondary and higher education levels. Acceptance to the Open Primary and Secondary Education are supervised by the MNE and acceptance to the Open Higher Education is conducted by the Student Selection and Placement System (SSPS) organized by the Student Selection and Placement Center (OSYM, 2007). Two types of placements are available for the SSPS open education programs: a) Graduates of the vocational and technical high schools can be placed to the open associate degree programs related to their field without taking any exams. b) Individuals receiving 160 score and more in the Student Selection Exam can be placed into any open associate and bachelor's program without any quota. The ones who cannot be placed into any program by the Student Selection and Placement System can be enrolled in Open Education e-Certificate programs and receive education to get a certificate.

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There are five ways of being accepted to the open education in Turkish education system.

1. Individuals who could not complete their face-to-face primary education can go to the open primary school.
2. Individuals who completed their primary education can go to the open education high school or vocational high school.
3. High school graduates and individuals who could not be placed into a higher education program by the Student Selection and Placement System can be enrolled in open e-certificate programs.
4. High school graduates and the ones who obtain 160 or higher score in the Student Selection Exam can be placed to an open associate degree or bachelor's degree program. The ones placed to the on-campus associate degree or bachelor's program can transfer to the open education system through "vertical transfer", "bachelor's degree completion", or "second university" opportunities.
5. Graduates of vocational and technical high schools can be placed to the open associate degree programs by the SSPS. The ones placed to the on-campus associate degree programs without taking an exam and having sufficient requirements can transfer to the open education system through "vertical transfer", "bachelor's degree completion" and "second university" opportunities.

The road maps offered to individuals to enter to the open education system are explained in the following sections.

Open and Distance Education Opportunities for Individuals Over 15 Year of Age

Individuals who could not continue their education after the first five years or who could not complete their face-to-face education can register in the 6th, 7th or 8th classes of the Open Primary School. The ones who complete the Open Primary School receive a primary school diploma. They obtain the right to go to the Open Education High School and Vocational Open Education High School (Fig. 3).

Figure 3. The open and distance learning opportunities for individuals over 15 year of age.

Individuals having the qualifications below can apply for the Open Primary School (OPS, 2007).
- Individuals who started the age of 15;
- 5-Year programmed primary school graduates,
- Individuals who finished the 5th class of the primary schools and who left from the 6th, 7th or 8th class,
- Adults who completed reading-writing courses of the public education centers,
- The ones studied abroad and having equivalence for the 6th, 7th or 8th grade.
- If they meet one of the conditions mentioned above, the ones who prove that they are imprisoned or physically handicapped and the ones who prove that they need special education through a document that can be received from the Special Education Services Committee can apply.

Open and Distance Learning Opportunities for Individuals Who Completed Their Primary Education

Individuals who cannot receive face-to-face education in secondary education institutions can register in the Open Education High School, Vocational Open Education High School or Vocational and Technical Open Education School. The ones graduated from the Open Education High School are considered as the graduates of a general high school, and graduates of the Vocational Open High School are considered as if they graduated from a vocational high school (Fig. 4).
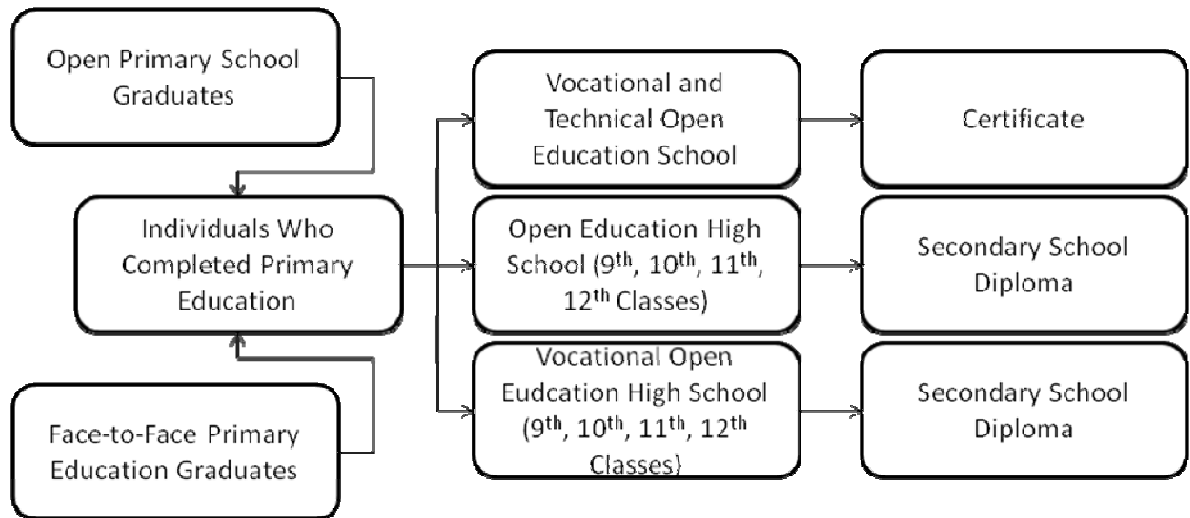
Figure 4. Open and Distance Learning Opportunities for Individuals
Who Completed Their Primary Education

Individuals having the following qualifications may apply for the Open Education High School (Grades 9, 10, 11, 12) (OEHS, 2007)

- Graduates of primary school/secondary school,
- The ones who left from the general high school programs within MNE or other ministries,
- Individuals who left from Anatolian Fine Arts High School, Sports High School, and Social Sciences High School,
- Individuals studied abroad and having the requirements mentioned above.

Individuals having the following qualifications can apply for a Vocational Open Education High School (grades 9, 10, 11, 12.) (VOEHS, 2007).

- Primary/Secondary school graduates,
- Individuals who left from secondary schools within MNE or other ministries or graduates of those schools.
- Individuals who studied abroad if their education level stated on the equivalence document meets one of the conditions mentioned above.

Vocational and Technical Open Education School (VTOES, 2007)

- It is an institution that teaches professions to individuals graduated from a primary school or higher level schools and that uses distance education or face-to-face education when necessary.

Open and Distance Education Opportunities Offered to High School Graduates and Who could not be placed to Higher Education by SSPS

Graduates of general high schools or vocational and technical high schools can be accepted to open e-Certificate programs organized three times a year and taught using distance education methods if they cannot be placed to university as a result of the centrally conducted student selection and placement exam (ECP, 2007) (Fig. 5).
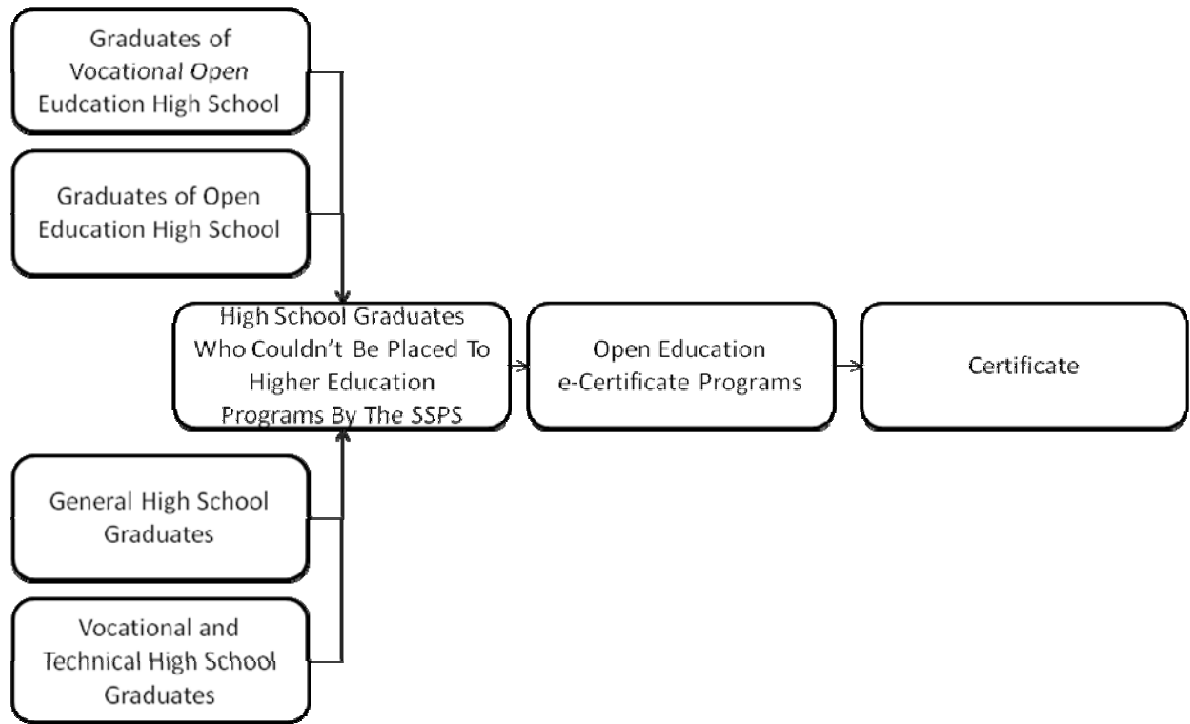
Figure 5. Open and Distance Education Opportunities Offered to High School Graduates
and who could not be placed to Higher Education by SSPS

Anybody possessing a secondary school or higher level diploma can apply for the open education e-certificate programs. Twenty-two certificate programs are available for the time being.

Open and Distance Learning Opportunities for High School Graduates and Individuals Placed to a Higher Education Program by SSPS

Graduates of open general or vocational and technical secondary school and who receive at least 160 score and higher in the SSE (student selection examination) conducted by the SSPS can be placed to open associate and bachelor's degree programs. The ones who have been placed to face-to-face associate degree or bachelor's degree programs can transfer to open education thanks to 'vertical transfer in open education', 'bachelor's degree completion in open education' and 'second university in open education' opportunities.

Those individuals are offered different opportunities depending on whether they are placed to open or face-to-face programs or open vocational or bachelor's degree programs by the SSPS. Those opportunities are examined in the following sections (Fig. 6).
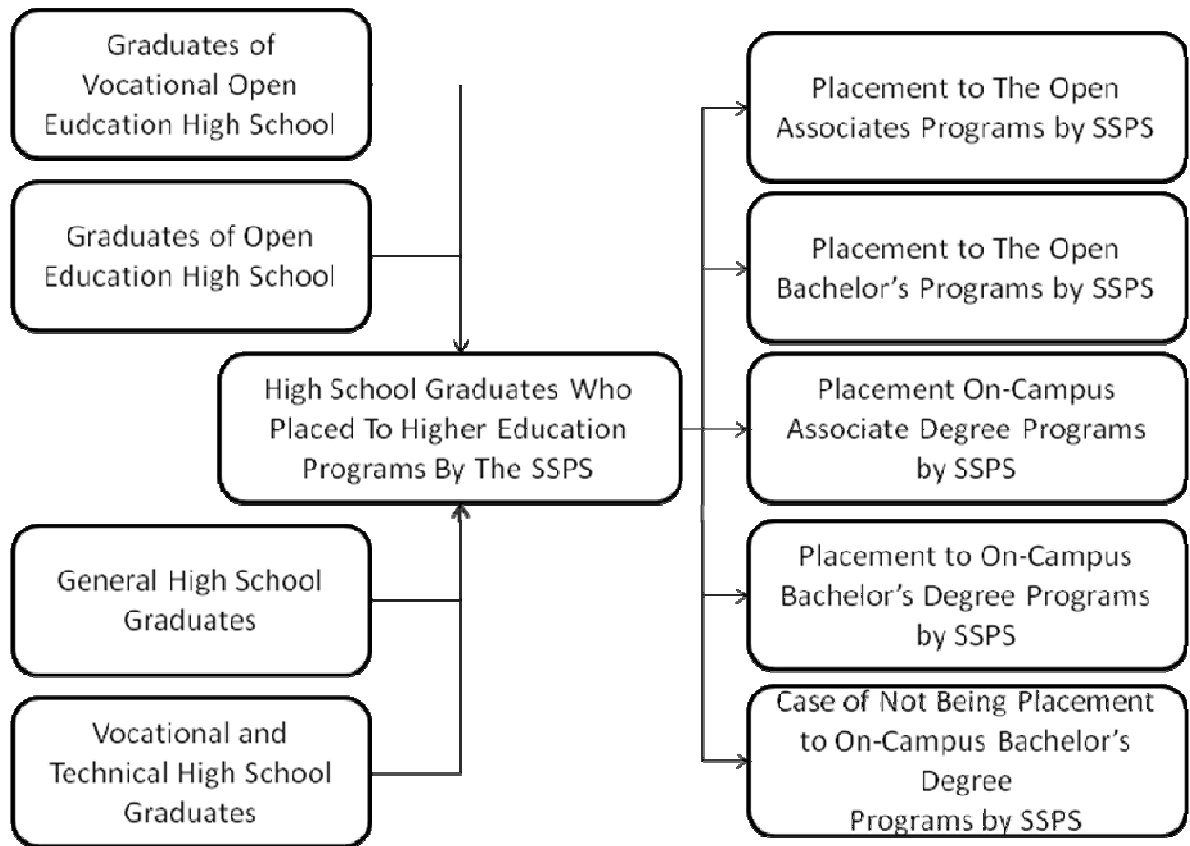
Figure 6. Open and Distance Learning Opportunities for High School Graduates and
Individuals Placed to a Higher Education Program by SSPS

a) Placement to the Open Associate Programs by the SSPS

In the 2007-2008 academic year, students are accepted to 15 open associate degree programs via the SSPS.

Individuals placed to those programs receive an associate degree diploma when they complete those programs. Those graduates can register in an open bachelor's degree program suitable to them trough vertical transfer opportunity and either directly continue the program or after studying one year in the preparatory class.

Vertical transfer to the Open Education System is realized without taking an exam. Open education students can continue to the on-campus bachelor's degree programs if they obtain a required score in the vertical transfer exam. In this study, the priority is given to the open education opportunities offered to individuals and hence not all the on-campus education opportunities are examined.

b) Placement to the Open Bachelor's Degree Programs by the SSPS

In the 2007-2008 academic year, students will be accepted to 7 open bachelor's program.

Individuals who completed the first two years of the open education bachelor's degree programs and left the program can find the 'bachelor's degree completion' opportunity. This bachelor's degree completion is available for many associate degree programs. Individuals completing the first two years of the universities offering face-to-face education and leaving the program after receiving an associate degree diploma can complete their 'bachelor's degree' in the open education system.

Individuals can obtain a bachelor's degree via either vertical transfer or bachelor's degree completion.

c) Placement to the On-Campus Associate Degree Programs by the SSPS

Individuals placed to an on-campus associate degree program can register in the open bachelor's degree programs thanks to the 'vertical transfer' opportunity after completing the program and receive an associate degree diploma. While studying in an associate degree program or after their graduation from such a program, individuals can enroll in open associate degree programs and can enroll in an open bachelor's degree program via vertical transfer after completing the program.

d) Placement to the On-Campus Bachelor's Degree Programs by the SSPS

Individuals who are placed to an on-campus bachelor's degree program can register in open bachelor's degree programs after receiving their associate degree diploma after completing the first two years thanks to "bachelor's degree completion in open education" opportunity. While they are studying in a face-to-face bachelor's degree program or after graduation, individuals can register in open associate or bachelor's degree programs thanks to "vertical transfer in open education" or "bachelor's degree completion in open education" opportunities.

e) Case Of Not Being Placed To On-Campus Education Institutions By The SSPS

Candidates who could not be placed to face-to-face programs by the SSPS can be accepted to a program they like if there is free place offered by SSPS. Additional placement can be done to the open education programs without quota restriction. People can register in an open associate degree or bachelor's degree program using this opportunity

Open and Distance Learning Opportunities Offered To Vocational and Technical School Graduates

Graduates of vocational and technical schools are placed to an associate degree program in their field in the Anadolu University Open Education System without taking an examination, which is an application organized by the SSPS (Fig. 7).
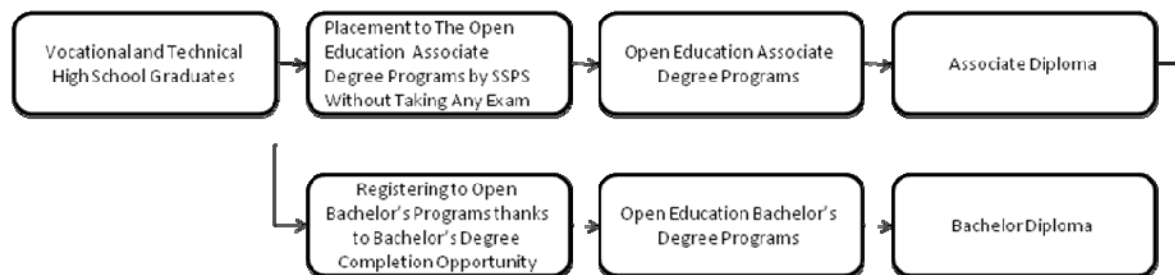

Figure 7. Open and Distance Learning Opportunities Offered To Vocational
and Technical School Graduates

Individuals who completed the open vocational school can transfer to an open bachelor's degree program using the 'vertical transfer in open education' opportunity.

Thanks to all these opportunities, people who could not start or complete their face-to-face education can get the opportunity to complete their education. Individuals who complete their education thanks to open education can continue their face-to-face education at a higher level if their success level is enough. The ones who cannot manage to pass to face-to-face education can continue to study through open education until they receive a bachelor's diploma. Individuals receiving a diploma from an open bachelor's program have the right to enter a face-to-face master's or doctoral program if their success level is sufficient. Opportunities such as "additional placement to open education programs by SSPS", "Transfer to open education programs without examination by SSPS", "vertical transfer in open education", "bachelor's degree completion in open education" and "bachelor's degree completion in open education" and "second university in open education" adds flexibility to Turkish Open Education System and enhances the transfer opportunities between face-to-face education and open education.

e-Learning in Open Higher Education

The initial design of the open higher education system of the Anadolu University includes five components i.e., course books designed according to distance education techniques, instructional programs broadcasted in the national television channel, face-to-face academic facilitation courses given at evenings and week-ends, central examinations organized simultaneously in all cities, and bureau services offered to students. Since 1999 a series of e-learning services has been designed and offered to students in the Internet environment. The first service in the Internet environment was the trial exams composed of randomly chosen questions. This service later was entitled as e-Exam. Then e-Practice materials, interactive multimedia software, including text, picture, animation, and voice, have begun to be offered. The following service was e-Book that was actually electronic copies of the course books published on the Internet. The e-Television service, i.e., publishing the digital video files of the instructional programs that are published on the Internet, has begun as a result of the developments in the Internet infrastructure in the country and increase in the number of students having broadband Internet access. In the following period, e-Consulting service that allowed students ask questions to the subject area specialists and receive reply asynchronously was offered. In the same period, the e-Audio Book service, which means publishing radio-phonically vocalized digital audio files of the course books on the Internet, has begun. For all those services, the e-Support application that allows students to get help from experts about technical problems via the Internet has been put into practice. Those services that were developed by different teams at different times were combined under the name of Open Education e-Learning Portal in 2005. This allowed students to access all services once they log in. In 2006, a multimedia e-Course design that included text, picture, animation, voice, and video has developed and courses have begun to be developed according to this design for large number of students. Video presentations based on the Flash Video technology are used in this design that requires a larger Internet band width than other services (Mutlu and Ozkul, 2006).

Various e-learning environments have been designed for each course in the Anadolu University, Open Education e-learning system and hence students having different learning styles are offered different options so that they can use the most suitable learning environments for their needs. Such an approach allows creating teams having different types of production processes and allows those teams to design and develop various learning environments that are parallel to each other.

Although it was not compulsory students use the Anadolu University e-Learning Portal frequently. In the e-learning portal where more than 2 million students including graduates have the right to log in using their TR identity numbers, more than 635.000 different students logged in more than 19, 5 million times between May 2005-September 2007. During this time period, 1.146 million hits and 163 TB data transfer occurred. The average visit time was observed as 26 minutes. Research shows that students using e-learning services are more successful than the ones who do not use it.

Anadolu University e-Learning Portal is the largest portal of Turkey in terms published content and the copy right of the content belongs to the university, in terms of the number of users accessing this content and in terms of the number of access. Anadolu University owns the server and band width infrastructure that is able to offer those services to 50.000 students at any time and 500.000 different students in a day. This capacity is expected to double in one year.

e-Learning in Open Primary School and Open High School

e-Learning services belonging to Open Primary School, Open High School, Vocational Open High School and Vocational Technical Open School is offered by EGITEK unit which has been found for this purpose by the ministry. EGITEK prepares the following e-learning materials for students enrolled in Open education institutions within the ministry (EGITEK, 2007).

- PDF files of the courses are accessible on the Internet.
- Television-radio programs are sold in cassette and CD format.
- Television programs are published on the Internet via the Internet-TV service.
- Radio programs are broadcast on the Internet via the Internet-Radio service.

Anadolu University and Ministry of National Education should coordinate so that e-Learning experiences of Anadolu University are evaluated by the MNE and for the production of e-Courses for MNE open education institutions and for the design of projects to deliver those courses via a learning management system.

Conclusion

In the open education system of Anadolu University 1.100.000 students are offered e-Exam, e-Book, e-Television, e-Practice, e-Facilitation, e-Support, and e-Voiced Book services while 628.000 students in the MNE open education schools are offered only e-Book and e-Television services. EGITEK should take the initiative to diversify and increase the e-learning services offered in MNE open education institutions. This will help offer an effective continuous open education to individuals from primary school to university. Investigating the national open education systems of other countries will allow to prepare the inventory of open education opportunities offered to individuals.

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VOEHS, Vocational Open Education High School, http://maol.meb.gov.tr/, 2007

VTOES, Vocational Technical Open Education School, http://egitek.meb.gov.tr/aok/mtao/okultanitimi.htm, 2007

Study on a Structural Equation Model of the Effects of E-learning Perceived by Elementary School Students

Innwoo Park (Korea University)
Jin Ho Lim (Korea University)
Taewoong Kim (Korea University**)**

Abstract

The purposes of this study are to create a Structural Equation Model for explaining the factors which influence the effects of e-learning perceived by elementary school students, to examine the model fit of the Structural Equation Model, and to explain the structural relationship among the factors.

To this end, the theoretical framework was developed to explain elementary students' perceived effects of e-learning, based on critical analysis of the previous studies. Second, the model fit of the measurement model based on the theoretical framework was tested, using the confirmatory factor analysis and structural equation modeling(SEM) analysis. Third, the hypothesized structural equation model was revised and refined as the final model for the most appropriate one. Finally, the paths and effect size of the factors which influence the students' perceived effects of e-learning were analyzed.

The result of the confirmatory factor analysis for measurement model pointed out that the fit of the AGFI did not satisfy the statistical criterion. Accordingly, Squared Multiple Correlations(SMC) was conducted, and 6 factors were eliminated to revise the measurement model. The second test for the revised measurement model was conducted. The result indicated that the fit of indices in the SEM were higher than the previous model with $\chi2=2,401.83$, df=979, GFI=0.913, AGFI=0.900, TLI=0.938, CFI=0.943, and RMSEA=0.036. Both credibility and validity were examined and turned out to be appropriate.

Next, the SEM analysis was also conducted to verify the appropriateness of the hypothesized structural equation model based on the revised measurement model. The result indicated that the entire model was appropriate, but GFI and AGFI still did not satisfy the desired statistical criterion. The result led to finding the more appropriate model than the present model. The hypothesized structural equation model, therefore, was revised according to both the previous studies and the modification indices, using AMOS 5.0. The revised model was eventually decided as final, indicating a more appropriate fit than the previous model. The model fit of the final structural equation model presented $\chi2=2,776.39$ (p=0.000), df=999, $\chi2$/df=2.779, GFI=0.900, AGFI=0.887, TLI=0.924, CFI=0.929, and RMSEA=0.039.

In conclusion, this study presented that the theoretical framework and the final structural equation model were found to be appropriate for explaining the factors which influence elementary students' perceived effects of e-learning. This study also added new findings to the relevant studies in that the characteristics of e-learning environments caused the effects of e-learning in the characteristics of the learners as a parameter.

Finally, the findings about the paths and effect size of the factors which influence the effects of e-learning in this study can be used to design e-learning service which is most appropriate to the students' abilities and to understand the processes of the elementary students' learning and perceived effects during e-learning.

Introduction

The term "e-learning" started to be widespread in Korean elementary and secondary education after it was used in the Education Ministry's announced measures in 2004 to reduce private tutoring expenses by normalizing public education (The Ministry of Education and Human Resources, 2004). E-learning, therefore, has a relatively short history in the Korean education field.

Now there is a move to broaden the concept of e-learning in Korea as the government has been actively working to use e-learning in teaching and learning in elementary and secondary schools (Jang Sang-hyeon et al. 2004; Han Geon-woo, Song Gi-sang, Lee Yeoung-jun, 2005). This has caused varied terms such as cyber learning, online learning, and internet learning, commonly used in elementary and secondary schools, to be all replaced by the term e-learning (Byeon Yeoung-gye, Kim Gyeong-hyeon, 2003).

The trend has made e-learning a familiar teaching and learning method for the elementary and secondary education. As part of its policies, the Education Ministry is providing e-learning services nationwide including "EBS Lectures for the Scholastic Ability Test" and "Cyber Home Learning" for elementary and secondary school students. These services are aimed at expanding education beyond the classroom into cyberspace; enabling students to learn according to their own levels and have greater right to learning choices; and enhancing the quality of public

education by providing students with self-directed learning opportunities that enable them to study whenever necessary.

Despite the enthusiasm surrounding e-learning, few efforts are being made to prove the effectiveness of e-learning in elementary and secondary education. Some are even voicing concern about its effectiveness (Han Geon-woo, Song Gi-sang, Lee Yeoung-jun, 2005).

Park Innwoo (2004) said that e-learning, by nature, is self-directed learning. This means that a more careful and effective approach is necessary when providing e-learning service to elementary and secondary schools than to universities and companies as schoolchildren are less capable of directing their own learning than adults (Song Sang-ho et al., 2005). Han Geon-woo, Song Gi-sang, and Lee Yeoung-jun (2005) stressed the need to make constant efforts to enhance the effectiveness of e-learning in their research on "Ways to improve EBS lectures for the scholastic ability test for the good of the public education," where they argued that the EBS lectures failed to take advantage of e-learning by conducting one-way lectures, and pointed out the lack of lecture information and evaluation. These points indicate the urgency of taking a systematic and comprehensive look at the effects of e-learning used in elementary and secondary education.

Theoretical Background

Every study has different yardsticks for measuring the effectiveness of e-learning. Many studies focusing on its academic effects adopted learners' academic achievement as the major yardstick (Kang Ok-mi, 2001; Kim Se-eun, 2002; Lee In-sook, 2002; Moore & Kearsley, 2005; Neuhauser, 2002; Hiltz, 1990), while others used learners' satisfaction (Park Seong-ik, Yoon Soon-gyeong, 2000; Thurnond et al., 2002). Some studies took learners' academic achievement, participation, and satisfaction into account to explain the effectiveness of e-learning (Kang Yeoung-hwan, 2004; Seo Hye-jeon, 2001; Lim Jeong-hoon, Lee Hang-nyeong, 2003; Yoo Pyeong-jun, 2003b).

This study defines the effectiveness of e-learning as individual learner's comprehensive and subjective perception of the educational experience and benefits gained through e-learning, including their academic achievement, participation and satisfaction. Based on this definition, it examines existing studies and relevant documents for the theoretical background to find that most studies on the effectiveness of e-learning dealt with individual learner's characteristics and e-learning environmental characteristics as factors influencing effectiveness. The findings will be explained in detail below.

Kang Myeong-hee (2004) argued that computer-based learning is not suitable to all learners, and that benefits and level of satisfaction can vary according to learners' characteristics. This means that learners' characteristics determine whether e-learning is effective. Relevant studies focused the individual characteristics that affect the effectiveness of e-learning. The characteristics identified include learning motivation, achievement motivation, academic self-efficacy, computer self-efficacy, learners' familiarity with technology, learners' desire and ability to direct their own study, learners' educational background or preliminary education, learners' personality, learner's interest, time management strategies, positive attitude, test anxiety, cognitive strategies, and meta-cognitive strategies (Kang Ok-mi, 2001; Kim Se-eun, 2002; Song Sang-ho, 2000; Yang Yeon-sook, Yoo Pyeong-jun, 2003; Eom Woo-yong, Choi Eun-hee, 2001; Lee In-wook, 2002, 2003; Lee Ji-yeon, 2004; Lim Jeong-hoon, Lee Hyang-nyeong, 2003; Yoo Pyeong-jun, 2003a; Cho Il-hyeon, Lim Gyu-yeon, 2002; Ju Yeoung-ju, Moon Ja-yeoung, 2004; Compeau & Higgins, 1995; Hasan, 2003; Houle, 1996; Kelsey, Lindner & Dooley, 2002; Moore & Kearsley, 2005; Oliver & Shapiro, 1993; Torkzadeh & Van Dyke, 2002).

Other studies found that the effectiveness of e-learning is dependent on e-learning environmental characteristics (Song Sang-ho, 2004). They focus mainly on design and operational elements of e-learning, and identify elements including composition of learning contents, learner support, convenience or ease of use, interaction such as teachers' feedback and operators' social role, user interface, teachers' capability, various evaluation methods, preliminary education, interaction between learners, accessibility, and physical and psychological support (Park Seong-ik, Yoon Soon-Gyeong, 2000; Seo Shin-seok, 2003; Seo Hye-jeon, 2001, Lee Ji-yeon, 2004; Cho Il-hyeon, Lim Gyu-yeon, 2002; Choi Jeong-im, 1999; Harasim, 1986; Kelsey, Lindner & Dooley, 2002; Thurmond et al., 2002).

Purpose of the Paper

Although there are a number of theories and studies on the effectiveness of e-learning, few studies take a comprehensive look at various e-learning factors such as learners' profile, general learning-related elements, web-based learning-related elements, learners' satisfaction, learners' academic achievement, and learners' participation. As a result, Lee In-sook (2003) and Yoo Pyeong-jun (2003b) strongly raised the need to conduct comprehensive research taking all e-learning factors into account. This study aims to design a comprehensive theoretical model to explain the effectiveness of e-learning based on existing studies, which revealed the effectiveness of e-learning

according to learners' characteristics and environmental characteristics, and to verify the model by measuring paths between factors and effect size to identify factors contributing to the perceived effects of e-learning. This will help us understand the elements that must be considered to enhance the effectiveness of e-learning.

Research Questions

The purposes of this study are to design a model that can explain factors affecting the perceived effects of e-learning; to identify a structural relationship between those factors; and to assess the model fit of the structural equation model. To that end, it has set up the following research tasks.

Research Task Ⅰ: To design a theoretical structural model of factors influencing the effects of e-learning perceived by elementary school students based on existing studies

Research Task Ⅱ: To devise a provisional structural equation model based on the theoretical model, and test the model fit of the equation model

Research Task Ⅱ-1: To decide whether the provisional structural equation model based on the theoretical model is the optimum model or not, and, if not, to identify the optimum model

Research Task Ⅱ-2: To discover whether hypothetical paths between factors affecting the perceived effects of e-learning are significant

The Model

This study used the Input-Environment-Outcome (I-E-O) model by Astin (1993) as the conceptual basis for a structural model of factors influencing the perceived effects of e-learning. The I-E-O model has been used by many researchers to verify the relationship between learner's characteristics, e-learning environmental characteristics, and e-learning effectiveness (Astin & Sax, 1998; Campbell & Blakey, 1996; House, 1999; Kelly, 1996; Knight, 1994a, 1994b; Long, 1993; Pace, 1976).

Adopting the ideas of Astin (1993), the study defined "input" as the characteristics of individual learners participating in educational programs and "environment" as the practical experiences and activities educational programs provide for students. Based on existing studies, "outcome" was defined as the learners' academic achievement and satisfaction through participation in learning (Kang Yeoung-hwan, 2004; Koo Gyo-jeong, 2005; Seo Hye-jeon, 2001; Yoo Pyeong-jun, 2003b; Lim Jeong-hoon, Lee Hang-nyeong, 2003).

Figure 1 shows the theoretical structural model indicating the elements of each factor and hypothetical paths between them.

Figure 1. Theoretical Structural Model

Measurement Issues

Table 1 shows the composition and sources of a survey tool to analyze a structural model. The questionnaire has three factor categories – e-learning environmental characteristics, learners' characteristics, and e-learning effectiveness. The e-learning environmental characteristics category consists of four parts, which as are the same as the four elements – composition of learning contents, learner support, usability, and interaction. The learners' characteristics category also consists of four parts – intrinsic motivation, extrinsic motivation, academic self-efficacy, and computer self-efficacy – and the e-learning effectiveness category three parts – learners' academic achievement, learners' participation, and learners' satisfaction.

Table 1. Composition and Sources of Survey Tool

Category	Elements	Sources
E-learning environmental characteristics	Composition of learning contents	Seo Hye-jeon (2001)
	Usability	Yoo Il, Hwang Jun-ha (2002)
	Learner support	Stewart, Hong & Strudler (2004)
	Interaction	
Learners' characteristics	Intrinsic motivation	Velayo (1993); Stein (1997); Chung Jae-sam, Lim Gyu-yeon (2000)
	Extrinsic motivation	
	Academic self-efficacy	Yang Myeong-hee (2000), Lee Jae-gyeong (2000)
	Computer self-efficacy	Al-Khaldi & Al-Jabri (1998); Oh Yoon-jin (1999)
E-learning effectiveness	Learners' academic achievement	Lim Jeong-hoon, Chung In-seong (1999); Seo Hye-jeon (2001)
	Learners' participation	Yoo Pyeong-jun (2003b); Chung Jae-sam, Lim Gyu-yeon (2000)
	Learners' satisfaction	Lim Jeong-hoon, Chung In-seong (1999); Seo Hye-jeon (2001)

The questionnaire is composed of 53 questions measured 1 to 5 according to a Likert-type scale, with 1 meaning "strongly disagree"; 2 "disagree"; 3 "neither agree nor disagree; 4 "agree"; and 5 "strongly agree." The questions were created based on existing studies to verify a provisional structural model devised on the basis of a theoretical structural model. In relation to the question items, a validity test by experts and a reliability test were conducted. For the reliability test, a preliminary survey was also carried out on 130 sixth-graders in elementary schools in Seoul from Apr. 5-7, 2006, to compute Cronbach's a of the questionnaire. The reliability of the questionnaire was .94, which is fairly high.

Data Analysis

The survey for the study was conducted on 1,500 sixth-graders in seven elementary schools in Seoul and Gyeonggi Province Apr. 18-29, 2006. Some 82.7 percent, or 1,241, out of the 1,500 questionnaires distributed were collected, and 1,154 of them were found valid for statistical analysis.

With the collected data, a confirmatory factor analysis of a measurement model based on the theoretical structural model was carried out using AMOS 5.0. The analysis included the assessments of the model fit index and construct reliability, and calculation of the variance extracted index to evaluate if the scales of the measurement model are representative of the factors concerned. A discriminant validity test was also conducted using a correlation matrix analysis of constructs. An analysis of a measurement structural equation model based on the measurement model showed that AGFI, a model fit index, was not high enough to be valid, and as a result, six measurement variables were removed using squared multiple correlations, modifying the measurement model. A model fit test of the modified measurement model found that most of the model fit indices improved in the measurement structural equation model with the value of χ^2=2,401.83, df=979, GFI=0.913, AGFI=0.900, TLI=0.938, CFI=0.943, and RMSEA=0.036. The reliability and validity of the measurement model were also assessed to be valid.

All the results of the confirmatory factor analysis were valid enough to next conduct an analysis of a structural equation model, which was carried out for a provisional model based on the measurement model modified. A model fit test of the provisional model showed a fairly good fit, but the values of GFI and AGFI were lower than acceptable, raising the need for a better model than the provisional model. After checking the modification index of the provisional model and the theoretical background of existing studies, two paths indicating a direct relationship between interaction and learners' participation, and between composition of learning contents and learners' participation, were added.

Table 2. Results of Model fit Test of Provisional Model and Modified Model

Model	x^2	d.f	P	x^2/df	GFI	AGFI	TLI	CFI	RMSEA
Provisional model (1)	2,949.59	1,001	0.000	2.947	0.895	0.882	0.916	0.923	0.041
Modified model (2)[*]	2,776.39	999	0.000	2.779	0.900	0.887	0.924	0.929	0.039
Model 1: Model 2	173.20	2	0.000	-	-	-	-	-	-

[*]Modified model = Provisional model + (Interaction → Learners' participation, Composition of learning contents → Learners' participation)

A model fit test of the modified provisional model showed an improvement of model fit with the value of χ^2=2,776.39 (p=0.000), df= 999, χ^2/df=2.779, GFI=0.900, AGFI=0.887, TLI=0.924, CFI=0.929, and RMSEA=0.039. Thus, the modified model was chosen as the final model. Figure 2 shows the final modified model and path coefficients.
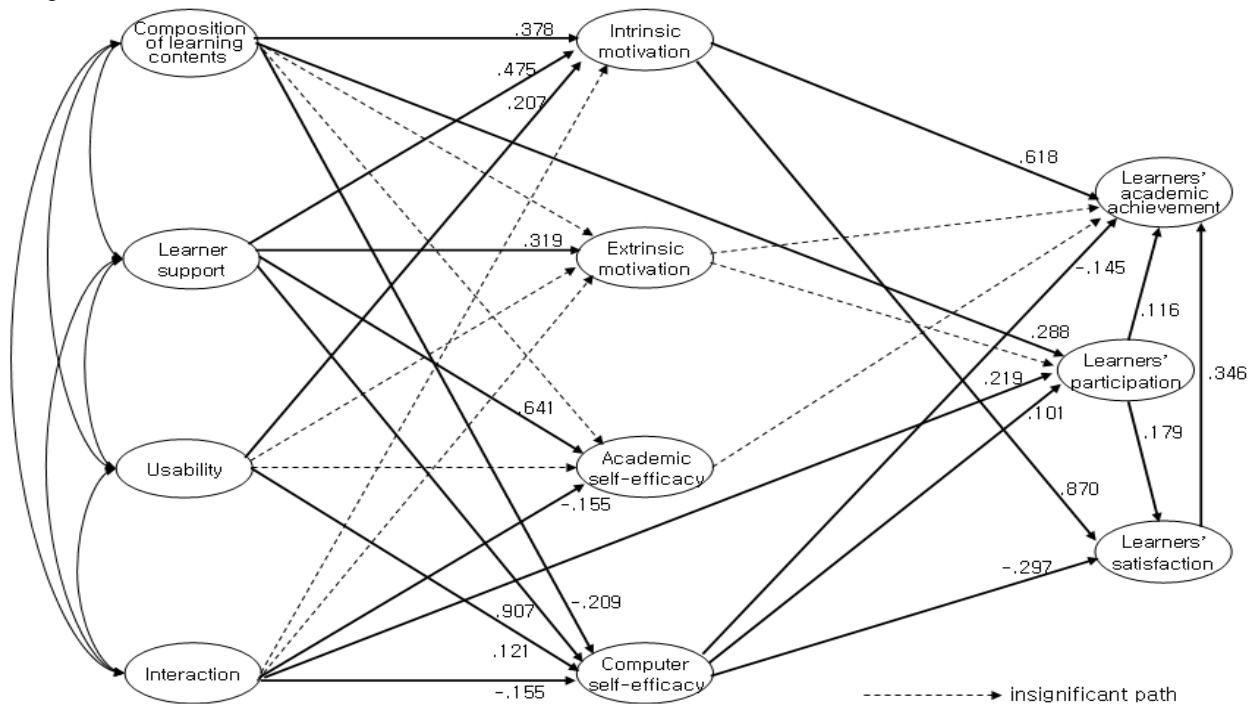

Figure 2. Final modified model and path coefficients

Discussion

Efforts to raise the effectiveness of e-learning are needed not only in elementary and secondary education but also in university and corporate education. Many studies have therefore been conducted to assess the effectiveness of e-learning and thus provide an effective e-learning service. This study aims to design a model explaining the effects of e-learning perceived by elementary school students and assess the paths and effect size of various factors influencing the effectiveness of e-learning. This is expected to promote in-depth understanding of how elementary school students learn in e-learning and enable creation of an e-learning service that suits the needs of child learners.

The following conclusions can be reached based on the study results.

First, the final structural equation model was proved valid to explain factors influencing the effects of e-learning perceived by elementary school students through the confirmatory factor analysis and structural equation model. The model fit test of the final model showed a fairly good fit with the value of χ^2=2,776.39(p=0.000), df=999, χ^2/df=2.779, GFI=0.900, TLI=0.924, CFI=0.929, and RMSEA=0.039. This means that the final structural equation model is a proper structural model to explain the effects of e-learning perceived by elementary school students.

Second, unlike models in past studies, the model in this study showed that e-learning environmental characteristics influence the effectiveness of e-learning through the mediation of learners' characteristics. For example, in the composition of learning contents, an element of the e-learning environmental characteristics that affect academic achievement, the effect size was significant at .447, even when taking into account indirect effects alone that take place through the mediation of intrinsic motivation, computer self-efficacy, and learner's participation. Learner support also showed a significant effect size of .228 toward academic achievement, even taking into account indirect effects alone that took place through the mediation of intrinsic motivation and computer self-efficacy. These results indicated that e-learning environmental characteristics can have indirectly influence the effectiveness of e-learning through the mediation of learners' characteristics. This study is distinguished from past studies by its interest in the mediating effects of e-learning environmental characteristics and learners' characteristics on the effectiveness of e-learning (Seo Hye-jeon, 2001; Koo Gyo-jeong, 2005; Chung Jae-sam, Lim Gyu-yeon, 2000).

Third, it was found that e-learning environmental characteristics have positive effects on learners' characteristics. In the case of intrinsic motivation, learner support, composition of learning contents, and usability had positive effects in that order, with the effect size being .475, .378, and .207, respectively. Learner support (.319) had a positive effect on extrinsic motivation. On academic self-efficacy learner support (.641) had a positive effect, and on computer self-efficacy learner support (.907) and usability (.121) had a positive effect. This showed that e-learning characteristics influence the effectiveness of e-learning in combination with specific learners' characteristics.

Fourth, an analysis of learners' characteristics influencing the effectiveness of e-learning found that extrinsic motivation and academic self-efficacy do not have a significant effect on learner's academic achievement, participation, or satisfaction. This goes against existing study results: Wlodkowski (1999) and Chung Jae-sam and Lim Gyu-yeon (2000) said that extrinsic motivation had a direct impact on learners' academic achievement and participation in e-learning, and Lee In-sook (2002) found that academic self-efficacy was a major factor affecting learners' academic achievement. The results suggest that the structural model could include another element of e-learning effectiveness on which extrinsic motivation and academic self-efficacy have indirect impact, or a new path.

Fifth, the effect size of each factor influencing the effectiveness of e-learning can be compared by analyzing indirect, direct, and total effect size. Of factors affecting learners' academic achievement, intrinsic motivation had the biggest effect size with .919. Composition of learning contents came second with .447, followed by learners' satisfaction (.346), and learner support (.228). In relation to learners' participation, composition of learning contents showed the biggest effect size with .267, followed by interaction with .203. In the case of learners' satisfaction, intrinsic motivation was found to have the biggest impact with the effect size being .879. Composition of learning contents came in second with .439 followed by learners' participation (.179) and learner support (.160). This suggests that to raise the effectiveness of e-learning, that is, learners' academic achievement, participation, and satisfaction, it is essential to actively work on development of factors found to affect it most and take child learners into account when doing so.

Future Research

Based on the study results, some suggestions can be made in relation to future study on the effectiveness of e-learning. First, the study showed that it is intrinsic motivation, a learner's characteristic, that has the greatest influence on learners' academic achievement. This indicates that when developing a new e-learning service for child learners, the focus in a new service needs to be placed on ways to increase intrinsic motivation, which makes learners feel rewarded and pleased with their learning activity. This is in contrast to existing services, which focus on ways to boost extrinsic motivation, like providing cyber prize money, prizes, gifts, and vouchers.

Second, as mentioned earlier, the e-learning service for elementary and secondary school students needs to be more carefully thought out and effective than that for university students and corporate workers because children are less capable of regulating their own study than adults (Song Sang-ho et al., 2005). This raises the need for serious study on the differences in characteristics between child and adult learners. This study produced some results that go against past studies. Previous studies, in many cases, have focused on adult learners and thus failed to reflect the characteristics of child learners in e-learning. Many other studies on ways to enhance the effectiveness of e-learning have also failed to present the differences in e-learning environments for children and adults. Therefore, as Kim Do-il et al. suggested (2003), it is necessary to work to increase in-depth understanding of the e-learning environment optimized to suit the level of child learners, who analyze, use, and understand information in a different way from adults due to difference in cognitive ability.

Concluding Comments

E-learning is a comprehensive cyber learning space where various environmental factors and factors related to learners' characteristics play a major role. As such it is essential to identify those various factors and study in depth what role they play in raising the effectiveness of e-learning. Existing studies on the effectiveness of e-learning have usually applied one or two factors for evidence, but future studies should look at all e-learning composition factors in a comprehensive and complete way. While it is important to study how each e-learning factor influences the effectiveness of e-learning, it is more important to establish a systematic relationship between e-learning factors, and discuss ways to operate e-learning effectively and make the e-learning environment more learner-friendly.

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A Study on the Improvement of Reading Comprehension through Visual Organizers in an Online Reading Course

Myeonghwa Park, Sung-hee Jin, Eunmo Sung
(Seoul National University, Korea)

Introduction

Various kinds of reading strategies have been applied in designing e-learning reading contents for improving reading comprehension. Presenting structured overview in pre-reading phase (Barron, 1969; Griffin & Tulbert, 1995), embedding questioning signals (Hartley, Tureman, & Pigram, 1984; Nist, & Hogrebe, 1984) and highlighting key sentences or phrases (Lee, 1998; Dyson & Gregory, 2002; Mok, 2004; Sohn, 2004) in the middle of reading phase, and using graphic organizers and summarizing in post-reading phase have effect on reading comprehension (Dunston, 1992; Bae, 2004).

In supporting recent stream of research in text design, more specifically text structure, US National Reading Panel Report (2000) emphasize the significance of text structure strategies and suggest that for adults' reading and teenagers' reading, comprehending topics and inferring is more rather than on learning vocabulary or word-relating.

As commonly known, text structure is of significance shown well in the expository paragraphs, beginning with a topic statement, and then, by several subdivision to support and connect the central idea. In expository text the information is organized in a logical manner using various expository text structures and they include description, enumerative or listing, sequence, comparison and contrast, cause and effect and problem and solution (Gillet and Temple 1994; Irwin 1991; Meyer & Freedle, 1984).

According to Block's investigation (1986), low comprehending readers tend to read in reflective mode, directing their attention away from the text and toward themselves, and focusing on their own thoughts and feelings rather than on the information in the text. Whereas high comprehending readers' response in extensive mode to deal with the message conveyed by the author, focusing understanding the author's ideas, and not to relate the text to themselves affectively or personally.

Regardless of using the strategy in pre-, post-reading or in the middle of reading, teaching text structure impact on comprehension (Pehrsson and Denner 1988; Englert 1990; Mosenthal, 1994). In order for a reader to integrate information presented to the main idea consistently, text structure needs to be reminded, and at this point, a tool or opportunity reminding the text structure will surely have effect on the reading comprehension in a positive manner. Visual Knowledge Organizer(VKO), for instance, is a strategy representing the organization of information and knowledge from the texts in a visual format (Rha & Ahn, 2006). Visual knowledge organizer including structured overview, concept map, and graphic organizer has revealed its effectiveness in recent research (Dunston, 1992; Moore & Readence, 1984). In addition, visual knowledge organizer is expected to operate as a cognitive tool to maintain reading in extensive mode (Block, 1986). The purpose of the current study is to develop visual knowledge organizer and to examine its effects for improving reading comprehension in online reading course.

Visual Knowledge Organizer

As an explicit technique for structuring the text, VKO is a strategy representing the organization of information and knowledge from the texts in a visual format (Rha & Ahn, 2006). Human beings tend to encode information in a sequence and then save it. However, when several texts are delivered, the linear process of information cause cognitive overload and bring about difficulties in decoding and saving (Sweller, 1994; Paivio, 1986). According to dual code theory, human beings enable to treat visual information in parallel, saving and decoding text information separate. From this point, VKO has been developed on the ground of parallel processing of visual stimulus coping with the linear processing of text information. VKO is also a cognitive strategy utilizing visual aids for improving efficiency and effect of text comprehension (Rha, Ahn, 2006). VKO is expected to function as a visual cognitive tool based on the visual intelligence that humans obtain. Some features that VKO evolve are as follows: i) VKO presents the key information of the text in a visual format in order to provide structural knowledge (DiCecco, 1992; Pehrsson & Denner, 1989). ii) VKO represents overview on the text by providing semantic text information, iii) VKO facilitate to memorize key words in text information by supporting retrieval cues from long term memory (Levin, 1987).

In the context of reading expository text, VKO facilitate to improve text comprehension by providing visually or mentally represent of text structure. Text structure can be represented in the format of verbal and visual. However, visual representing strategies of text structure are needed to efficiently, effectively process and memorize a good amount of text information. In other words, representing VKO about text structure will improve learner's reading comprehension.

Design & Development of VKO

On the basis of the literature review and the results of survey targeting experts, the optimal VKOs depending on text structure patterns were developed for improving reading comprehension in e-learning environment. The types of VKO and design principles were driven through literature review. In case of expository text, the text structure patterns commonly include: (1) sequence, (2) comparison/contrast, (3) description, (4) problem/solution, and (5) cause and effect/process.

Because text structure is a kind of semantic concept, text structure could be represented in the various types of VKO (Gillet and Temple 1994; Irwin 1991). Therefore, optimal VKO needs to be represented, which enables learners to perceive the semantic structure of text with ease. The design principles for VKO has been established such as symbolicity, simplicity (Rha & Han, 2006; Jo et el., 2005; Thompson, 1994), and predictability (Rha & Han, 2006) through literature review. The validity of VKO was examined by 6 subject matter experts (SME) in the domain of teaching English. And thus, for applying VKO into e-learning contents, VKO should reflect the characteristics of e-learning environments in terms of improving the learning achievement. For this, the development principles of VKO has been established such as interactivity (Baek, 1995; Lim, 1999; Morris & Hinrichs, 1996), navigability (Han, 2006), and simultaneity (Morris & Hinrichs, 1996). Each of detailed principle is as follows.

Design Principles for the Conceptual Models of VKO

Symbolicity

VKO needs to be designed in a visual format which enables to represent the semantic text structure. From the semiotic perspective, VKO can be regarded as a 'sign', composed a 'signifier' and 'signified'. A signifier represents figures of a specific object or a concept like pictures, languages, sounds, and so on. A signified implies the meaning or concept that a signifier possesses. Seeing VKO as a sign, the figure represented visually is a signifier and the underlying semantic structure of the signifier is a signified. That is, the principle of symbolicity is to design VKO in compliance with signifier and signified.

Simplicity

VKO needs to be designed in the simplest form. Text structure can be represented in a variety of visual forms. In order for learners to perceive the holistic information on text structure at a glance, VKO should be composed of minimum information which require for comprehending text structure without redundant information. Jo et al. (2005) suggested simplicity as a design principle of e-learning contents.

Predictability

VKO needs to be designed for learners to predict what VKO means and which functions VKO has (Rha & Han, 2006). Human beings have the information on images by means of repeated experiences and learning. VKO should be designed reflecting conceptual mental model on this visual information. That is, VKO is a strategy of organizing text, which cannot be an object to demand learning, must be comprehended by every learner through their prior experiences.

Development Principles for Applying VKO to Online Reading Contents

Interactivity

VKO needs to be designed so that learner may efficiently obtain structural text information. To interact between learner and VKO, it will be considered an immediate reaction, learners' adaptability, convenience, and usability of learning (Son, & Jeon, 2002). An immediate reaction means that learner instantly recognize how to use a VKO. Learners' adaptability and convenience means that learner directly utilize VKO. Usability of learning means that learners should be received substantial helps in read texts by using VKO.

Based on this, VKO was developed in three phases considering the levels of interaction. Phase I was developed in the form of completed VKO including text structure and details. Phase 2 was developed in the form of half-completed VKO including text structure and partial blanks for the details. Last phase 3 was developed in the form of open-ended VKO, which learners construct by themselves. Learning activity to construct visual knowledge through reading can guide meaningful learning on the ground of self-directed learning. The Phases applied to VKO appear. in Table 1.

<Table 1> The Phases applied to Visual Knowledge Organizers

Phase	Phase 1	Phase 2	Phase 3
	Completed VKO	Half-Completed VKO	Open-ended VKO
Examples			Learners construct VKO by themselves
The level of students' participation	Teacher-centered		Student-centered

Navigability

  VKO needs to be developed functioning as navigation in order for learners to comprehend easily verbal and visual information representing text structure. When a part of VKO is clicked, the relevant contents are highlighted. This function make VKO to play a role of navigational aid exploring the holistic structure and contents of text.

Simultaneity

  VKO needs to be presented with text simultaneously. e-Learning contents can be developed dividing the frames even though there are some differences depending on developed programs. In case of developing HTML based e-learning contents, VKO can be presented with text simultaneously. If VKO is presented in another window, pop-up window can disturb learners' reading activities and there are some difficulties for learners to use VKO. Thus, VKO is designed in divided frame to use it as learning support aid and to make learners pay attention to reading activities. The optimal representation forms of VKO driven through the results of survey and the examples of developed e-learning contents are shown in table 2.

<Table 2> The representation forms of VKO and the examples of developed e-learning contents

Text Structure	Visual Representation of VKO	Examples of Contents
Chronological sequence		
Description		
Comparison/ Contrast		
Problem/ Solution		
Process/Cause and effect		

Methodology

The purpose of current study is to examine the effectiveness of visual knowledge organizers on reading comprehension in online reading course. The overview of research methods are as follows.

Participants

Visual knowledge organizers were adapted to develop the contents for online course of English reading comprehension in the S cyber university. The participants were 54 students that took the online reading course, who were seniors (male: 20, female: 34). They are majoring in English and have taken online courses for approximately 3 or 4 years. They already learned the text structure, however, haven't experienced in taking online English reading comprehension course to utilize VKO. And thus, the participants were appropriate subject for examine the effects of VKO.

Research Design

The comparison on the results of pretest and posttest related English reading comprehension were analyzed. In this study, independent variable is the usage of VKO and dependent variables are reading comprehension and satisfaction on learning. English reading comprehension was categorized into comprehending topic, comprehending the details, inferring, understanding the text structure. This study was analyzed how much VKO affected on those specific English reading comprehension.

Materials

The online instrument for reading comprehension test comprises of 15 question items with three different kinds of expository texts. The difficulty of the test was intermediate and high intermediate with approximately 600-800 words per paragraph. Both pre-, and post test are composed of 18 question items with subordinate category of comprehension asking: four question items for main theme or topic, four for understanding details, four for

inferring, and four text structure. All question items are multiple choices and conducted online with limited time of thirty minutes. The reliability was cronbach α=.82.

 The test instrument for examining students' satisfaction on VKO use was developed on the basis of the literature review. It consisted of 10 items including/using 1-5 likert scales. One of doctor and three of graduate candidates majoring in Educational Technology reviewed the instrument and examined the degree of credibility. The degree of credibility was α=.79.

 Procedures
 This study was conducted through the process of design, development, implementation, and evaluation. First of all, principles for designing and developing VKO according to the types of text structures were driven and the contents for online English reading comprehension were developed in the phase of design and development. Students had taken the course, learned with using VKO for 15 weeks from February to June, 2007 in the implementation phase. After finishing the course, quantitative and qualitative date were collected and analyzed such as the result of reading comprehension, satisfaction of learning with using VKO, and focus group interview.

 Data Analysis
 For examining the effectiveness of VKO, two-dependent samples t-test between the results of pretest and posttest was examined. In order to examine the effectiveness of VKO on comprehending topic, comprehending the details, inferring, and understanding the text structure that are subordinate reading comprehensibility, two-dependent samples t-test between the results of pretest and posttest on subordinate reading comprehensibility. The program, Window SPSS 12.0, was used to analyze the data.
 Further more, Effect size was analyzed in order to examine the practical significance of effects. Survey data and interview data, and thus, were analyzed to examine students' satisfaction on VKO.

Results

 Effect of VKO improving reading comprehension
 The result of t-test between pretest and posttest is displayed in Table 1. Pretest was Mean=33.10, SD=19.29, and posttest was M=54.93, SD=19.76. There was a significant difference t = -10.374, p<.05. In other words, the result indicated that using a VKO in online reading course was proved to have positive effect in improving reading comprehension.

 <Table 3 > Analysis of t-test about reading comprehension

	N	Mean Score	Standard Deviation	t	Sig.	Effect size
Pre-test	54	33.10	19.29	-10.374	.000	1.104
Post-test	54	54.93	19.76			

 The result reported there is a statistically significant difference. In real world, however, using VKO may be practically non-significance in improving reading comprehension, For that reason, we conducted an analysis about the effect size of VKO. Effect sizes can be generally interpreted as fellow: small is below 0.2, medium is 0.5, and large is great than 0.8(Cohen, 1988). The result of effect size was Δ=1.104. Therefore, Using a VKO in English reading would predict a practical effect in improving reading comprehension.

 Effect of VKO in sub-ordinate reading comprehension
 VKO in e-Learning was reported to improve learner's reading comprehension in general. we further analyzed what effect VKO have on sub-ordinate reading comprehension; understanding main idea, details, text structure, and inferring, This analysis was undertaken by t-test between pretest and posttest score of sub-ordinate reading comprehension. After that, Effect sizes were computed for four parts. Table 2 presents the means and standard deviations, t-value, significant, and effect sizes.

<Table 2.> Analysis on t-test of sub-ordinate reading comprehension

Compre-hension	Test	N	Means	Standard Deviation	t	Sig.	Effect Sizes
Topic	Pre	54	7.87	8.51	-5.39	.000	.837
	Post	54	14.19	7.55			
Detail	Pre	54	18.98	11.05	3.97	.000	-.771
	Post	54	13.20	7.49			
Infer	Pre	54	3.93	5.86	-10.92	.000	1.528
	Post	54	17.03	8.75			
Struc-ture	Pre	54	2.31	4.90	-8.17	.000	1.346
	Post	54	10.74	6.26			

The results of t-test indicated a significant difference in four parts; topic = -5.59, detail = 3.97, infer = -10.92, structure = -8.17 at the level of $p<.05$. This result interpreted that using a VKO also has a positive effective in sub-ordinate reading comprehension. Effect sizes were different among four parts. It was a practically significant in main idea ($\Delta=1.104$), inferring ($\Delta=1.528$), and text structure ($\Delta=1.346$). However, it was a practically non-significance in details.

The result was interpreted that using VKO influenced understanding of macro structure, main topic, and inference of the text. However, it seemed that VKO have near to never effect on details. In spite of a practically non-significance on details, reading comprehension was presented statistically significant. It may be possible to state that reading comprehension due to cognitive processing of human being that sub-capability in reading comprehension was interacted as for dependent factor rather than independent one.

Satisfaction with using VKO

We conducted FGI (Focus Group Interview) to identify satisfaction with using VKO in online English reading comprehension course. FGI was conducted with six participants who were selected randomly out of the whole participants. Table 4 is a questionnaire, which used in FGI.

Table 3. Questionnaire for Focus Group Interview

	Questionnaire
1	Does VKO help with learning?
2	Does VKO help with understanding text contents?
3	Does VKO help with improving vocabulary?
4	Does VKO help with grammar based reading?
5	Does VKO help with understanding main idea?
6	Does VKO help with inferring or guessing the unknown words?
7	Does VKO help with analyzing of text structure?
8	Do you want to use a VKO when you read next time?

According to the result of FGI, learners reported that using VKO in reading comprehension supported facilitating of understanding main idea and analyzing text structure in macro level. Also, they stated to use a VKO continuously when they read. On the contrary, learners thought that VKO was not helpful for understanding meaning of difficult words and grammar based on reading. This result of interview is matched the result of t-test between pretest and posttest in reading comprehension

Consequently, it seemed that using VKO in online learning of reading comprehension was effected understanding text.

Conclusion

This study was undertaken to develop and to identify effect of VKO, which was to improve reading comprehension in online reading comprehension course. VKO was designed and developed by means of principles such as clarity, simplicity, predictability, interactivity, navigability, simultaneity.

To identify the effect of VKO, Quantitative and qualitative measures were used: achievement score of reading comprehension (pretest, posttest score), learning satisfaction through focus group interview. Following the result, using a VKO in online reading comprehension course was identified positive effect in effectiveness and satisfaction of learning. VKO was facilitated understanding main idea, macro text structure, and inferring. However, it was practically non-effect about details.

Finally, the developed VKO in this study strongly suggest that it was more effectiveness not understanding micro text information, but understanding macro text information such as main idea, topic, and text structure at the macro level.

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Block (1986) also suggested that proficient readers recognized aspects of text structure and responded in an extensive mode, whereas non-proficient responded in reflective mode, failing to be aware of text structure. In the reflexive mode, readers relate affectively and personal.

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Using Peer Feedback in Online Discussions to Improve Critical Thinking

Jennifer C. Richardson
jennrich@purdue.edu
Department of Curriculum and Instruction
Purdue University
3134 BRNG
100 N. University St.
West Lafayette, IN 47907

Peggy Ertmer
Department of Curriculum and Instruction
Purdue University
100 N. University St.
West Lafayette, IN 47907

James Lehman
Department of Curriculum and Instruction
Purdue University
100 N. University St.
West Lafayette, IN 47907

Timothy Newby
Department of Curriculum and Instruction
Purdue University
3134 BRNG
100 N. University St.
West Lafayette, IN 47907

Abstract

This study sought to evaluate the effectiveness of a peer feedback strategy in asynchronous online discussions. Specifically, this exploratory study examined the impact of peer feedback in online discussions on students' perceived and actual critical thinking skills in terms of receiving and providing peer feedback Participant interviews and pre and post surveys targeting critical thinking skills were utilized in a mixed method study approach. Results indicate that participants perceived the peer feedback strategy as having impacted their learning at a higher cognitive level. Qualitative data reveals how the peer feedback process impacted students' learning, both as receivers and providers of peer feedback. The study has implications for teaching and designing online courses that employ asynchronous discussions.

Background

The increase of online learning, including fully online and hybrid courses continues to increase with no plateau sight. In the United States alone there were nearly 3.2 million students taking at least one online course as of fall 2005 (Allen & Seaman, 2006). Within these courses online discussions and dialogue have been heralded as a potentially powerful tool that can assist students in the construction of knowledge, serve as a scaffold that allows for multiple perspectives resulting in additional knowledge, negotiation of meaning, and an understanding of knowledge gaps a learner may possess (Land, Choi & Ge, in press; Haavind, 2006; Maor, 2003; Roehler & Cantlon, 1997). This method aligns with social constructivist theories, specifically Vygotsky's social constructivist theory of learning

(Driscoll, 2004). Social constructivist theory argues that learning is social in nature, suggesting that online discussions can become fruitful learning environments when they are developed in an appropriate manner. In particular, the use of online discussions can be tied to Vyogtosky's notion of the Zone of Proximal Development (ZPD), the distance between what learners can do by themselves and what they can achieve with assistance (1978).

Peer Feedback in Online Learning

Feedback, as an integral aspect of the learning process, is promoted by researchers and practitioners alike (Mory, 2004; Driscoll, 2004). In his analysis of feedback research in learning, Mory (2004) suggested that feedback is a "critical function in knowledge acquisition" (p. 777) and that without a feedback mechanism learning would not occur. Whether learners are in an online or traditional environment this holds true, and as Dunlap (2005) suggested feedback for online learners can also serve to counter feelings of disconnect or isolation while a lack of feedback can slow learners' progress. Nicol and Macfarlane-Dick (2006) suggested that feedback serves as a form of formative assessment, designed to improve and accelerate learning. Specifically, feedback is defined "… as anything that might strengthen the students' capacity to self-regulate their own performances" (p. 206).

Given this, proponents of online learning environments have several reasons to explore feedback strategies, including peer feedback. Instructor workload, for one, has been an issue discussed, though mostly anecdotally, in the literature (Dunlap, 2005; Dennen, 2003). Just as students perceive their workload increasing for online courses, so do instructors. Peer feedback has the potential to reduce an instructors' workload while simultaneously providing the type of feedback that is important to students' learning and growth.

Boud, Cohen, and Sampson (1999) explained the importance of peer learning or feedback in today's world, including employers' demands that college graduates possess a broader range of skills including the ability to communicate effectively. Specifically, they cite the need for transferable skills, key competencies, and generic attributes or competencies, all skills that foster lifelong learning. Furthermore, peer learning and lifelong learning skills both incorporate "the development of learning outcomes related to collaboration, teamwork, becoming a member of a learning community, critical enquiry and reflection, communication skills, and learning to learn" (p. 417).

Liu, Lin, Chiu and Yuan (2001) described peer learning as "valuing the exchanges of critical feedback among peers and modifying works according to peer feedback" (p. 246). They suggested that peer review or feedback can foster an authentic learning environment in which students actively construct knowledge. In their study of a web-based peer review system they described what students achieved through the peer review process: peer review allowed them to "read, compare, or question ideas, suggest modification, or even reflect how well one's own work is compared with others. While processing these cognitive functions one monitors the adequacy of their work" (p. 248). It is during this process that cognitive functions, including critical thinking, are hypothesized to increase. Correspondingly, Boud et al. (2001) expressed the idea that students learn a great deal by explaining their ideas to others and by participating in activities in which they can learn from peers.

Just as there are many advantages to using peer feedback, there are also potential challenges. The first challenge that instructors need to be aware of is that many students are not familiar with the peer assessment process, not in any formalized way; as Palloff and Pratt explain, meaningful peer assessment "is not a naturally acquired skill" (1999, p. 123). Topping, in his review of peer assessment, noted several of the more prominent challenges including: poor performers not accepting peer feedback as accurate, students refusing to take responsibility for assessing peers if they see the peer assessment as substituting for instructor feedback or if they are part of a small "socially cohesive" group, a need to monitor peer assessment for potential abuse of peer power, and a concern about issues of reliability and validity (Topping, 1998, p.256).

Teaching and Assessing Critical Thinking

There is much talk given to the concept of critical thinking and related skills in learning and instruction, and as many definitions and perspectives as there are disciplines. Facione and Facione (2007) define critical thinking as "reflective decision-making and thoughtful problem solving about what to believe and do" (p. 44). Similarly, Halpern (2003) defines critical thinking as "cognitive skills and strategies that increase the likelihood of a desired outcome. . . thinking that is purposeful, reasoned, and goal-directed—the kind of thinking involved in solving problems, formulating inferences, calculating likelihoods, and make decisions" (2003, p. 6).

The many approaches to teaching critical thinking skills is parallel to the many approaches to assessing them as well. Spicer and Hanks (1995) reported on seven standardized critical thinking tests available as well as several performance assessment approaches that can be used as outcome measures within various subjects.

Standardized tests can provide useful information that is diagnostic and may help to guide instruction. However, multiple measures of critical thinking should be used whenever possible, since critical thinking is not a general ability but rather a complex set of general and specific factors. For example, in addition to multiple-choice tests, open-ended assessments and interviews could be incorporated into assessments of critical thought.

Studies have shown that online discussions can support critical thinking (Gunawardena, Lowe, and Anderson, 1997; Bullen, 1997; and Jeong, 2000 as cited in Yang, 2002). Furthermore, several recent studies have reported on the assessment of critical thinking skills focusing on students engaged in online discussions. The Community of Inquiry (COI) Model is a framework that was developed to assess the nature of critical thinking, specifically higher-order thinking, in online discussions from a practical approach (Garrison, Anderson & Archer, 2001). The COI is a four phase model (triggering, exploration, integration and resolution), based on earlier work (see Garrison & Archer, 2000), that was developed by conducting a content analysis of transcripts form online discussions. The study concluded that the framework could provide instructors with a tool to asses critical thinking but also cautioned that in order to have higher order thinking there must be sustained critical discourse, one that involves the full cycle of the critical thinking process, a skilled instructor facilitation, and interaction that is both coordinated and synergistic (p. 11).

Similarly, Hemphill and Hemphill (2006) investigated the affect of virtual guest speakers in an online educational technology graduate course and the extent to which the students engaged in critical thinking within online discussions. The results indicated that higher-order thinking occurred throughout the course, and reported that their findings had implications for instructors, including monitor discussions and a "judicious use of appropriate responses by facilitators [to] maintain a high frequency and critical thinking level of responding by the students"(p. 292).

Purpose of the Study

Prior to this study, the peer feedback strategy was implemented in a graduate level technology integration course in the spring semester of 2005. Feedback from students about ease of use and perceptions of the process informed the use of peer feedback in this study (See Ertmer, Richardson, Belland, Camin, Connolly, Coutlhard, Lei & Mong, 2007). The peer feedback instructional strategy was initially envisioned as a way to provide ongoing feedback to students while decreasing instructor load in online courses. This study was designed to evaluate the effectiveness of a peer feedback strategy in asynchronous online discussions. Specifically, this study examined the impact of peer feedback in online discussions on students' perceived and actual critical thinking skills. The research questions included:

1. What were students' perceptions of the impact of the peer feedback strategy on their learning? in terms of providing and receiving peer feedback?
2. What was the effect of peer feedback on students' critical thinking skills, as measured by a critical thinking skills test?

Methods

Given that this is an exploratory study, a mixed model research approach was utilized (Johnson & Christensen, 2004). The mixed methods research design maximizes the strengths and minimize the weaknesses associated with single-method designs, while allowing for triangulation of the data (Johnson & Onwuegbuzie, 2004; Frechtling & Sharp, 1997). Specifically, a pretest-posttest design (Gall, Borg, & Gall, 1996) was triangulated with participant interviews.

Participants. The participants included an intact group of 16 graduate students (of 19 total) enrolled in an online technology integration course during the spring semester of 2006 at a large Midwestern university. Participation in the research study was voluntary; the peer feedback process, however, was not voluntary as it was embedded within the course. Participants earned extra credit for participating in the study; an alternative extra credit option was also presented.

Participants ranged in age from 24 to 52; 8 were female, 8 were male. Twelve participants were Caucasian, 2 were African-American, 1 was Hispanic, and 1 identified him/herself as "Other." Seven participants indicated this was their first online course, 6 had taken one or two online courses including this course, and 3 had taken more than two online courses. Students indicated they spent an average of 6.5 hours per week on the online discussion portion of the class.

Context and Procedures. The researcher reporting on this exploratory study also served as the faculty member teaching the course. While the peer feedback process was embedded in the course the interview data were collected by two independent (graduate) researchers and not provided to the researcher until the close of the course and assignment of final grades.

The course, Integration and Management of Computers in Education, was an online, graduate level course. The course was co-taught by a faculty member (the researcher) and an experienced graduate assistant who had previously taken the course. Students met face-to-face (or via Internet-based video conferencing) for the first class session; all subsequent interactions occurred electronically, within a WebCT course management environment. While the course had several major projects, this study focused on the weekly discussion questions (DQs) and postings. In a typical week, students were given one or two discussion questions and expected to post at least one response to each discussion question and two responses to peer's postings for each discussion question. A total of 18 discussion questions were posted over the 15 week semester. Students were also provided with a "free pass" which allowed them to skip the discussion question(s) for one week.

The scoring rubric for the discussion questions was adapted from Ertmer and Stepich (2004), and provided the instructors and students with a concrete tool for determining the quality of thinking embedded within online postings. Prior to using the rubric for peer feedback students were exposed to modeling of feedback by the instructors and examples of possible responses, with an explanation of why each response merited a specific score (e.g. handout with examples, discussion in class). Moreover, the course instructors provided two weeks of feedback, for a total of four discussion questions. This feedback was provided as a model of the peer feedback the students would provide as the course progressed.

For this study, peer feedback was defined as 1) a numerical score (from 0 - 2) based on Bloom's taxonomy and 2) descriptive comments, supporting the assigned score. Postings demonstrating analysis, synthesis, or evaluation received 2 points; postings at the knowledge, comprehension, and application levels received 1 point; non-substantive comments received 0 points. The peer feedback process was set up in advance with students receiving specific guidelines, including the following:

- Peer feedback provided was confidential,
- Peer feedback assignments were randomly assigned for each DQ Students were asked to utilize the Bloom's taxonomy rubric to award points in combination with either constructive comments for improvement or a rationale for the points awarded.
- Students were awarded up to 2 points for each peer feedback response completed (8 discussion questions requiring peer feedback, two people per question at 2 points each for a total of 32 points); points could be deducted if peer feedback was not provided as assigned or in a timely manner.
- The discussion scores provided via the peer feedback process counted towards students' discussion grades; an average of the 2 scores received from peers for each DQ was calculated for an overall DQ score. Students were informed that if they felt any score or comment was unwarranted that they could protest the feedback via the instructors (mediation process). Only five scores/comments were protested during the process.

In addition, students were provided feedback from the instructor on their use of peer feedback for the first two DQs involving the peer feedback process. The process was completed via an online survey system, and channeled through the instructors who looked over the comments and scores for any obvious discrepancies or inappropriate comments. A sample screenshot of the peer feedback tool is provided (see Figure 1).

Figure 1. Screenshot of the peer feedback tool (ratings tool) in the Blackboard Leaning System, overall ratings view.

Data Collection and Analysis

Quantitative and qualitative data were collected. Qualitative data were gathered by means of interviews conducted by two researchers, independent of the course, following the peer feedback process in the course (weeks 14 and 15). This data was not provided to the researcher/instructor until the close of the course. Interview results captured students' overall perceptions of the peer feedback process and perceived changes in critical thinking skills. Quantitative data were collected using a pre- and posttest administration of a critical thinking skills survey, the California Critical Thinking Skills Test (CCTST).

Interviews. Participant interviews (n=16) were conducted to obtain more detail about individual students' thoughts and perceptions about the peer feedback process (as well as participants' perceptions of their critical thinking and any changes they may have noticed over the course of peer feedback process. Interviews lasted 45 to 60 minutes, were recorded electronically, and then transcribed.
Following are several sample interview questions used in the study:
- What were your initial impressions of the peer feedback process?
- How prepared did you feel providing peer feedback?
- Thinking back to receiving you peer feedback, especially early on, do you see any connection between the peer feedback you received and your posts?"
- When planning your posts, did you consider previous feedback you received? Previous feedback you provided to others?
- Do you feel that the peer feedback process, especially the reflective portion when you are providing peer feedback to your peers, impacted how you thought about your responses and/or the material?
The interview data were analyzed using a coding schema that was derived from the broad interview questions. After each interview was coded a search was conducted for recurring themes across interviews using NUD*IST qualitative data analysis software (Miles & Huberman, 1994). General coded categories, and thus themes, included but were not limited to the impact of peer feedback on posts, impact of peer feedback on reflective process, experiences with giving peer feedback experiences receiving peer feedback, students' perceptions of their

preparedness to provide peer feedback (from the criteria provided and from modeling by the instructor), students' experiences compared to previous experiences with peer feedback, and recommendations for improvement of the process.

Pre-Post Critical Thinking Skills Survey. The California Critical Thinking Skills Test (Form 2000) was used to measure students' critical thinking skills prior to the online discussions and at the end of the course. The CCTST is based on the American Philosophical Association's Delphi consensus conceptualization of critical thinking (Facione, Facione, Blohm & Giancarlo, 2002, p. 1) and is designed to measure the skills dimension of critical thinking, with critical thinking being composed of the "disposition to think critically as well as have the skills to do so" (Facione, et al, p. 2). The CCTST measures the core reasoning skills of analysis, inference, evaluation, deductive reasoning and inductive reasoning.

The test is designed for college undergraduate and graduate level uses, from freshman year on. The CCTST survey contains 34 items and the questions provide the content to which one's reasoning skills are applied (Facione, 1990, 1992). The data were analyzed using a paired sample t-test for each of five subtests (induction, deduction, analysis, inference, and evaluation) and the total score. Mean scores and t-test results are provided in the Results section.

Validity and Reliability Issues

The California Critical Thinking Skills Test (Form 2000) is an updated version of the California Critical Thinking Skills Test Form A. Form A has been well established in terms of both its reliability and validity. (e.g. Kuder-Richardson 20 estimates of internal consistency ranging from .68 to .70; see Facione, P.A., 1990 for further details). Form 2000 retains 22 items from Form A in addition to 12 new items. A correlational study was conducted between Form A and Form 2000 with a result of r=0.912, indicating a strong reliability for Form 2000. Moreover, the developers indicate that internal consistency measures provided evidence that Form 2000 was slightly more reliable than Form A (Facione, et. al., p. 16). Finally, Content and construct validity for the CCTST Form 2000 is provided by the development of the instrument from the APA's Delphi study (Facione, e. al., p. 18)

Validity concerns were addressed, primarily, through the triangulation of data sources. For example, interview results provided perceptions of changes in student learning or critical thinking skills while the California Critical Thinking Skills Test (Form 2000) pre-post critical thinking skills survey provided researchers with standardized critical thinking scores. The interviews also provided opportunities for participants to elaborate on the ideas being explored and provide more detailed explanations. The interviews were transcribed verbatim and were member-checked to ensure accuracy.

Results

Participants' Perceptions of Impacts on their Learning

The first research question relates to participants' perceptions about their learning in relation to the peer feedback strategy. During the interviews all participants (n=16) discussed their learning and possible changes in learning (e.g. critical thinking skills) during the peer feedback process. Specifically, participants were asked about (1) their learning in terms of the impact the peer feedback process had on their discussion posts (n=14), and (2) how the reflective portion of the process, which occurred as they prepared the feedback for their peers, impacted their learning or critical thinking processes (n=14).

The majority of respondents (n=10) explained that the peer feedback they received impacted their postings. For example, one participant stated, "One time someone gave me feedback that I was not incorporating the readings, because I didn't…so as I read the articles I'd highlight something and say 'OK, I'm going to include this in my postings'" (Participant 7, lines 267-272). Similarly, another participant explained

> I would always take the peer feedback into consideration in my next [posting]. If there was something that they commented on that was lacking, I would definitely try to make up for it in the next discussion, or try to be more aware of it, and go back to the rubric and say "OK, what am I missing here?" And if there's things they liked I definitely… would do that more (Participant 1, lines 121-127).

Moreover, several participants (n=4) discussed the idea that the peer feedback they received impacted how they conceptualized their postings, more specifically they discussed the perceived relationship between peer feedback and improved critical thinking, mirroring the first example.

> I think in some ways [the peer feedback process] made me think about what I was posting and how much I was posting…and how someone else would perceive my postings. Early on I think my postings were less

in-depth. After a while I started to think about the topic more in depth before I actually posted…I found myself posting less but posting more significantly (Participant 4, lines 91-97).

Participants were also asked specifically about the reflective portion of the process, as described in a previous study by Ertmer, et. al. (2007). The reflective portion takes place as peers develop and provide feedback and is the part of the process that students in the previous study indicated had the most impact on their learning. Of the 14 participants who responded to this topic, the majority (n=10) indicated it did impact their learning, 2 did not see any connection between the process and their learning, and 2 were unsure of a connection. Of the participants who described a connection between providing peer feedback and their own learning, their examples varied from awareness to critical analysis. While the awareness of the process can prove to be an invaluable indirect connection to learning, the participants who spoke of engaging in more critical analysis of their work provide a more direct connection. For example, as one participant explained,

I started to think about why I was assigning the grade that I did to someone's postings, and I got to thinking, 'They're going through the same process', so I think it made me more aware of what I needed in mine to make sure I received the kind of grade I wanted to receive...It made me think more carefully about my own posts (Participant 8, lines 157-164).

Along these lines several participants (n=6) described a sense of awareness mixed with critical analysis of their own postings, as exemplified by the following,

I think that by doing [the peer feedback] it improved my own discussion and what I was contributing to the class because I knew better what was required and what would help the discussion. And, I [paid attention] to what others were using, what was working, and I told them in their feedback, and then I tried to implement that more in my own discussions…I guess it made me more critical of my own discussion [postings]. It made me more aware of other avenues I could take…by doing the peer feedback it enhanced my own discussions (Participant 1, lines 59-63, lines 146-150).

Overall all participants indicated that the peer feedback impacted their posts either through the reception or provision of feedback, and ranging from an awareness level to a higher cognitive level. In general, participants who described reaching "awareness" of the impact referred, primarily, to receiving peer feedback while the majority of participants describing changes at higher levels referred, primarily, to giving peer feedback.

Participants' Learning as Measured by the California Critical Thinking Skills Survey (CCTST)

The second research question examined changes in students' critical thinking skills after implementation of the peer feedback strategy, as measured by the California Critical Thinking Skills Test (CCTST) (Form 2000). The CCTST data were analyzed utilizing the null hypothesis that *there is no significant difference between the means of the two variables,* or in this case the pre and post CCTST scores.

Table 1
Paired Samples Statistics (n=16)

	Pre-Test			Post-Test		
	Mean	Std. Deviation	Std. Error Mean	Mean	Std. Deviation	Std. Error Mean
Induction	10.50	2.58	.65	9.75	2.96	.74
Deduction	8.38	2.50	.63	9.25	3.38	.84
Analysis	4.56	1.63	.41	4.19	1.17	.29
Inference	9.13	2.06	.52	9.31	3.34	.84
Evaluation	5.19	2.23	.56	5.50	1.86	.47
Total Score	18.88	4.49	1.12	19.00	5.67	1.42

The average mean for each pre and post test across the 5 subtests (induction, deduction, analysis, inference, and evaluation) and the means for the total scores for the pre and post test are provided in Table 1. The average mean increased for the deduction, inference, and evaluation subtests as well as total score.

Table 2
Paired Samples T-Test Results

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pre-Induction – Post-Induction	.750	2.543	.636	-.605	2.105	1.18	15	.256
Pre-Deduction – Post-Deduction	-.875	2.918	.730	-2.430	.680	-1.20	15	.249
Pre-Analysis – Post-Analysis	.375	1.962	.491	-.671	1.421	.764	15	.456
Pre-Inference – Post-Inference	-.188	2.613	.653	-1.580	1.205	-.287	15	.778
Pre-Evaluation – Post-Evaluation	-.313	1.991	.498	-1.373	.748	-.628	15	.539
Pre-Total – Post-Total	-.125	4.617	1.154	-2.585	2.335	-.108	15	.915

As Table 2 demonstrates, a paired-samples t-test revealed no significant differences in the subtest scores prior to the peer feedback process and following the process. Since the probability is greater than .05, we accept the null hypothesis of no difference. Several reasons could account for the lack of any statistically significant findings of the CCTST, including limited time of the peer feedback intervention (approximately seven weeks), and the limited sample size. However, a more likely reason is that the CCTST is not a good measure of the critical thinking being promoted by the online discussions.

Discussion

The peer feedback process described in this study served to assist students in their learning process, allowing for opportunities to engage in higher level thinking (Liu, Lin, Chiu, & Yuan, 2001). For example, in this study several of the participants perceived the peer feedback as having impacted their learning at a higher cognitive level, such as their critical thinking skills. In their interviews participants discussed how the peer feedback process impacted their learning, both as receivers and providers of peer feedback; the deeper impacts appear to have occurred during the reflective process of providing peer feedback.

While the critical thinking skills test (CCTST) did not demonstrate significant increases after the peer feedback process, participants' scores did not decrease, they appeared to have plateaued. The CCTST was chosen to measure actual outcomes for this study because the categories of the critical thinking skills being tested (analysis, inference, evaluation, deductive reasoning and inductive reasoning) appeared to align with Bloom's taxonomy (evaluation, synthesis, analysis, application, comprehension, and knowledge) on which the course was basing the ratings of the online discussions. However, as previously discussed in the review of literature, there are many definitions and measures of critical thinking, which leads the researcher to believe that perhaps the CCTST is not a good measure of the critical thinking being promoted by the online discussions. Given this, even if overall critical thinking is, as Halpern (2003) defines, the "cognitive skills and strategies that increase the likelihood of a desired outcome. . . thinking that is purposeful, reasoned, and goal-directed—the kind of thinking involved in solving problems, formulating inferences, calculating likelihoods, and make decisions" (2003, p. 6), then perhaps we as researchers need to look to more course or content specific measures. At the very least we should look to the Community of Inquiry model (Garrison, et. al., 2001) as it goes beyond a performance assessment and looks to the unique environment that online discussions create. And as good researchers often do when considering a variable as complex and broad as critical thinking, we should use multiple measures to help us better understand and target the variable being researched (Spicer & Hanks, 1995). Indeed, perhaps there is a need for a new measure that targets what the students' perceive as having occurred in terms of their learning.

Future Research

The peer feedback process was originally conceived of as a way to provide ongoing feedback and reduce instructor load, this study only examined the implementation of the peer feedback strategy while future research will include an examination of instructor load. Moreover, keeping in mind that this is an exploratory study, and thus the small number of participants, the researcher and her colleagues are currently implementing the research on a larger scale with undergraduates in education and engineering. A power analysis has identified a minimum number of 98 students as being necessary in order to obtain a medium linear relationship (e.g. .25) at the .05 level of significance while holding that .70 is a reasonable level of power for producing a statistically significant finding (Keppel et al., 1992). In addition, the researcher and her colleagues are looking into the use of a different standardized measure of critical thinking that may align better with the types of critical thinking promoted in online discussions.

Finally, research is currently being conducted on the impact of the peer feedback process as it relates to social presence (Gunawardena & Zittle, 1997). Specifically, the researcher is examining students' perceptions of the peer feedback process and whether they felt more connected to the learning community (e.g. peers) as a result of this process. Social presence, which has been shown to have an impact on students' perceived learning and satisfaction, is an important research area that speaks to the complexities of online learning (Richardson & Swan, 2003).

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Interaction Analysis, Synchronous CMC,
& a Multi-Modal Unit of Analysis

Jason K. Skinner
University of New Mexico

Abstract: The Interaction Analysis Model for Examining Social Construction of Knowledge in Computer Conferencing (Gunawardena, Lowe, & Anderson, 1997) is one of the most frequently researched asynchronous interaction analysis models. This paper will explore the findings and difficulties of utilizing this conventionally asynchronous model to investigate collaboration in a synchronous audio-conferencing environment. Of particular interest, this study questions what is an appropriate unit of analysis for investigation of synchronous online interaction?

Introduction and Theoretical Background

Content and Interaction Analysis

Content analysis is a research methodology that entails that the segmenting of communication content into units of analysis, coding and assigning units into categories, and providing quantitative results for these categories (Rourke and Anderson, 2004). The nature of computer-mediated communication (cmc) provides an automated and readily available archive of communication data for content analysis research (Gunawardena et. al, 1997, Marra et. al, 2005; Rourke, Garrison, Anderson, & Archer, 2001). Content analysis that makes inferential findings from constructs (such as models of cognition) have been complicated by such research being time consuming, expensive, and difficult (Henri, 1992; Rourke et al., 2001; Rourke & Anderson, 2004; Henri, 1992).

Marra et al. (2004) point out that there are not many content analysis models available to researchers. Rourke and Anderson (2004) note the extreme investment that development of a coding instrument entails. Yet they also note a reticence for re-using existing instruments. Researchers that re-use content analysis models contribute to the validity of existing procedure, benefit from comparing results with other normative data, and skip the costly instrument development phase (Rourke & Anderson, 2004). While many of the existing content analysis models have been re-used and studied, two that have been frequently reused in varying research contexts have been Garrison, Anderson, Archer's (2001) Communities of Inquiry Model and Gunawardena et al. (1997) Interaction Analysis Model for Examining Social Construction of Knowledge in Computer Conferencing.

Interaction analysis is a mode of content analysis that investigates interaction of people within their situated environment (Gunawardena et al., 1997). In defining social interaction Van der Aalsvoort and Harinck (2000) note reciprocity of actions, reactions, and emotional expression within the process of interaction. Within instructional contexts interaction studies are based in an understanding that learning is a distributed, social process. Evidence of learning must be found in "understanding the ways in which people collaboratively do learning and recognize learning as having occurred" (Gunawardena et al., 1997, p. 403).

Unit of Analysis

Unit of Analysis in Asynchronous CMC Interaction Analysis

Before data within cmc transcripts may be analyzed and learner interaction categorized according to the researcher's investigative instrument(s), transcripts must be divided into codeable units of analysis. Determining the unit of analysis is an important step before the final task of the actual analysis of conference transcripts begins (Garrison et al., 2001).

Content analysis researchers often choose the 'message', an individual threaded discussion post, as unit of analysis within asynchronous cmc (Garrison et al. 2001; Gunawardena et al. 1997; Gunawardena, et al. 1998; La Pointe & Gunawardena, 2004; Orrigun et al., 2005). This choice has been driven by the aspect that the 'message' is an objectively identified and demarcated unit of analysis where the length and content of the message are both decided upon by the participant and not the transcript coder, (Orrigun et al., 2005; Garrison, 2001).

Units of Analysis in Synchronous Conversation

The message as unit of analysis is not applicable to synchronous modes of cmc. To address a unit of analysis appropriate to synchronous interaction one needs to look to a discourses that focuses on the investigation of conversation. Conversation analysis (CA) is a form of content analysis that focuses on the investigation of conversational data (Markee, 2000).

Crookes (1990) describes conversation analysts as having utilized different units of analysis including turns, tone units, and utterances. The 'utterance' focuses upon a singular declaration of speech by a participant within a conversation in order to reflect and analyze the psychological processes that underlie speech production (Crookes, 1990). Markee (1991) critiques the utterance as taking a speaker's, not hearer's perspective of conversation analysis. This concept of conversation does not take into account the assertion by Sacks, Schegloff, & Jefferson (1974) that talk in interaction is fundamentally collaborative in nature and must address the natural pattern of talk in interaction. This critique supposes that a unit of analysis must not consider a single utterance in isolation, rather it must consider the collaborative context of conversation and provide a unit of analysis that is embedded within the reciprocal and ongoing interaction present in conversation.

The 'turn' embeds individual participants' turns of speech within the context and pattern of conversation that occurs. Samara-Fredricks (1998) quotes Boden (1994) saying that the turn has become the "central focus of all researchers in CA," (p.66). Crookes (1991) points out that the turn is "one or more streams of speech bound by speech of another, usually an interlocutor" (p.185).

Figure 1. Turns of Speech (Crookes, 1991, p.185)

1 A: Are you going home?
2 B: Sure, I'll be leaving in ten minutes.
3 A: Great.

The example in Figure 1 exemplifies the bound context that each stream of speech has within the interaction pattern as a whole. In the example participant A has two turns, while Participant B has one turn. The turn may provide a useful unit of analysis within an investigation of synchronous audio cmc transcripts. A comparable aspect between the message and turn as unit of analysis is that the turn is self produced by the participants in the conference, not decided upon by the coder.

Research Purpose

This study investigates the use of the Interaction Analysis Model for Examining Social Construction of Knowledge in Computer Conferencing (IAM) (Gunawardena, Lowe, & Anderson, 1997) in a synchronous audio-conferencing environment. Specifically the researcher focused on two research questions: 1) Can the IAM be used to provide evidence for the social construction of knowledge within a collaborative community of learners via synchronous desktop audio-conferencing audio artifacts? 2) Is the turn an appropriate unit of analysis for synchronous cmc-based interaction analysis studies?

Research Methods

Participants

A small community of learners comprised of three educational technology graduate students participated in an online study group with the objective to learn the web-based learning object authoring tool Pachyderm 2.0. Of the two female and one male participants, pre-study interviews indicated that only one had previously used audio-conferencing and instant message technologies. None of the participants were familiar with Pachyderm 2.0.

Procedures

The participants were charged to complete a collaborative project-based learning exercise. The objective of this exercise was to create an instructional resource using the Pachyderm 2.0 authoring tool. Utilizing the audio conferencing features of the instant message client iChatAV® to facilitate group communication, the participants were tasked to assign responsibilities to individual group members and self manage the process of resource development. Proscriptive constraints for the exercise included:
- The online resource should be designed and created within the audio-conferencing environment.
- The group should make all decisions about the design and creation of the resource collaboratively.

Five sixty-minute online CMC sessions were held over a twelve week period. Two face-to-face Pachyderm 2.0 authoring training sessions proceeded the online sessions. Due to difficulty maintaining a stable multipoint audio-conferencing connection using participant home internet connections, only the final two online sessions were analyzed for social construction of knowledge by participants. Each session was audio recorded and then transcribed.

Instruments

The IAM model depicts the phases of social cognitive processes learners move through during cmc interaction. The difference in content analysis model approach can be noted by the location of analysis. While investigations of the patterns of connection found within cmc messages seeks to decontextualize messages from their original context and recontextulaize them into threads of related messages and units of meaning, the use of the IAM investigates interaction in the original context of the cmc transcript and seeks to understand the process of social construction of knowledge through the actual flow and pattern of interaction that took place during the conference (Gunawardena et al., 1997).

The IAM is broken into five phases of co-constructing knowledge that learners may negotiate during the process of interaction: Phase I Sharing and Comparing Information, Phase II Dissonance or Inconsistency of Ideas, Phase III Negotiation of Meaning/ Co-construction of new knowledge, Phase IV Testing and Modification, Phase V Agreement and Application of New Meaning. Gunawardena et al. (1997) make a correlation between this model and Vygotsky's concept of a learner's movement from lower to higher mental functions. In this correlation, the model begins with participants working within lower mental functioning (the sharing and comparing of information) and moving through the phases into higher mental function (co-construction of new knowledge, testing, and application) (Gunawardena et al., 1997). It is at Phase III that evidence of socially constructed knowledge appears. Phase IV and V represent the testing, metacognitive statements of the social process in which the new knowledge was constructed, and the adoption of the new knowledge into the learner's framework and schema.

Each phase in the model is composed of a series of sub-phases that represent types of operations that participants may move through during that stage. These sub-phases act as indicators for coders to infer group social cognitive processing. This is not a prescriptive coding scheme, rather a proscriptive model that needs to be interpreted and accommodated by a researcher that chooses to use it.

Data Analysis

Two raters coded the transcripts using the turn as the unit of analysis. After reaching 95% agreement test coding one of the earlier sessions not included in the results, the raters independently scored the final two sessions. A total of 1250 turns of speech were coded. Using Holsti's coefficient of reliability interrater reliability is cr = .82.

Findings

Synchronous CMC and IAM

The raters found just two instances, a total of 33 turns, of social construction of knowledge by the session participants. The agreement between coders for these 33 turns was cr = .94. The researcher expected a higher frequency of instances higher than phase III between session participants.

The first instance of social construction of knowledge falls within the domain of participant interaction with the authoring tool interface, the second creating group definitions for the difference between instructional technology and technology . The following excerpt from the first example illustrates the participants discovering that they cannot simultaneously edit a single page. Through the subsequent interaction they come to a shared understanding of the problem.

Figure 2. Example 1

III/C	0128	C: So all of us can't, I'm doubting that we can all be on it simultaneously editing it. We can try it but that's kind of, that's one issue.
III/D	0129	A: If we can't do it simultaneously it seems like. Um, we can, um, just take turns and then maybe we can watch while one person is doing it so we can actually see the editing going on.
IV/C	0130	B: Well they have to go through the save now process. I think this is like our server at school. We can't all have the same file open at the same time working on it because not everybody's changes will be accepted.
III/C	0131	C: Right.

Example 1 illustrates phase III interactions that follow initial phase I description of technical problems. The example demonstrates the group collaboratively coming to a new understanding about the web authoring environment.

The IAM is not prescriptive, but rather a proscriptive model that enables the researcher to interpret and accommodate its application and use within an experiment. This allowed for the its application into a mode of cmc other than the asynchronous mode it was initially designed for. The data show evidence that the IAM can be utilized to investigate synchronous audio transcripts for the social construction of knowledge, yet few interactions within this study passed into phase III of the model or beyond,

Task design may have influenced the high level of phase I interactions. While the design offered a collaborative outline for the group task, the participants chose to use labor division to break the task into individual sections that would be synthesized by the group at the culmination of the project. Since the majority of work was completed individually group interactions rarely left the sharing and coming stage of the IAM. As Blake (2000) demonstrates non-task related may have also effected the quality of interactions. Frustrations with technical difficulties and joking among participants accounted for a large number of session interactions.

The Turn

Benefits of the turn include enabling coders to objectively and precisely code the same number of units of analysis. Also discussed previously turns are determined by the participant speaker, not retroactively by the coder. When the interactants remained within the oral mode of communication the turn was found to be an adequate unit of analysis.

Communication, however, did not remain within the oral domain throughout the sessions. The following example demonstrates that participants also utilized the text-based chat to pass information to one another.

Figure 3. Example 2

0229	C: So I just sent a test. I grabbed a //small/
0230	A: Oh I see it.
0231	C: A small portion.

Between turn 0229 and turn 0230 participant C sent something. A text message was sent that briefly described one of the technologies the participants included in the final project. Participant C enters into the text chat: *Unitedstreaming is a digital video-on-demand service, the largest and most current K-12 digital video/video clip library available today. Unitedstreaming continues to grow as new content and features are continuously being added.* From the audio transcripts the coders are unable to identify what was sent, account for the contents, or allow for the interaction in their coding.

The dominant concept of the turn within conversation analysis research does not take into account communications that occur within visual or actional text-based channels (Lamy, 2004). Lamy (2004) discusses Mondada's (2001) concept that the turn becomes increasingly fragile as non-verbal elements, and the material, spatial, and technological environments within which interactions are situated are taken into

account. To account for the multiple channels of communication that may occur during interaction one must consider multiple modes of communication that may transpire simultaneously. Jewitt, Kress, Ogborn, and Tsatsarelies define this as multimodal communication, the "ensemble of modes we regard as the normal condition of communication, " (2001, p. 6). Transcribing interaction through turns within oral channels of speech may not be the most appropriate choice for unit of analysis within synchronous cmc environments, because students must negotiate and interact through multiple communication channels including not only the auditory and oral channels, but also the visual channel (i.e. graphical interface, text-based communication) and the actional channel (i.e. manipulating interface and applications).

Methodological Challenges

Utilizing a multimodal unit within interaction analysis poses two unique methodological challenges, determining the unit of analysis and transcription. Multimodality focuses on the use of several semiotic modes to produce a semiotic product, with particular attention paid to the combination of these modes (such as how modes reinforce, compliment, or are hierarchically ordered) (Hampel, 2003). A multimodal unit of analysis needs to account for interactions that occur within multiple semiotic channels (such as auditory, oral, visual, actional). Contemporary synchronous cmc environments often synthesize many communication tools within a single interface (such as text chat, audio/video conferencing, whiteboard, and shared desktop). A multimodal unit of analysis also needs to count for the possibility of several technological modes of communication within a single semiotic channel.

Another significant challenge to utilizing a multimodal unit of analysis is transcription. Kress, Ogborns, and Martins (1998) suggest that actions, objects, materials, and gestures can become the central semiotic units within an interaction. Transcription of synchronous cmc must be able to demonstrate the interrelation of multiple semiotic modes, as well as the hierarchy within the meaning making process (Hampel, 2003). Transcribing a multimodal unit of analysis may include a sequence that runs across many turns (Lamy, 2004) that represent a semiotic product, while individual turns account for the multiple communication channels that contribute to the production of the semiotic product.

Conclusion

Evidence was found that the Interaction Analysis Model for Social Construction of Knowledge (Gunawardena, et al., 1997) can be utilized to investigate social construction of knowledge within a synchronous audio conferencing environment. The unit most often used in synchronous conversation analysis was found not to be adequate for analysis of interactions that occur within the multiple communication modes found in synchronous cmc. Further research to investigate elements of a multimodal unit of analysis, as well as its methodological application within the transcription, coding, and analysis phases of research is suggested.

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A Case Study of Three Educational Technology Graduate Programs and Their Responses to Technological Change

Kristen Sosulski
Teachers College Columbia University

Purpose

The purpose of this study was to understand the evolution of educational technology graduate programs. The advances and changes in computer technology raise questions about the levels of knowledge and skill required for future educational technology practitioners as well as how, when and where skills should be acquired. Graduate programs in educational technology are challenged with staying current in the new trends and technologies, designing curriculum to accommodate the broadness of the field, while working within the constraints and structures of graduate schools of education. The focus of educational technology programs is on using technology to enhance learning; in this study the concern is how students learn about technology to help others learn with technology.

The faculty members and curricula of three programs were studied to understand how their educational technology programs evolved. This study presents the responses from faculty members to the changing impact of computer technology on their programs and courses over the past thirty years. The three programs selected for study were elite U.S. based educational technology graduate programs in schools of education.

Theoretical Framework

Educational technology is "the study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources for learning" (Association for Educational Communications and Technology, 2004, p. 1). Since the mid-1970s computer technology has been transforming the practice of educational technology (Ely, 1998). Computer technology in this context refers to "computer tools and programs and the learning activities they enable" (Salomon, Perkins, & Globerson, 1991, p. 2). The capacity of computer technology to enable users to navigate, engage, and communicate has offered immense opportunities for educational technology. A study of three educational technology graduate programs revealed the approaches and perspectives of faculty concerning the impact of technological changes on their programs.

A common approach towards comprehending the possibilities of the computer's role in education was to compare it to other media. Initially the computer was categorized along with other technologies used in education. It was described as an independent variable in the learning process where the computer could directly impact learning (Clark, 1983). This approach was popular when behavioral learning theory dominated the practice of educational technology.

A major theoretical paradigm shift occurred when the cognitive perspective emerged. This perspective focused on the learner and described their cognitive processes as mediating learning. According to Saettler (2004) "it is now known that technologies do not mediate learning, but that knowledge is mediated by the cognitive processes produced by technologies" (p. 453). Furthermore, "these cognitive effects are not necessarily unique to any particular medium or attribute of the medium" (Clark & Sugrue, 1988, p. 21). This theoretical paradigm shift impacted the role of the computer in educational technology. Technologies can have a positive effect on learning, however, "such benefits are not likely to occur automatically as technologies advance. Rather, they need to be cultivated through the appropriate design of technologies and their cultural surrounds" (Salomon, Perkins, & Globerson, 1991, p. 8).

Faculty members in educational technology programs face the challenge of finding balance between teaching pedagogical designs and supporting the technical articulation of those designs. In many educational technology graduate programs, students are prepared with knowledge in the design, development, evaluation, management and utilization processes and techniques for learning (Ely, 1998). The ways that students apply theoretical knowledge to the implementation of digitally-based learning environments in these programs is central to this study. What knowledge, skills, and abilities do students need to effectively conceptualize, innovate and use technologies to meet specific learning objectives?

This study contributes to an area underrepresented in the literature by focusing on the evolution of educational technology programs. The adaptation of new technological developments created distinct divisions within the field and among educational technology programs, such as specialized tracks of study focused on

computers and education (Orey, McClendon, & Branch, 2005). According to Ely (1998), "One of the best ways to trace growth and development of professional education in our field is to review the curricula of graduate programs that prepare individuals for service in the field" (p. 18). However, to date, no specific analysis of educational technology graduate programs traces the growth and changing response to technological innovations. It is still not understood how programs adapt to technological changes that affect the field of educational technology.

This study differs from previous, more general research on educational technology graduate programs. The field of educational technology is very complex, catering to a number of professional settings and areas of practice. There is little literature that exclusively concentrates on the role of technology in the evolution of educational technology programs. Rather, studies tend to focus on workplace needs and the competencies for future educational technologists. "Much of the debate has centered on the degree of expertise and range of qualifications required at various levels of professional assignments" (Snow, 1969, p.8). This study is unique in that it looks within in programs to determine what faculty value and teach as they prepare educational technology professionals. As leaders in educational technology research and practice in the field, the faculty teaching in these programs are shaping the next generation of educational technology practitioners. Employers may dictate the knowledge and skills needed in the workplace, however, the curriculum in educational technology graduate programs defines what is important and unimportant by those who helped define and shape the profession.

Mode of Inquiry

This study utilizes a multiple case study methodology to identify the role and representation of computer-based technologies in educational technology curricula and programs. Typically, "the case study relies on many of the same techniques as a history, but it adds two sources of evidence not usually included in the historian's repertoire: direct observation of the events being studied and interviews of the persons involved in the events" (Yin, 2003, pp. 7-8). A multiple-case study was utilized to best illustrate the approaches to technological change adopted by the three major educational technology programs studied. A historical review of three programs in educational technology serves as an explanation of the various approaches taken toward the integration of computer technology within the programs. Through the identification and analysis of computer technologies in educational technology programs and curricula from 1975 through 2005, this study addressed the following questions:

- How have educational technology programs responded to the introduction of computer technologies?
- How have the curricula in educational technology programs adapted to accommodate changes in computer technologies?
- How have educational technology faculty viewed computer technologies over the last thirty years?

Data Sources & Analysis

Data was obtained from multiple evidentiary sources. The evidentiary data was gathered from open-ended dialogue with faculty during interviews and from a multitude of primary and secondary historical documents. Faculty member selection was based on their influence on their school's program. For example, program chairpersons and long-term, full-time faculty were typically identified for interviews. These individuals were deemed "key informants" because they possessed specialized knowledge of their respective programs' history (McMillan & Schumacher, 1993). A broad set of interview questions were administered to each of the twelve faculty members participating in the study. The questions asked were designed to elicit information regarding each faculty member's knowledge about the program. They were asked their opinions regarding computer technology within their programs (McMillan & Schumacher, 1993). Interview responses were used to capture the historical development of each program to understand the role of the computer at the onset of each program; the current role of the computer within the program and curricula; and faculty member's reflections on the evolution of their respective program with regard to computer-based technologies. The interviews served as a primary data resource. The historical documents used as primary and secondary sources included school bulletins, program web sites, course syllabi, course evaluations, materials developed by the faculty or staff of the program, and relevant journal or newspaper articles. The use of multiple data sources helped insure the quality of the research.

Each program's course offerings were examined. This document analysis included an examination of the course title, course description, the semester and year that each course was taught, and the faculty member assigned to teach the course. As part of the inquiry into the course content, syllabi for courses were reviewed as were all other pertinent documents such as course evaluations. Information collected from these program-specific sources were organized using a timeline structure. This highlighted all program changes, such as new course offerings (Miles &

Huberman, 1994). The data was organized into an event listing, "a matrix that arranges a series of concrete events by chronological time periods, sorting them into several categories" (Miles & Huberman, 1994, p. 111). Focus was placed on those events that related to computer-based technological innovations represented in programs. In particular, a time-ordered matrix was used to "display time-linked data referring to phenomena that are bigger than specific 'events,' so as to understand (and perhaps later explain) what was happening" (Miles & Huberman, 1994, p. 119).

The interview responses were transcribed and used to help create an intellectual history of the effects of computer technologies within the programs studied. This information was combined with the data collected from program-specific historical documents. The interview data was organized within the same event-listing matrix used for the salient events gathered from the historical documents.

Results

Response to Introduction of Computer Technology in Educational Technology Graduate Programs

In the mid-1970s and early 1980s the response from the three educational technology programs studied indicated a strong need to prepare students the actual practice of developing educational software. Within each school students had opportunities to develop educational software. The rationale early on was that there was a general lack of software available and it was important to provide students with grounding in the technology to envision the use in education. Also, programming was a trend in K-12 schools in the early 1980s, which also necessitated students in educational technology graduate programs to learn the popular approaches to computing in education at the time. Each program addressed equipping their students in computing skills through different methods. The commonality in the response to the computer as an innovation in education was to provide opportunities for educators to actually develop software programs. Each program began prior to the popularization of the graphical user interface (GUI) and lack of authoring environments available to build software. Therefore, many students learned a computer programming language as their main tool to software development.

Evolution of Applications of Technology in Education Based on Emerging Capabilities
of the Technology

The field of educational technology has adapted to changes in theory and practice shifting towards constructivist learning environments, microworlds, anchored instruction, and problem based learning (Jonassen & Rohrer-Murphy, 1999). Underlying these approaches are cognitive theories and strategies such as situated cognition, cognitive flexibility, distributed learning, and social cognition. Educational technology graduate programs have increasingly used computer software for the design, development and utilization of learning environments. The faculty interviewed for this study described the potential of computer and other technologies as tools to support education, as a catalyst and an environment to purposefully apply various learning theories. Several faculty discussed the affordances of technology which can be defined as the "perceived and actual properties of a thing, primarily those functional properties that determine just how the thing could possibly be used" (Pea, 1993, p. 41). This was evidenced by the increase in course offerings and diversity in types of courses offered. From discussion with faculty and a review of the curricula changes five stages of evolution emerged on how programs educated in the best practices in education. The five stages of the evolution identified were: an increase in emphasis course topics related to computers and cognition; concentration on strategies for use over contexts for use; focus on collaborative learning through telecommunications; the construction of hyper-mediated learning environments; and the Web as the primary delivery mechanism for learning technologies and distance learning. The trends were a combination of the new affordances of technology and the ability to apply specific theoretical constructs into practice.

Responses and Adaptation to Advances in Computer Technologies

The rapid pace of technological change impacts the hardware and software used and taught in educational technology graduate programs. Keeping abreast of the latest technology presents challenges for these programs. The three programs studied presented a response as to how their students are skilled in the latest technologies used in the field of educational technology. There was much overlap amongst the three programs on the approaches to taken to ensure their students had opportunities to learn the latest technologies. The approaches ranged from informal

methods such as workshops and group-based learning to more formal methods such as classes dedicated to learning specific technologies. The presence of an approach was an acknowledgement by the programs of a need and demand for those skills. However, while there were efforts to provide students with technical training, the faculty interviewed presented two opposing perspectives on how, where, and to what extent should students be educated in technology in educational technology graduate education?

A selection of faculty interviewed amongst the three programs studied indicated a need for students to obtain skills in technology. There were three arguments presented by faculty for students to obtain some skills in technology. The rationale presented by some faculty emphasized the importance of equipping students with a foundational knowledge in computers as a means to realize the potential afforded by the technology. Specifically, understanding the strengths and limitations of technology prepared students in the ability to conceive of educational technology solutions. From this perspective, selecting solutions to learning challenges requires an understanding of the appropriateness of the technology and the knowledge of the possibilities of technology to address particular learning needs. Secondly, some faculty felt that a foundational knowledge in technology was essential for their students, as future educational designers or project managers to have the capability to communicate within a team of developers. From this perspective, faculty envisioned students working in a larger team of software developers, engineers, researchers, and artistic designers. The student in this future role needed to understand the basic constraints of the technology, such as network or hardware limitations. Moreover, in this view it was important that student formed judgments and reasonable expectations concerning development time of software projects. From this viewpoint, skills in technology helped prevent the naivety in the future educational technologist. Some faculty valued the ability for students to realize their educational visions through the development of digital mockups. For some faculty it was not enough to sketch out their educational designs using paper and pencil. From this perspective, the ability to provide a partial working prototype of an educational application was a valuable tool in communicating with teams of software developers and designers. It both provided the artistic designer with a sense of the interface and the programmer with a sense of the underlying functionality required. A working prototype also articulated the flow of the software and the points of interaction. Moreover, from a career perspective faculty felt that students should have a portfolio of work in digital form. They felt that the ability to demonstrate prototypes of educational software would serve as a huge advantage in the marketplace as some faculty felt that digital mockups represented an activity in educational technology practice. In addition, supporting this view were those programs that required master's projects that were to be digital in nature. Faculty viewed the projects as opportunities to have students understand the entirety of the process of analysis, design, development, implementation, and evaluation.

A selection of faculty favored the de-emphasis of technology skill development in their educational technology graduate programs. There were three arguments by faculty to decrease the focus on educating students in technology. The first argument presented by faculty was that the field of educational technology was in need of graduates with skills in creativity and knowledge of learning theories over technology. Faculty valued educating students in the foundational areas of design, cognitive learning theories, and specific approaches towards addressing educational challenges with the use of technology. Some faculty were concerned with the appropriateness of the use of technology in education. By teaching technology skills faculty felt too much emphasis would be placed on the design and development of educational software over the analysis of learning situations, curriculum development, and evaluation of appropriate solutions. Some faculty indicated that their programs placed too much of an emphasis on teaching technology. Even as the authoring environments have removed the burden computer programming skills to develop software, some faculty felt that this had little impact on the quality of student work. In a similar vein, one faculty noted that the computer programmers were a readily available resource, therefore it was impractical to skill education students in computer languages. However, creativity and innovation in learning were skills that some faculty felt were more difficult to develop and those were the skills faculty sought to instill in their students. A second argument presented by faculty to de-emphasize the teaching of technologies in their graduate programs was based on the constraints of time, practicability, and purposes of their programs. Specifically, some faculty felt that master's programs were too time constrained to expect students to acquire much skills in computers, to the degree and depth to realize educational designs. For example, an introductory course on computer programming would not provide students with the necessary skills to create the types of software projects that students were designing. Even with multiple courses in computer programming or software development faculty explained how it was unreasonable for students to obtain the skills of a second or third year computer science major. Faculty cited examples of how students who had a previous background in computer science were challenged in actually programming their educational software designs for their master's projects. In the three programs studied, all could be completed within two or three semesters, which many faculty felt was not nearly enough time to acquire sophisticated skills in computing. Many faculty agreed that skills in technology could be more easily learned in a community college or through tutorials rather than in graduate program. They felt that those options were more

appropriate for students seeking to become developers of technology rather than educational leaders and designers. Lastly, some faculty felt that their incoming students were already equipped with the technology skills needed in the field of educational technology. This formed the opinions of some faculty who thought there was less of a need than there has been in the past to teach students technical skills. To compliment that viewpoint, some faculty felt that the software available as of 2007 was easier to learn therefore allowed for realize their educational visions more easily. Therefore, since there were other venues for students to learn technologies skills, faculty felt those were more appropriate than in a graduate school of education.

Five Approaches Toward Addressing the Need to Skill Students in Technology

Despite the two opposing viewpoints of the faculty interviewed, the programs studied were creative in way to ensure to some extent that students obtained technical skills, verifying the importance of these skills. The three programs studied presented many different, unique and overlapping approaches to equipping students with computer software skills. These opportunities ranged from informal to formal learning situations.

One approach by programs to address the issue of technology training in their programs was to simply provide opportunities for only those students with previous backgrounds in technology. Two out of the three programs studied offered courses required prerequisite knowledge in computing. For example, courses that required advanced technical knowledge had course prerequisites. Moreover, while students self-selected into many for the courses, the faculty advisor also guided students into courses that were appropriate to their level of technology knowledge. Secondly, all three programs provided opportunities for students to develop educational projects using various technologies. Generally, the faculty from the programs studied celebrated the differences amongst students and preferred having the students strong in technology teaching those that were novices. Another common approach towards training students in technologies in the three graduate programs was through free workshops. For example, some programs provided workshops through their library or information technology departments. A fourth strategy to provide students with skills in specific technologies as through short courses offered through for a credit. Students were provided a structured educational experience in a technology through a series of short one-credit work conference courses. These courses were typically taught during one weekend day a semester. Lastly, some programs offered full introductory level courses in various technologies, such as computer programming.

 The five methods identified indicate a consideration toward providing students with some foundation in technology. However, the there were still mixed opinions by the faculty of these programs. One group of faculty felt that it was essential to prepare students with the technology skills to be effective leaders in educational technology. Their rationale was that students should be able communicate with technical people and create digital prototypes of their educational designs. The other group of faculty strongly opposed students learning any type of technical skills. These faculty members advocated for their graduate programs to educate students in educational and technological theories. It was not an efficient use of the students' or faculty time to learn skills in computer software and hardware. Rather faculty felt that students could learn these skills outside the constructs of the program. These opposing viewpoints indicate the need to reconsider the role of technology plays in programs designed to prepare professionals for the field of educational technology, particularly in light of ongoing technological advances.

Framework for Understanding the Role of Technology in Educational Technology Curricula

The findings from this study revealed three basic reasons for students to learn technologies in educational technology graduate programs:

1. To realize the potential and capabilities for education.

2. To produce intelligent educational technologists that can communicate with software developers.

3. To actualize educational designs in digital form.

The presence of technology activities in the curricula centered primarily on use and development. The terms *use* and *development* delineate the production of software versus the application of software. With regard to computers, the skills needed in using software are much different than those skills needed to develop software, systems, or applications. The distinction between use and development provides a way to discuss how educational technology programs can respond to the next generation of digital technology.

Use of technologies for the context this discussion is the application of existing software or tools. Using technologies in educational technology graduate programs involves working with existing tools to implement learning designs. In two out of the three programs studied much of the coursework in computers and content areas reviewed existing software applications for use. Much of the software examined in these courses was designed specifically for a subject area, such as M-ss-ng L-nks or Geometers Sketchpad. In others cases, everyday computer applications, such as word processing programs were used to apply instructional designs. Many courses offered examined and studied the affordances of technology in learning. These courses were primarily focused on using existing tools for teaching and learning, rather than inventing new tools. The innovation was in the use and application of the technologies, rather than in the construction of new software or systems.

Development in this context is the actual construction of a new computer based educational product. Development in educational technology graduate programs involves working with authoring tools such as Flash, Dreamweaver, Final Cut Pro or integrated software development environments such as NetBeans for writing computer programs. For example, using Flash to build a custom interactive simulation falls under the realm of development. In the three programs studied coursework and master's projects in the realm of development ranged from building working prototypes of educational designs to fully functioning software applications, Web sites, or new hardware devices. In the cases when the usage of existing tools or software is inappropriate custom educational digital environments serve as one method towards implementing educational designs.

One example of distinguishing use versus development is in the creation of hyper-mediated learning materials. The use or development of hyper-mediated materials in this context implies that the appropriate analysis and design practices were used to determine hypermedia as a way to improve or support an educational challenge or problem. In the realm of *use* there are many options for designing a hypermedia environment, such as through a course management system (CMS). A CMS enables the creation and linking of content in a Web-based environment. This activity requires basic cutting and pasting of content created in another more ubiquitous application such as Microsoft Word. As an alternative a Wiki, allows for the creation and linking of content. A Wiki "is a medium which can be edited by anyone with access to it, and provides an easy method for linking from one page to another. Wikis are typically collaborative websites, though there are now also single-user offline implementations" ("Wiki", 2007, par 1). Using a Wiki as a tool achieve some educational objective involves skills in the Wiki language such as using brackets ([]) to create hyperlinks, using asterisk to create bulleted lists (*), and other tags such as *h2* to alter the font face, size, and emphasis. These are the basic skills needed to properly use a Wiki from a technical standpoint. Course management systems and Wikis are examples of tools for use. On the other hand, implementing a Wiki system or developing custom templates for a Wiki are skills that falls outside of the general use and more in the area of development. Furthermore, to go beyond the basic functionality of a CMS, it may require the creation of a custom learning environment that allows for forms of interactivity and dynamic generation of content. This may then require development in database programming, computer programming, and web design.

This example aims to distinguish the focus between the use of existing technology and the development of custom educational environments. Educational technology programs can respond to technology changes through these two approaches. With more generic environments such as a CMS or Wiki, makes the construction of certain types of educational experiences easier, however, it does not ensure solid pedagogy. However that is where educational technology graduate programs can model and demonstrate best practices for use.

This clarification between the use and development may assist in furthering the discussion concerning the role of technology in educational technology graduate curricula. Appropriately applying educational designs to the use of existing applications or working with developers to design new software represents the practice of educational technology. Development of software requires a complex set of skills, akin to a software engineer. Software engineers consider various aspects of development such as unit testing, usability testing, error checking, and scalability. Additionally, software developers are typically well versed a variety of tools for development, not just Flash or Dreaweaver which are typically tools educational technology students learn. For students in educational technology programs to learn software development may not advance the field. Rather, the application of innovative and effective strategies toward learning is central to the field and practice. Moreover, the need for actually developing custom software, in particular, may change with the availability and deployment of many of the Web 2.0 technologies. These technologies allow for easy construction of content without knowledge of skills more closely associated within the realm of development such as HTML, programming, or database development.

Clearly understanding how to represent the areas of use and development within the curricula can then help determine if and where to skills students in learning technical skills. This research indicated that producing programmers, software developers, engineers, or interface designers is not the aim of educational technology curricula. Rather, the aim of these programs is to educate students in appropriate strategies and theories of learning

and design. As educational technology graduate programs are described as practically focused (Ely 1998), examining examples of educational approaches that incorporate the use of technology, rather than the development of new technologies can help focus educational technology curricula more on design and application. The implementation of those designs in digital spaces must reliable, useable, and thoroughly tested. However, the emphasis in programs should be placed on having students experience educational applications and become real users of educational software, and web-based environments along with investigating the literature on the effectiveness of various digital learning applications. For example, knowing how to program, develop simulations, or construct a Web site does not advance the practice of educational technology. The innovation of the field should not be driven by the development of technology, rather from the effectiveness of new educational designs.

Summary

In a 1960's study educational technology curricula was criticized for "placing too much emphasis upon the 'machine' portion of the 'man-machine system' known as instructional technology" (Snow, 1969, p. 107). This cautionary statement reflected the media-centric view of educational technology, equating the field to electronic devices (Saettler, 2004). This media-centric view influenced early educational technology programs during the popularity of audiovisual technologies from the 1940s through the mid-1970s. However, beginning in the late 1970s and early 1980s the interactive attributes of the personal computer presented new possibilities for designing learning technologies. Learners could be engaged with software programs prompting them for keyboard or mouse input. Each learner interacting with the same educational software program could have different experiences based upon individual learning characteristics. For example, information could be presented in a different format to visual learners and a different format for verbal learners. These characteristics distinguished the computer from any other media-based technology such as film or television that lacked interactive and customizable for options for learning. However, the affordances of the computer in education had to be hypothesized, researched, designed, developed, tested, and evaluated. As echoed by Kim, "it is through innovation and research that the computer has come to have significant implications and applications in education" (Stanford Educator, 2003, para 2). While the personal computer has permeated many aspects of work, school, and leisure, the options for learning with the technology have been significant whereby it has become the medium of the field of educational technology (Jonassen & Rohrer Murphy, 1999). As the primary medium used in the field, the ways in which educational technology graduate programs prepare their students in understanding the technology and the capabilities was the focus of this research. The significance of understanding how these programs respond to new technologies may influence the virtual toolkit of future educational technologists. The emphasis placed in the curriculum on developing technical skills also suggests the focus of graduate education in the field. The concern is if educational technology programs are becoming *technology education* programs rather than centers of educational innovation, theory and practice.

By selecting educational technology programs from three elite schools of education, the findings revealed innovative approaches toward educating students in the field. The approaches are intended to serve as a mode of comparison to other programs that may be concerned with the rapid pace of technological change. The findings and analysis of the historical multiple-site case study described the impact of changing computer technology on three educational technology graduate programs. The three programs illustrate more than a thirty-year history of the changes in technology along with responses by faculty to these changes. The results from the study indicate that programs implemented various tactics as a response to equipping their students with technology skills. This response in part indicated that programs while in agreement or disagreement with educating students technologies, in fact, recognized the importance of those skills.

Through the examination of the initial response to computing at the onset of each of the three programs studied revealed that programs began with teaching the technology, which in the mid-1970s and early 1980s was computer programming. Teaching programming occurred for primarily three reasons. First, in the late 1970s and early 1980s the availability of educational software was scarce. Therefore, programming was taught to skill students in a tool for educational software development. Secondly, programming was advocated as a powerful way to approach different subject matter. Lastly, some faculty felt that it was important to ground students in the fundamentals of computing as method to envision its affordances in education. In addition, the graduate programs also provided coursework on learning popular software programs for use in specific subject areas such as mathematics, science, languages, and humanities. This approach allowed students to concentrate in the utilization of educational software for a specific context over the development of software.

Programs continued to evolve in their perceptions and understanding of the possibilities of computer technology in various educational contexts. While there were other theoretical influences such as culture, design, and communications, the cognitive perspective of educational technology was shared by the programs studied. Moreover, programs moved away from content specific use of technology towards strategies for use. As authoring

environments emerged in the mid 1980s this allowed for educational technology students to create interactive hypermedia environments within the realm of an academic semester without the burden of learning a computer language. Constructivist learning could be realized by exploiting the functions of hyper-mediated computer environments. In the mid-1990s other tools such as Director, Flash, and Web authoring software emerged. In combination with hypermedia, telecommunication technologies allowed for collaborative learning in a hyper-mediated environment. Collaboration over the Web or intranets allowed for the communication amongst teachers and learners. The Web's influence on the field of educational technology as a primary mode of delivery via the computer of learning technologies and distance education was apparent in the graduate programs studied. The emergence of multi user environments and Web 2.0 tools allowed for the construction of educational experiences that inherently included opportunities for collaboration and group learning.

According to Jonassen and Rohrer-Murphy (1999) "the ways of 'doing instructional design' have changed as new technologies and learning theories evolve and are shared in the instructional design community" (p. 66). With each new technology, the programs made changes in their curricula, incrementally. Cuban (1999) described incremental curricula change as one of the easiest types of change to implement because it does not disrupt existing structures, such as programs or universities. Each of the three programs responded to new technologies in their curricula through new course offerings or modifications to existing courses.

A selection faculty presented strong argument for equipping their students with skills in technology. Faculty also presented a persuasive rationale on why programs should delegate the responsible of technological training elsewhere. Program responded to a demand and perceived need for technological skill development through five methods: short courses, full courses, workshops, prerequisites, and peer-to-peer learning. While, educational technology graduate program faculty viewed the acquisition of technical skills with mixed opinions the programs studied only placed value on those technical skills insofar as they support the articulation or implementation of educational ideas.

The application of these findings to future research may help to reflect on the curricula design and purpose of educational technology graduate programs. Pressures from market in changing technologies, employers, and the broadening of the field present ongoing challenges to educational technology programs. The field of educational technology is at an important juncture with an abundance of research, graduate programs, and practitioners. The new stream of Web 2.0 technologies present even more interesting possibilities for the field. Having the framework of the use of technology and the development of technology can help guide educational technology practitioners, faculty, and students in their response and reactions to new technological change.

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Media Production Curriculum and Competencies: Identifying Entry-level Multimedia Production Competencies and Skills of Instructional Design and Technology Professionals: Results from a Biennial Survey

William Sugar, Ph.D.
Associate Professor and Interim Chair
Library Science and Instructional Technology
East Carolina University
1103 Joyner Library
Greenville, NC 27858

Abbie Brown, Ph.D.
Associate Professor
Library Science and Instructional Technology
East Carolina University
Old Cafeteria 339
Greenville, NC 27858

Lee Daniels, Ph.D.
Associate Professor and Graduate Coordinator
Educational Media and Educational Technology
East Tennessee State University
Box 70684
Johnson City, TN 37614

ABSTRACT: This study focuses on identifying multimedia production competencies and skills on Instructional Design and Technology professionals. Current Instructional Design and Technology employers were queried on what skills and competencies a current graduate needs in order to succeed in their respective workplace. The results of this survey provide insight into the needs of specific Instructional Design and Technology organizations and facilitate redesigning curricula to meet these needs.

Overall Purpose

It is essential for educators to align their curricula to the needs of their respective disciplines and fields. This is as true for instructional design and technology educators as it is for any other field. The goal of just about every program of study in instructional design and technology is to prepare students to become capable and competent field professionals (Orey, McClendon, & Branch, 2007). In order to do this, continuous review and improvement of curricula is in order to ensure that courses will prepare students with the necessary competencies and skills to succeed in the workplace. The goal, one might posit, is to establish a seamless transition between the individual's role as student and his or her role as instructional design and technology professional.

Any course of study in instructional design and technology must at some point address the issue of media production (Brown, 2004). Yet, multimedia production competency in particular may be difficult to determine as the tools used change, evolve, and fall in and out of popularity. The overall goal of this study is to implement a biennial survey on these multimedia production competencies and skills, querying current Instructional Design and

Technology employers on what skills and competencies that a current graduate needs to have in order to succeed in their respective workplace. This paper presents the results of the first set of biennial survey results.

This study is conducted in the hope that the data collected will help educators modify their respective curriculums to meet the need of students, employers, and the profession in general.

Background

For our initial study we decided to focus on multimedia production competencies and skills. These competencies and skills were identified in two sources: Earle and Persichitte's (2005) AECT curriculum standards and Richey, Fields, and Foxon's (2001) instructional design competencies. Specifically, these multimedia production competencies and skills focus on the following areas:

– Incorporate contemporary instructional technology processes in the development of interactive lessons that promote student learning (Earle & Persichitte, 2005)

– Produce instructional materials which require the use of multiple media (e.g., computers, video, projection) (Earle & Persichitte, 2005)

– Demonstrate personal skill development with at least one: computer authoring application, video tool, or electronic communication application (Earle & Persichitte, 2005)

– Use appropriate analog and digital productivity tools to develop instructional and professional products (Earle & Persichitte, 2005)

– Develop instructional and professional products using a variety of technological tools to produce text for communicating information (Earle & Persichitte, 2005)

– Design, produce, and use digital information with computer-based technologies (Earle & Persichitte, 2005)

– Use authoring tools to create effective hypermedia/multimedia instructional materials or products (Earle & Persichitte, 2005)

– Acquire and apply new technology skills to instructional design practice (Richey, Fields, & Foxon, 2001)

– Specify the capabilities of existing and emerging technologies to enhance motivation, visualization, interaction, simulation, and individualization (Richey, Fields, & Foxon, 2001)

As we began this study, we hoped the data collected would help answer our initial question on how to effectively match our respective curricula with the necessary competencies and skills required of an incoming instructional design and technology professional. We anticipated the results might considerably enhance our respective curricula as well as that of other educators' Instructional Design and Technology programs.

In addition to discovering specific frequencies of various survey responses, we expected to identify significant relationships between various factors within the survey. For example, we hoped we might discover whether incoming instructional design and technology professionals who enter corporate settings are expected to have a different set of multimedia production skills than their counterparts who enter higher education settings.

Methods

We created a survey instrument comprised of fourteen questions that concentrated on the following areas: – Work setting (e.g., College/University, Corporate, etc.) – One's role/position within organization (e.g., Instructional Designer, Project manager, etc.) – Years of experience and education level – Types of delivery system(s) (e.g., World Wide Web, Intranet/LAN, etc.) – Authoring applications (e.g., Flash, Dreamweaver, etc.) – Attributes that are most important to selecting an authoring application (e.g., price, advanced features, etc.) – Interactive media features that are commonly used (e.g., Customized Buttons, Local or Global Variables, etc.) – Authoring skills for incoming employees (e.g., If-Then Functions, Animation/Video Control, etc.).

Survey Questions:

1. Which of the following professional organizations do you belong to (check all that apply)
_AACE
_AECT
_ASTD
_ISPI

2. Which term best describes your work setting?
_K-12
_College/University
_Military
__Government (non-military)
__Corporate/Business
__Other (please explain:_____)

3. Which of the following best describes your role within your work setting?
_Instructional Designer
_Asset Manager
_Project Manager
_Evaluator
_Media Producer/Developer
_Programmer
_Instructor
_Other (please explain: _____¬¬¬)

4. How many years have you been employed in instructional media design/development?
_Less than 2
_2 – 5
_6- 10
_More than 10

5. Which of the following best describes how you acquired your professional knowledge and skills?
_Graduate Degree (Master's or higher)
_College Degree (Associate's or Bachelor's)
_ On the Job Training
_Private Training
_Other (please explain:_____)

6. Do you outsource, or have other institutions or companies create instructional media to your specifications?

7. Is media production part of your professional responsibilities?
_Yes
_No

8. Do you oversee or specify content for media production personnel?
__Yes
__No

If you answered "yes" to questions 7 or 8, please continue:

9. What content delivery system(s) do you design/develop for most often?
_World Wide Web
_Intranet/LAN
_DVD/CD

_Printed Materials
_Other (please explain:_____)
10. Which authoring applications do you or your media producers regularly use? (Check all that apply)
__Flash
__Director
__Authorware
__Toolbook
__Dreamweaver
__Other (please list:_____)

11. What attributes are most important to your choice of an authoring application? (Check all that apply.)
_Price
_Compatibility with other products/vendors, etc.
_Advanced features
_Ease of use
_Industry Standards
_Other (please explain:_____)

12. Which aspects of interactive media do you regularly include in your instructional media designs?
(Check all that apply)
__Standard Buttons
__Customized Buttons
__Images that act as Buttons
__Preset Screen Transitions
__Linear Navigation
__Non-Linear Navigation
__Input Fields (text input)
__Output Fields (text output)
__Local or Global Variables (e.g. for keeping track of selections)
__Math Functions (e.g. for keeping track of scores)
__If-Then Functions (to determine the next step in a branching sequence based on user input)
__User Feedback: Dialogue Boxes
__User Feedback: Test Questions/Answers
__Sound Files
__Sound Control
__Animation/Video files: MPEG, QuickTime, WMV..etc.
__Animation files: Flash SWF, Director DCR…etc.
__Animation/Video Control

13. What authoring applications should employees joining your organization be familiar with?
__Flash
__Director
__Authorware
__Toolbook
__Dreamweaver
__Other (please list:_____)

14. What authoring skills should employees joining your organization have?
The ability to create:
__Standard Buttons
__Customized Buttons
__Images that act as Buttons
__Preset Screen Transitions
__Linear Navigation
__Non-Linear Navigation
__Input Fields (text input)

__Output Fields (text output)
__Local or Global Variables (e.g. for keeping track of selections)
__Math Functions (e.g. for keeping track of scores)
__If-Then Functions (to determine the next step in a branching sequence based on user input)
__User Feedback: Dialogue Boxes
__User Feedback: Test Questions/Answers
__Sound Files
__Sound Control
__Animation/Video files: MPEG, QuickTime, WMV..etc.
__Animation files: Flash SWF, Director DCR…etc.
__Animation/Video Control

The survey was posted on the Web. Respondents provide their name and e-mail address to begin the survey itself. The survey itself is a form that transmits results to a database. Survey respondents were then solicited via listservs and discussion forums.

In determining which listservs and discussion to post survey solicitations, we decided to focus on Instructional Design and Technology organizations that are represented by the following associations: the American Society for Training & Development (ASTD); the Association for the Advancement of Computing in Education (AACE); the Association of Educational Communications and Technology (AECT); and the International Society for Performance Improvement (ISPI). We also sent survey solicitations to members of university departments of Instructional Design and Technology, requesting that the solicitation be forwarded to their programs' alumni listservs and discussion forums.

Results

For our preliminary survey, we had 36 respondents. Over sixty percent of these respondents (22) worked in the College/University environment and over thirty-six percent of these respondents (13) worked in the Corporate/Business environment. One respondent reported working the in the K-12 environment. As illustrated in Figure 1, more than thirty-eight percent (14) of the respondents were instructional designers and over twenty-two percent of the respondents (8) were either instructors or project managers/directors. Two respondents were media producers and developers, two other respondents were evaluators and two other respondents were researchers and marked "other" on the survey. The respondents were a part of four Instructional Design and Technology associations (see Figure 2); almost 70% of the respondents were members of AECT. All of the respondents were involved with the media production process. Over eighty percent of the respondents (80.6%) administer or specify content for media production personnel and almost seventy percent of the respondents (69.4%) had media production as one of their professional responsibilities.

Figure 1: Responses to the question, "Which of the following best describes your role within your work setting?"

Figure 2: Responses to the question, "Which of the following professional organizations do you belong to?"

Which of the following professional organizations do you belong to (check all that apply)? (n=36)

AACE: 19.4%; AECT: 69.4%; ASTD: 36.1%; ISPI: 22.2%

In determining the necessary computer-based authoring skills that an Instructional Design and Technology graduate needs to possess, we asked two questions: *Which authoring applications do you or your media producers regularly use?* and *What authoring applications should employees joining your organization be familiar with?* Clearly, as illustrated in Figure 3, the top two choices were Flash and Dreamweaver. Though selected by individual respondents, Director, Authorware, and Toolbook were not as popular. A distinct third choice among respondents was the "Other" choice. Other applications consisted of a variety of applications, including: e-learning applications (i.e., Lectora and Articulate); screencast applications (i.e., Captivate), video and audio editing software (i.e., Final Cut Pro, Premiere, i-DVD, Audacity, and Pinnacle Studio Media); graphics editing software (i.e., Photoshop, Fireworks and Illustrator); Javascript and other programming languages; open-source applications; course management software (i.e., WebCT, Blackboard, Moodle, Contemplate, Breeze, and BBEdit); and PowerPoint.

Figure 3: Responses to the question, "Which authoring applications do you or your media producers regularly use?" and "What authoring applications should employees joining your organization be familiar with?"

What authoring applications should employees joining your organization be familiar with? (n=36)

Flash: 80.6%; Dreamweaver: 66.7%; Other: 44.4%; Director: 16.7%; Authorware: 13.9%; Toolbook: 13.9%

Which authoring applications do you or your media producers regularly use? (n=36)

Flash: 66.7%; Dreamweaver: 58.3%; Other: 41.7%; Authorware: 13.9%; Director: 11.1%; Toolbook: 8.3%

Similarly, more than 70% of the respondents design and develop CBI applications for the Web and more than 35% of the respondents design and develop CBI applications for an Intranet and/or LAN (see Figure 4). Interestingly, over 40% of the respondents use CBI applications to design and develop printed materials. We also note a third of the respondents deliver their CBI programs via DVD or CD-ROM.

Figure 4: Responses to the question, "What content delivery system(s) do you design/develop for most often?"

What content delivery system(s) do you design/develop for most often?
(n=36)

We also wanted to establish a set of core CBI competencies that Instructional Design and Technology students need to have upon completion of their respective degree programs. In responding to the following two sets of questions, *Which aspects of interactive media do you regularly include in your instructional media designs?* and *What authoring skills should employees joining your organization have?*, respondents identified key CBI competencies (see Figures 5 and 6). We note that a majority of the respondents (~50%) identified using images as buttons, non-linear navigation (>60%), sound files (>60%) and animation files (>60%) as key CBI skills. Though not identified by a majority of the respondents, at least a third of the respondents noted that use of local/global variables, if-then statements, math functions, and sound and animation control also were essential CBI skills and competencies.

Figure 5: Responses to the question, "Which aspects of interactive media do you regularly include in your instructional media designs?"

Which aspects of interactive media do you regularly include in your instructional media designs? (n=36)

Customized Buttons	Images that act as Buttons	Linear Navigation	Non-Linear Navigation	Input Fields	Output Fields
69.4%	55.6%	75.0%	63.9%	58.3%	41.7%

Which aspects of interactive media do you regularly include in your instructional media designs? (n=36)

Local or Global Variables	If-Then Functions	Math Functions	User Feedback: Dialogue Boxes	User Feedback: Test Questions/Answers
38.9%	36.1%	36.1%	52.8%	69.4%

Which aspects of interactive media do you regularly include in your instructional media designs? (n=36)

Sound Files	Sound Control	Animation/Video files	Animation/Flash files	Animation/Video Control
66.7%	33.3%	72.2%	61.1%	44.4%

Figure 6: Responses to the question, "What authoring skills should employees joining your organization have?"

What authoring skills should employees joining your organization have? (n=36)

Customized Buttons	Images that act as Buttons	Linear Navigation	Non-Linear Navigation	Input Fields	Output Fields
58.3%	50.0%	66.7%	66.7%	50.0%	38.9%

What authoring skills should employees joining your organization have? (n=36)

Local or Global Variables	If-Then Functions	Math Functions	User Feedback: Dialogue Boxes	User Feedback: Test Questions/Answers
30.6%	33.3%	30.6%	50.0%	58.3%

What authoring skills should employees joining your organization have? (n=36)

Sound Files	Sound Control	Animation/Video files	Animation/Flash files	Animation/Video Control
61.1%	44.4%	63.9%	63.9%	52.1%

Implications

36 responses represent a very small portion of the entire population of Instructional Design and Technology professionals. It would be unwise to generalize the survey results to the entire population, but the survey and its initial results are a place to begin the discussion on how best to align program curriculums with the needs of the professional Instructional Design and Technology community. For example the top two choices for authoring applications were Flash and Dreamweaver, which suggests that it may be prudent to use these applications in instructional media production course work; using the survey results to make a decision about this, even with a small pool of respondents, may be preferable to relying solely on the predilections or best guesses of a single faculty member or small faculty group. Most importantly at this point, the survey results suggest it may be possible to determine trends in the use of various software applications for instructional media design and production. Subsequent iterations of the survey would strive to increase the number of respondents to a number that might allow for generalization to the entire population.

This first effort may best be viewed as a pilot study, the result of which suggests to the authors that more research in this area is recommended, and that the use of a survey instrument similar or identical to the one used for this study applied to a larger pool of respondents may indeed reveal how to effectively match our respective curricula with the necessary competencies and skills required of an incoming instructional design and technology professional.

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The Use of "Talking Head" Video to Support Second Language Comprehension

Penny Thompson
Michigan State University

Abstract

The effects of "talking head" video (video showing the face of the speaker) on L2 comprehension were investigated. Fifty-seven university students in a Spanish language class were randomly assigned to one of three video treatment groups: still picture with audio, low quality video with audio, and high quality video with audio. Within each treatment, students were presented with a three-minute video of a native Spanish speaker talking about herself, using the vocabulary of the current class lesson. The students' comprehension of the spoken text was measured using a 10-question fill-in-the-blank quiz. The results indicate that the presence of talking head video did not significantly affect listener comprehension.

Introduction

Constructivist learning theorists emphasize the importance of giving learners a meaningful context for the new material they are learning. Rather than memorizing facts in isolation, learners need to understand the real-world relevance of what they are learning (Jonassen, Peck & Wilson, 1999; Duffy & Cunningham, 1996). Theorists in the field of L2 acquisition have addressed this need for authentic context by shifting the focus away from the study of vocabulary and grammar in isolation, and instead stressing the importance of authentic communication in the target language. For example, Krashen's (1981) Monitor Theory addresses the importance of authentic language inputs in combination with more structured language study. Krashen makes a distinction between language learning and language acquisition. Language learning occurs when the learner memorizes vocabulary and grammar rules, focusing on the proper *form* of communication. Language acquisition is a deeper, internalized ability to use the language for communication with other people. Acquisition occurs when the learner focuses on *content* rather than form.

According to Krashen (1981), language acquisition requires more than mere exposure to a language. The L2 input must be at the right level and must engage the learner. The ideal input is at a level just above the learner's comprehension level, but with enough scaffolding that the learner can still understand it. He referred to this as the "i + 1" (input plus one) concept. Scaffolding in this context comes from extra-linguistic information present in the immediate environment. This idea of scaffolding to bring the learner up to the next level is similar in some ways to Vygotsky's (1978) Zones of Proximal Development. However, the i + 1 concept focuses on the individual's processing of language input rather than on the sociocultural aspects of learning (Kinginger, 2001).

Achieving authentic language input is more difficult for students studying a foreign language in their home country, compared to students living where the target language is spoken (Krashen, 1981). Technology has helped to bring authentic L2 input to these students. Early uses of technology for language learning included radio, television, and the language lab where students listened to cassette tapes and occasionally watched authentic video (Salaberry, 2001). These tools allowed learners to hear natural dialog in the varied accents of native speakers. Modern equivalents of these tools include authentic internet radio broadcasts and digital video streamed over the internet from a course web site. Newer technologies allow even more realistic language use. The Horizon Wimba Voice Tool application, for example, allows asynchronous conversation (via mp3 files) between learners and native speakers anywhere in the world.

These technologies all bring different aspects of natural human conversation into the language learning process, and thus all contribute to a realistic context for L2 learning. However, because they emphasize audio-only conditions (or, in the case of authentic video, dialog between characters on the screen), they are missing one element that is present in a natural face-to-face conversation: a sustained view of the speaker's face.

Although the usefulness of seeing the speaker's face has not been extensively studied in L2 listening comprehension, research on speech comprehension in the first language suggests that visual processing is an integral part of listening to speech (McGurk & MacDonald, 1976; Kellerman, 1990). If this visual information is also

important in L2 comprehension, then the use of audio-only listening exercises might make the listening task unnecessarily difficult. Kellerman (1990) compares these audio-only situations to listening over a telephone line, one of the most intimidating experiences language learners encounter. If seeing the speaker's lips, eyes, and facial expressions is an important part of natural conversation, then it would make sense to include this information in second language listening exercises and proficiency tests. One way to do this would be to add what is known in the television industry as "talking head" video, a head and shoulders view that allows listeners to focus sustained attention on the speaker's face.

If this type of video does provide a benefit to L2 learners, instructors will want to provide this material for their students and encourage students to use it frequently to practice their listening skills. Since course web sites are an increasingly important means for instructors to distribute course material, the issues related to distributing video over the internet must be considered. Digital video files are very large, and must be compressed in order to perform well for someone viewing them over an internet connection. The more a file is compressed, the smaller the file size. Since compression reduces the quality of the image, however, it is necessary to balance the competing demands of small file size versus acceptable video quality. Instructors and students would benefit from a set of guidelines for achieving the smallest file size possible without losing any benefit from the talking head video.

The purpose of the present study was to explore whether the use of talking head video facilitates L2 listening comprehension, and whether different qualities of video provide different levels of benefit. In this paper I review the literature relevant to the use of video in both L1 and L2 comprehension, describe the methods used for the research, present the results, and examine the implications of the study and some ideas for future research.

Review of Literature

Visual information in a multimedia educational program must be used carefully. Multimedia learning aids have the potential to facilitate deep cognitive processing, but also carry a risk of distracting learners or overloading their cognitive processing ability (Mayer, 2001; Mayer & Moreno, 2002). When learners receive both verbal and visual information from a multimedia presentation, they must integrate these two sources of information with each other, and also integrate them with prior knowledge. This requires a more active, generative process than receiving only verbal or only visual information, and also makes greater cognitive demands on the learner. Mayer (2001) provides this concise summary of this cognitive theory of multimedia learning: "people have separate visual and auditory channels; …the channels are limited in capacity; and …meaningful learning involves actively selecting, organizing, and integrating incoming visual and auditory information." (p. 189) Therefore, in order to facilitate second language comprehension the video will need to help the learner organize and integrate information, and should minimize cognitive demands that increase the burden on limited working memory. To achieve this delicate balance, Mayer's (2001) cognitive theory of multimedia learning emphasizes the integration of audio and visual information and the avoidance of any input that is not directly relevant to the learning task. It is helpful to review the research on how visual information affects language comprehension against the backdrop of Mayer's (2001) theory.

Although the use of "talking head" video for second language comprehension has not been extensively studied, the research on speech perception in the first language provides some clues about how viewing a speaker's face affects language comprehension. Kellerman (1990) provides a summary of the research that has been done on how infants use visual information when acquiring their first language. Visually handicapped infants take longer to produce certain sounds, such as the "b" in "boy" or the "f" in "fine," where the articulation is easy to see. For consonants where the articulation is less visible, such as the "k" in "kick," there is no difference between the visually impaired and the sighted infants. Sighted infants appear to observe and imitate the mouth movements of the adults around them, and to use this information to learn sounds that are considered "easy to see and difficult to hear." While the process of learning a second language is quite different from learning a first language, this research with infants suggests that language comprehension is a bimodal process where both visual and auditory information are used.

To demonstrate the way adults use visual information in understanding spoken language, Kellerman (1990) refers to the foundational work of McGurk and MacDonald (1976). They presented adult volunteers with video segments where the speaker's lip movements did not match the sound on the audio track. For example, a video of someone articulating "ga" was accompanied by an audio track of a speaker saying "ba." Ninety-eight percent of the listeners reported hearing "da," a fusion of the two conflicting pieces of information. This phenomenon is known as the McGurk effect, and demonstrates that visual information does contribute to language comprehension, at least for distinguishing phonemes.

Rudman, McCarley and Kramer (2003) demonstrated how adults use visual information to understand a speaker in a noisy room. They presented the voices of six actresses reading different texts at the same time, and asked participants to focus on one designated target speaker. The participants were better able to focus on the target speaker when they were shown video of that speaker. An analysis of eye movement revealed that it was not necessary for listeners to focus on the speaker's lips; they only needed to see the face. This suggests that even when distinguishing specific phonemes is not possible because of extraneous noise, a view of the speaker's face helped to focus the listener's attention, and thus aided comprehension.

Much of the research on the use of video in second language comprehension has centered on "authentic video," such as movies and serial television programs. Weyers (1999) studied a group of university students studying Spanish as a second language, who watched a Mexican *telenovela* (soap opera) as part of their regular course work. These students showed significantly greater increases in their post-test scores compared to students in the control group, who attended class for the same number of hours but were taught the standard curriculum. The author attributed these higher gains to the motivating aspect of the video and to the presence of visual cues (e.g., action, gestures, etc.) supplementing the aural information. These visual cues helped learners select and organize the information needed to understand the dialog, which resulted in meaningful learning.

Another use of video that has been studied extensively in second language comprehension is the use of a series of still photos or graphics to depict either content (the subject matter being discussed), or context (information about the speaker). The results of this research have been mixed. Ginther (2002) looked at the use of graphics on the listening comprehension portion of the Test of English as a Foreign Language (TOEFL). In this test the audio track was supplemented by a series of still photos showing either the speakers or something related to the content being discussed. The results showed that the presence of content visuals slightly improved students' comprehension. The context visuals, on the other hand, only improved comprehension when they helped to distinguish between speakers, such as when both speakers were the same sex and had similarly-pitched voices. When the speakers could be clearly distinguished by their voices, the use of a series of context visuals seemed to slightly suppress comprehension. Changing from one picture to another appears to have been distracting in situations where it provided no useful information. This is consistent with Mayer's (2001) principle that all extraneous visuals should be avoided.

Context graphics do not appear to distract the listener when a single picture is used instead of a series. Mueller (1980) studied the use of simple line drawings to accompany a listening exercise for students learning German. A control group and two experimental groups listened to the same taped interview. The control group did not view any visual aids, but the experimental groups were shown a simple line drawing of the speakers either just before or just after hearing the audio tape. The post-test showed that novice learners were able to write a more complete summary of the interview if they had seen the drawing, while there was no significant difference in the scores of more proficient learners. The author suggests that the visual aids provided contextual information that would not otherwise have been understood by the novice listeners.

Other research has addressed the use of video with captions in the target language (Shea, 2000; Jakobsdottir & Hooper, 1995) and the use of authentic newscasts that include titles, graphics, and short segments of video (Gruba, 2004). All of these additional elements appeared to facilitate listening comprehension, although in many cases they provided more benefit to novices than to advanced learners. It is interesting to note that adding captions in the target language conflicts with one of Mayer's (2001) principles. When information is presented in the listener's native language, text on the screen that merely duplicates the audio track is a distraction that can suppress learning (Mayer, 2001). In the second language the result appears to be the opposite. It may be that for L2 listeners the scaffolding provided by captions is beneficial enough to compensate for the cognitive burden of the redundant text.

Sueyoshi and Hardison (2005) addressed the use of "talking head" video directly when they studied the effects of facial cues and gestures on a group of English language learners. They studied the effect of video on listening comprehension for university students enrolled in English as a second language classes. The participants were identified as either high or low proficiency English speakers, and participants from each level performed one of three listening tasks. One group watched a video that included the audio track and a close view of the speaker's face. The second group watched a video that used the same audio track, but showed both the face and the hand gestures of the speaker. The control group listened to the audio track with no video. The listening exercise was followed by a multiple choice comprehension test. The results showed that the low proficiency group had the highest scores on the post test when they could see both the face and the gestures of the speaker. For the high proficiency group, the highest scores occurred in the group that saw only the speaker's face. The audio-only condition showed the lowest test scores for both proficiency levels. The authors suggested that the higher proficiency learners' greater level of experience with English enables them to use visual information from the

speaker's face more efficiently. The fact that learners of both proficiency levels showed the lowest performance under the audio-only condition, however, supports the hypothesis that seeing the speaker's face facilitates comprehension.

Sueyoshi and Hardison (2005) focused on English language learners who were living in the United States and thus immersed in their target language. The learning conditions are different for native English speakers learning a second language in the U. S., where their exposure to the target language is limited. It would be useful to know if there is a clear benefit to providing talking head video to L2 learners in this situation. Because of the challenges of delivering high quality video over the internet, it would also be useful to develop guidelines for minimum standards for video quality required to realize those benefits. Therefore, this study addressed the following questions:

1) does the use of talking head video facilitate listening comprehension for second language learners?
2) is the facilitating effect of talking head video, if there is one, different at different levels of video quality?

Method

This chapter presents the method used in this study, including a description of the participants, materials, experimental design, dependent measures, and data analysis.

Participants

Ninety students from an accelerated beginning Spanish class at a large midwestern university were invited to participate in this study. Sixty-six students volunteered and signed consent forms, and fifty-seven of those students completed both the pre-test and post-test components of the study. The sample included 37 females and 20 males. The average age of participants was 19.15 years (SD = 1.46), with two participants declining to report their age. The course fulfills the language requirement for all undergraduates in the College of Liberal Arts. Students were placed in this course based on a standard placement test created by the Spanish department and administered by the university's Language Testing Center.

The participants were enrolled in four different sections of the class and taught by two different teaching assistants, who were supervised by the same senior lecturer. All sections of the course used the same text book (Conexiones, 3rd Edition), covered the same material, and used a standardized WebCT Vista course web site. The video exercises that made up this experiment were part of the regular curriculum for this course, so all students completed the exercises, but the instructors provided the researcher with the scores for only those students who signed consent forms to participate in the research.

Materials

The materials used in this study consisted of two three-minute videos featuring natural speech from native Spanish speakers, and two ten-point comprehension quizzes corresponding to the two videos.

Videos: The videos were each three minutes long and featured native Spanish speakers talking about a topic related to the current week's lesson. The speakers deliberately used vocabulary and grammatical constructions (e.g. verb conjugations) that had been covered in the lesson. The first video featured a male speaker from Puerto Rico talking about his favorite sports. This video, which came from existing course material, was prepared in QuickTime format and was provided online to the students on the course website.

The second video featured a female speaker from northern Spain, who described her personality. This video was prepared explicitly for this study. It was recorded in a quiet room using a Panasonic model AG DVC7 video camera with an external PZM microphone, edited using iMovie. The video footage was exported from iMovie and compressed for playback using the Flash 8 Video Encoder with the Sorenson Spark codec. The dimensions were 540 by 360 pixels. Three versions of the video were prepared. One version featured only a still picture of the speaker along with the audio track. The audio track was extracted from the source video footage, and a still shot of the speakers face (exported from iMovie in .jpg format) replaced the motion video. The second version included full-motion video processed with a frame rate of 12 frames per second and the "low" quality setting of Sorenson Spark. The low quality setting and low frame rate resulted in video that was clear when the speaker sat still, but became slightly blocky when she moved. The third version also included full-motion video, but this version was processed using the high quality setting and a frame rate of 30 frames per second. The quality of this video appeared comparable to a commercial DVD.

Comprehension Quizzes: The pretest quiz, which corresponded to the first video, consisted of two multiple choice and three short answer questions that asked participants to write down what the speaker had said. Each question was worth two points, so the highest possible score was ten points. Participants took this quiz using the quiz feature in the course web site.

The post-test quiz, corresponding to the second video, consisted of ten fill-in-the-blank questions, each worth one point, where participants were required to write in Spanish the exact word they had heard the speaker say. This second quiz was taken in class using paper and pencil.

The instructor and one teaching assistant reviewed the test questions to assess validity. The original draft of the post-test quiz included a combination of short answer and multiple choice questions, but there was some concern that participants might guess the correct answer even if they didn't understand the speaker. Therefore, the quiz was revised and all of the multiple choice questions were changed to short answer format. The K-R 21 reliability for the post-test quiz was .75.

Procedure

The experiment took place in a computer lab on campus, with all of the students using Macintosh G5 computers. Participants were randomly assigned to one of the three treatment groups, and upon entering the computer lab, were assigned a specific computer based on their treatment group. The arrangement of the lab allowed participants to be seated in clusters with their group so they could not see the computer screens of the other groups. They watched the video on their computer screens and listened using headphones. They were instructed to watch and listen to the video once before seeing the quiz questions. After they had listened once, the quiz was passed out and they were given ten minutes to complete the questions, replaying the video as needed during the time allowed. The instructor and the researcher observed the class to make sure that each participant worked independently.

Design and Analysis

A one-way analysis of variance (ANOVA) was used to identify any significant differences in post-test scores between the three groups. Alpha was set at .05. The independent variable was video type: still picture, low quality motion video, or high quality motion video. Participants were randomly assigned to only one video type.

A second factor, Spanish proficiency level, was initially considered in the design of this study. However, the pre-test data did not provide any evidence that the participants had significantly different proficiency levels. In addition, the sample size was small, with only 63 participants taking the pre-test, so dividing them by both proficiency level and video type would have resulted in groups that were too small for valid statistical analysis

The dependent variable was learner comprehension as measured by the comprehension quiz.

Results

In this section I report the comprehension scores for the three video treatment types. The dependent variable was the number correct answers on the comprehension quiz. The quiz scores were normally distributed for the Still Picture group, Shapiro-Wilk(19) = .919, p = .110, and the Low Quality Video group, Shapiro-Wilk(18) = .930, p= .197. Scores for the High Quality Video group were somewhat negatively skewed, Shapiro-Wilk(20) =.823, p= .002, partly because one participant earned a score of zero. After confirming with the instructor that the zero was an actual earned score, rather than a missing score, I elected not to remove it from the data set. Table 1 shows the means and standard deviations for each of the treatment groups.

Table 1
Means and Standard Deviations by Treatment

Video Type	n	Mean	SD
Still Picture	19	6.95	2.51
Low Quality Video	18	6.78	2.24
High Quality Video	20	7.55	2.78

ANOVA indicated no significant effect of video type on listener comprehension, $F(2,54) = .50$, $p>.05$. Table 2 shows the results of the ANOVA.

Table 2
ANOVA Performed on Comprehension Quiz Scores

Effect	df	MS	MSe	F	P
Video Quality	2	3.18	6.39	.50	.611

Because the ANOVA did not show any significant differences, no follow-up tests were done.

Discussion

This chapter presents a discussion of the results of the study. The purpose of the study was to see if the use of talking head video, showing the face of the speaker, would improve listening comprehension for L2 learners, and to explore whether the quality of the video had any effect on listening comprehension. Participants completed an exercise under one of three different conditions – still picture with audio, low quality video with audio, and high quality video with audio – and their scores on a listening comprehension quiz were compared.

The results showed no significant differences in the listening comprehension scores between the three treatment groups. Therefore, they hypothesis that talking head video facilitates L2 listening comprehension was not supported. Furthermore, the hypothesis that higher quality video has a greater effect than low quality video was not supported.

There are several possible explanations for the non-significant result found in this study. One is the low level of Spanish language proficiency of the participants. Sueyoshi and Hardison (2005) found that listeners with higher language proficiency were better able to take advantage of the visual cues provided by watching the speaker's face, possibly because they had had more L2 interaction experience and had learned to recognize visible speech cues. Participants in the present study came from an accelerated first-year, first semester class. Although they had taken at least one year of high school Spanish, they had been identified by the Spanish department's placement test as being low-proficiency learners. It is possible that the results would be different if the experiment were repeated with participants whose Spanish language skills were at the intermediate level or higher.

A second possible explanation is that the three-minute video may not have been long enough to measure the effect of the video. According to Mayer (2001), one of the benefits of providing relevant visual information is

that it helps the learner focus attention on the content of the lesson. This benefit might be more important as fatigue begins to interfere with listeners' ability to focus attention on detailed information such as specific vocabulary words from the text (van der Linden & Eling, 2006). A possible follow-up study would be to repeat the same experiment using a longer video text.

A third possible explanation for the lack of significant finding is the relatively small sample size. There was a high absentee rate the day of the experiment, perhaps because it occurred during a week that was shortened by a holiday, and because the use of the computer lab required students to attend class in a different building from their regular classroom. A sample size of 30 is often cited as the ideal for statistical analysis, but the groups in this study ranged from 18 to 20.

A fourth possible reason is the limitation of the testing instrument used to measure comprehension. Although an original draft of the comprehension quiz was modified by the instructor to replace the easy-to-guess multiple choice questions with fill-in-the-blank questions, the data still show a ceiling effect. Twenty-one percent of the participants earned the maximum score of ten correct answers. This suggests that the test was not sensitive to variability among the highest-performing students, and therefore had a limited ability to reveal differences between treatment groups.

It is possible that the ceiling effect in these data could have been prevented by making the comprehension quiz even more difficult. However, the listening exercise used in this experiment was an in-class activity with a stated goal of giving students an opportunity to practice their developing Spanish language skills, rather than testing their achievement. The video gave them a taste of how the Spanish language is used outside the classroom, which is consistent with Krashen's (1981) recommendation to provide a guided but informal environment for language acquisition. The introduction of a stringent assessment component into a class activity that is normally used as a rehearsal of skills might have been discouraging for the students. A future study with a more difficult test would be valuable, but the present study reflects an authentic classroom activity, and therefore may have more relevance to how video would actually be used in L2 teaching.

Although there might be significant effects of video type that were not found in the present study, it is also possible, of course, is that there really are no significant effects of talking head video on L2 comprehension. Although disappointing in the context of the present study, language instructors may be encouraged by the fact that this study did not reveal any negative effects from using simple pictures or low quality video. Due to the large file size of video and the bandwidth required for viewing video over the internet, instructors are often limited to posting highly-compressed, low quality video on their course web sites. Despite this limitation, however, students like using video materials in their foreign language classes (White, Easton & Anderson, 2000). The attractiveness of video might make the listening exercise appear easier and put students at ease (Norman, 2004), which could increase students' motivation to learn. Because the present study did not find a significant difference between still picture, low quality video, and high quality video, it does not suggest any requirement that the video used in foreign language classes be of high visual quality.

Although the results of this study were statistically insignificant and therefore inconclusive, this project may serve as a pilot study on a topic that is worthy of further exploration, especially with more advanced learners and using longer, more complex video materials and testing instruments.

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Cultural Perspectives on Instructional Technology Consulting

Xiaoxue Wang
College of Education
Georgia State University

Abstract

This study explored instructional technology consulting in two different culture settings by examining what comprises instructional technology consulting, the personal experience of instructional technology consultants, and their feelings about instructional technology consulting. The study took a general qualitative approach (McMillan & Schumacher, 2001) and used a phenomenological method (Creswell, 1998) to interview experienced instructional technology consultants both in the USA and in China. The three ultimate purposes of this study were: (1) to reveal the essence of instructional technology consulting; (2) to explore similarities and differences of instructional technology consulting in these two different cultures; and (3) to seek implications for better instructional technology consulting practice in these two different cultures. This paper shares with readers the research design, implementation process, research findings, and discussions of the implications.

Introduction

Globalization has swept through the world with ever increasing global connectivity, integration and interdependence in economic, social, technological, cultural, political, education, and many other spheres of life. Scholars and practitioners believe that technology advancement together with fast-growing international ventures, increasing business outsourcing, and expanding distance education has dramatically changed the training and learning landscapes (Rosenburg, 2001; Welsh *et al.*, 2003) . These changes also create unprecedented opportunities as well as challenges for instructional technology consultants to provide their consulting services to individuals and groups beyond the borders of their own countries (Carucci & Pasmore, 2002).

Consulting is a unique social and human phenomenon that is widely practiced. Though people maintain different definitions of consulting, as a professional practice, consulting is often defined as the application of talents, expertise, experiences, and other attributes to help the client solve problems and improve the client's condition (Bellman, 2002; Block, 2000, 2001; Cope, 2003; Holtz, 2000; Schein, 2002; Weiss, 2004). Instructional technology consulting aims to solve the client's learning and performance problems through the application of the consultant's expertise and experiences in instructional technology.

A consultant is in a position to have some influence over an individual, a group, or an organization in a course of action, but often has no direct power to make changes or implement programs (Block, 2000). Robinson and Robinson (1999) concur with this perception of the consultant's role to influence and emphasize that consulting requires a great deal of both technical and relationship competence. Obviously, there is more to instructional technology consulting than just having the right answer or delivering a technically sound product.

The culture always directly impacts decision-making in any consulting practice and the important influence of culture has been widely acknowledged in consulting (Adams, 2003; Cope, 2003; Wright, 1997). In his discussion of the importance of culture in educational technology consulting, Wright (1997) emphasizes that culture is a multi-faceted attribute that distinguishes one country from another and advises instructional technology consultants to be ready to cope with the effects of different cultural influences when consulting in different culture settings.

With new global opportunities as well as challenges, consulting, as an industry and a profession, is undergoing rapid and dramatic changes and most of its old fundamentals about how to consult are now in a state of question and transformation (Greiner & Poulfelt, 2005). While this world will need all the help consultants can give to assist their clients in building up their capabilities to succeed in an interdependent and fast moving global community (Rhinesmith, 2005), instructional technology consultants need to better understand their consulting practice in different cultural settings given today's wave of globalization.

This study explores instructional technology consulting in two different culture settings (the USA and China) by examining what comprises instructional technology consulting, the personal experiences of instructional technology consultants, and their feelings about instructional technology consulting. One way to accomplish this is to examine consulting from the perspective of experienced instructional technology consultants to reveal its essence

in specific cultural settings. The paper first describes the study's framework, presents its findings, and finally discusses implications for improving the practice of instructional technology consulting in these two different cultural settings.

Research Questions and Methodology

The study took a general qualitative approach (McMillan & Schumacher, 2001) and used a phenomenological method (Creswell, 1998) to interview experienced instructional technology consultants both in the USA and in China. Phenomenology, according to van Manen (1990), explores the nature of "lived experience." Phenomenology, in research, questions the way subjects experience the world. Therefore, phenomenological research is situated in the "life-world" in order to gain insights into how individuals reflect on and understand their experience (van Manen, 1990). The questions in phenomenology ask for the meaning and significance of phenomena in order to reveal its essence. This study was designed to find answers to the following research questions.

Research questions

Five major questions guided this study. The first three questions sought to explore and reveal the essence of instructional technology consulting while the last two sought similarities and differences of instructional technology consulting practice in the USA and in China.

1. What is instructional technology consulting?
2. What is it like to be an instructional technology consultant?
3. What are the feelings about instructional technology consulting described by the study participants?
4. What are the similarities in the answers to the research questions 1 ~ 3 shared by the study participants from the USA and from China?
5. What are the differences in the answers to the research questions 1 ~ 3 given by the study participants in from the USA and from China?

Study Participants

Study participants refer to those who participated in the research interviews. The participants A to E are from the USA and the participants F to H are from the China. They were purposively selected due to their rich experiences in instructional technology consulting. They were initially invited to participate in the study by the researchers through e-mails and phone calls in which the nature and purpose of the study were explained. After they agreed to participate in the study, an informed consent form with a detailed description of the study purpose and processes were sent to them through e-mails. The informed consent forms were signed at the time of interviews. Table 1 on the next page summarizes basic information of study participants.

Interviews

The interviews with study participants varied from 42 minutes to 80 minutes in length. All the interviews were face-to-face interviews with audio-recording in one or two different media (audio-tape recording and/or MP3). The interviews were semi-structured with questions designed to uncover the perceptions, feelings, and lived experiences of instructional technology consultants. Semi-structured interviews allowed more interaction between the researchers and study participants and allowed the researchers to probe beyond specific questions (Kakabadse *et al.*, 2006). The interviews with the study participants in China were conducted in Chinese. Because the Chinese study participants understood English very well, many terms related to instructional technology and consulting used in the interviews were in English and sometimes in both English and Chinese to ensure smooth and accurate communication.

Table 1: Summary of Study Participants

Participants	Job Title	Degree & Major	Consulting Fields
Dr. A from the USA	• Retired professor of instructional technology • Instructional technology consultant with his own consulting firm	Ph. D. in Instructional Technology	Corporation and Higher Education
Dr. B from the USA	• Associate professor of instructional technology • Department chair	Ed. D. in Instructional Technology	Corporations and Higher Education
Dr. C from the USA	• Director of a university educational technology service center • Manager of the eLearning Group at a university	Ph. D. in Instructional Technology	Higher Education
Dr. D from the USA	• Senior research scientist in a university center for integrating science, mathematics, and technology into education	Ph. D. in Instructional Technology	K-12 and Higher Education
Dr. E from the USA	• Professor of instructional technology	Ph.D. in Instructional Technology	Corporation, Higher Education and Military
Prof. F from China	• Emeritus professor of educational technology • Director of educational research center	M. S. in Wireless and Electronic Science	K-12 and Higher Education
Dr. G from China	• Professor of educational technology	Ph. D. in Cognitive Science and Educational Technology	Corporation, Higher Education, and Government
Prof. H from China	• Associate professor of educational technology • Deputy director of a university educational technology center	Ph. D. Candidate in Information Technology	K-12 and Higher Education

Data Analysis

In phenomenological research, data analysis and interpretation involves a constant movement between understanding and the explanation between detailed microscopic data and macroscopic theory (Nicholls, 2003) with a goal to reveal the essence of the phenomenon by integrating the lived experience of the researched, the researcher, and the reader of the research into a whole (van Manen, 1990). Specifically the data analysis in this study included (a) organizing and cleaning data, (b) generating data categories and themes, and (c) validating and reporting the findings.

First, in organizing and cleaning data, the interviews were transcribed into text and the personal information in the interview transcripts was concealed to protect the confidentiality of the study participants and their clients. These revised interview transcripts were sent to the study participants to review for accuracy and confidentiality prior to data analysis. Some study participants made minor revisions to the interview transcripts. The Chinese interviews were first transcribed in Chinese and then translated into English. To ensure validity of the translation, the Chinese interview transcripts and their English translations were reviewed by a Chinese professor of linguistics teaching at an American state university and a Chinese study participant. The English translations of the interviews were also reviewed by an American English writing course instructor at a state university. Minor revisions were made to the translations according to their review comments before they were used for analysis.

In reading and generating categories and themes, the researcher progressively immersed into the data. First, each interview transcript was read and then categorized into three major categories: (1) definitions of instructional

technology consulting, (2) behaviors (what instructional technology consultants did), and (3) feelings (how instructional technology consultants felt). After all the interview data were categorized, the categories of data were repeatedly read and further categorized according to the emerging themes. The progressive immersion into the data enabled the researcher to identify clusters of themes from a rigorous analysis of the meaning inherent in the description of the phenomenon under investigation. Using these clustered themes, the researcher revealed the fundamental structure (nature or essence) of the phenomenon (Nicholls, 2003) - instructional technology consulting.

As a means to triangulate the data, the analysis results and report were sent to the study participants to review and to comment. Two American and one Chinese study participants reviewed and commented on both the data analysis results and report. Revisions were made according to their comments to ensure accuracy of data analysis and to validate the research findings.

Research Findings

The identified themes in this study are grouped in three major categories: (1) definitions of instructional technology consulting, (2) lived experience of instructional technology consulting, and (3) feelings about instructional technology consulting. This paper highlights the findings without referencing to the data collected due to the space limit.

Definitions of Instructional technology consulting

When the study participants come to define instructional technology consulting, they use very simple and plain words. In their eyes, instructional technology consulting is to "help solve problems for somebody else," "to provide services", and "to provide a fresh perspective on whatever their issue is." An American study participant, who is a retired professor and a professional consultant, defined instructional technology consulting as selling ideas. A Chinese study participant, concurring with the American colleagues, defined instructional technology consulting as leading and guiding the clients in improving their education conditions.

The study participants from both the USA and China agreed that instructional technology consulting dealt with concrete and real world problems and devised solutions to these problems in a systemic and innovative way. The definitions offered by the study participants from both the USA and China revealed the core mission and value of instructional technology consulting that were highly appreciated by the clients.

Lived Experience of Instructional Technology Consulting

Instructional technology consultants face many challenges and complete numerous tasks in their consulting practices. However, behind easy-to-observe consulting tasks like communicating with clients and analyzing data, what is the real essence of their consulting practice? Essence, according to van Manen (1990), is the very nature of a phenomenon and the internal meaning structures of the lived experience. The data analysis of this study reveals that the essence of instructional technology consulting is (a) meeting expectations, (b) applying creative and practical strategies, (c) working with the team, (d) building up trust and understanding needs, and (e) dealing with ethical issues.

Meeting expectations. Meeting expectations is an internal driving force behind all the consulting efforts. The bottom line for measuring success of consulting is to see if the consultant can deliver what is promised to meet the client's expectations. Meeting expectations strongly impacts decision making in consulting. Expectations in consulting must be realistic and shared with the clients, if the consultant wants to make a real difference. Very often instructional technology consultants go above and beyond the client's expectations because they are highly motivated and committed to demonstrating high standards of professionalism in their consulting practices.

Applying creative and practical strategies. Instructional technology consultants apply creative and practical strategies to solve the real world problems. Experienced instructional technology consultants are not only creative in

devising solutions to the problems but also very creative in communicating with and guiding their clients. Some strategies that the study participants from both the USA and China applied are inspirational and very practical.

Working with the team. Instructional technology consulting mandates working with a team (students, colleagues, and clients). Study participants from both the USA and China confirm the importance of the team approach in their consulting practice. Working with a team brings about several benefits in instructional technology consulting. For example, team approach expands the capabilities of instructional technology consultants and contributes to consulting project accomplishment. A study participant from China believes that his consulting team should always include his clients to ensure effective communication and shoulder up the shared responsibilities in consulting project.

Building up trust and understanding needs. Study participants from both the USA and China believe that consulting, which is always working for and working with people, really begins with a trusting relationship. Consulting begins with building trust and then maintaining and nurturing that trust. According to American study participants, trust is built through understanding client's needs and effective communication with the client while the Chinese participants believe that the trust relationship heavily relies upon the consultants' professional credibility and authoritative expertise.

Dealing with ethical issues. Consulting is a professional practice and being professional is really embedded in all the small but critical decisions made during the consulting practice. Being professional could be as simple as "being honest," and "not promising what you can't deliver and not delivering what they don't need." To the study participants, being professional in consulting reveals their ethical standards. This is very true both in the USA and in China when instructional technology consultants face the situation where they have to make hard choices. When dealing with ethical issues, the study participants often choose a "hard way out" and refuse to compromise their professional standards as instructional technology consultants.

Feelings about Instructional Technology Consulting

Interviews with the study participants both from the USA and China revealed their rich and multifaceted feelings about instructional technology consulting which cover a wide range from simple "joy", "fun" and "a great thing to do." to "self-realization" and "intrinsic reward." To them, instructional technology consulting is generally rewarding and beneficial. The positive feelings of the study participants for instructional technology consulting keep them motivated to continue their consulting practice. Their positive feelings about instructional technology consulting reveal the philosophic aspect of consulting. The philosophic aspect of consulting manifests as a love for learning in these instructional technology consultants and explains why consulting to them is intrinsically rewarding.

Discussion

This study sheds light on the complicated nature of instructional technology consulting by analyzing the definitions given by those experienced consultants from both the USA and China, exploring the feelings about instructional technology consulting, and most important, examining the lived experience of instructional technology consulting. The discussion here presents similarities and differences of instructional technology consulting in the USA and in China followed by the implications for consulting practices.

Similarities

Data analysis indicates the common ground of instructional technology consulting shared by study participants from both the USA and China. This shared common ground reveals the essence of instructional technology consulting, which consists of essential elements at five levels. These five levels of instructional technology are (1) objective level, (2) task level, (3) strategic level, (4) cultural level and (5) philosophic level. At the objective level, instructional technology consulting is solving problems and creating opportunities of advancement for the clients. This very core element of consulting is highly appreciated and highly valued by the

clients. At the task level, instructional technology consulting is meeting shared and realistic expectations in a professional manner. This is what an instructional technology consultant tries to accomplish in consulting. It involves the concrete consulting tasks that an instructional technology consultant handles on a daily basis. At the strategic level, instructional technology consulting is applying creative and practical strategies and working with the team, which is a means to "get the job done." At the cultural level, instructional technology consulting is building a trusting relationship, understanding the real needs of the clients, and dealing with ethical issues in the consulting practice. It represents the social essence of instructional technology consulting as working with and working for people. Finally, at the philosophical level, instructional technology consulting is intrinsically rewarding, beneficial to career development, and demonstrates the love for learning of instructional technology consultants. This philosophic essence of instructional technology consulting reveals the motivational aspects of instructional technology consultants, which are an intrinsic part of consulting.

These five levels of instructional technology consulting reflect instructional technology consultants' beliefs of consulting (objective level) and describe their consulting behaviors (task level, strategic level and cultural level) and reveal their feelings of their consulting experiences (philosophic level). Figure 1 illustrates the essence of instructional technology consulting shared by the study participants.

Figure 1: Essence of instructional technology consulting

Differences

Though the study participants from both the USA and China shared common ground in instructional technology consulting, there are distinct differences existing between them. At the objective level, the American participants really emphasized problem-solving "for the clients" while the Chinese participants clearly emphasize problem-solving "with the clients." This slight difference at the objective level of instructional technology consulting indicates the different positions taken when consulting in these two different cultural settings.

At the task level, most American study participants indicated the importance of setting up realistic expectations with the clients emphasizing specifications of the project deliverables from the consultants. The

Chinese participants also mentioned shared expectations, but with a focus on the shared responsibilities with the clients in the consulting project.

At the strategic level of instructional technology consulting, both the American and Chinese participants are using creative and practical strategies, but they differ on their approach to the teamwork. The American study participants form a consulting team to increase their consulting capabilities so that they will be able to solve the problems that are beyond the ability of individual consultants. The Chinese study participants form their team not necessarily for increasing their consulting capabilities or consulting scope, but mainly to increase the effectiveness of their consulting efforts.

At the cultural level of instructional technology consulting, the differences between the American and Chinese participants mainly exist on their perceptions of consultant-client relationship in terms of trust. The American participants believe that building a trusting relationship with their clients is a constant effort in their consulting practice and trust is built through effective communication and understanding of client's needs. The Chinese participants agree with this view, and at the same time, emphasize that trust is based on the professional credibility and authoritative expertise of the consultant.

At the philosophical level of instructional technology consulting, there are no major differences between the American and Chinese study participants. The study participants from both the USA and China believe that consulting is intrinsically rewarding and manifests their love for learning. Additionally, career benefits are also one of the motivation factors that keep the American study participants continuing their consulting practice. Table 2 summarizes the differences of instructional technology consulting between the American and Chinese study participants.

Table 2: Differences on Consulting from American and Chinese Study Participants

	American Consultants	**Chinese Consultants**
Objective Level	Problem solving for clients and providing services.	Problem solving with clients and providing professional leadership and guidance in addition to services.
Task Level	Setting up realistic expectations of consulting services to specify deliverables.	Setting up realistic expectations of consulting services focusing on shared responsibilities between the consultants and clients.
Strategic Level	Using team approach to increase consulting abilities and expertise to solve problems that are beyond the ability of individual consultant	Using team approach to increase the effectiveness and efficiency of their consulting efforts.
Cultural Level	A trust relationship with clients built through effective communications and understanding of clients' needs.	A trust relationship with the clients based on professional credibility and authoritative expertise of consultants.
Philosophic Level	Intrinsic rewarding and career benefits as motivational factors for consulting.	Intrinsic rewarding as motivational factors for consulting.

All the differences of instructional technology consulting mentioned above originate from the different beliefs of instructional technology consulting held by the study participants from the USA and China. The American study participants believe that consulting is set of professional services provided often with a formal contract and financial returns. They have a strong sense of business obligation and a strong sense of cliental relationship when talking about instructional technology consulting. When the Chinese participants are invited to a consulting project, they do not have the sense of the business obligation. They have a strong awareness of the fact that they are called in because of their professional knowledge, experience, and authoritative expertise. All three Chinese participants have not formally signed any consulting contract in their consulting practice. But, they are clearly aware that their professional credibility is on the line and they have to get the problem solved in a very professional way. They

almost immediately perceive the problem as their own when they get into their consulting practice. This explains why they feel like that they own the problem and why they consistently use the word like "leading" and "guiding" in addition to the services when describing their consulting experiences.

Implications

To explore instructional technology consulting is to seek implications for a better instructional technology consulting practice in these two different cultural settings. Three implications for instructional technology consulting practice can be drawn from the research findings in this study.

Systemic approach. Since instructional technology consulting is multifaceted and multi-leveled in its nature, the systemic approach should be the first "rule of thumb" for its practice. The problems an instructional technology consultant called to solve are usually complicated and serious, impacting many people in an organization. The consultant must see the "entire system, entire context" as pointed out by one of the study participants. Otherwise, "you lose the perspective of the whole big picture" (Dr. B). Only the systemic approach would enable the consultant to see "the whole big picture" so that the best solutions can be devised for the clients. This echoes the advice of many scholars and practitioners when they discuss consulting in human performance technology (Chevalier, 2006; Rummler, 2006), in organization development (Freedman & Zackrison, 2001; Rothwell & Sullivan, 2005), in management consulting (Poulfelt & Greiner, 2005), and in consulting in general (Block, 2000, 2001; Cope, 2003; Welsh et al., 2003). This applies to instructional technology consulting both in the USA and in China.

Soft skills. Instructional technology consulting at the cultural level clearly indicates its nature of working with people and working for people. The study participants from both the USA and China mentioned that having knowledge and skills of cutting edge technology is a "must-have" for people starting in the consulting field. However, the professional qualities and soft skills like "listening," "communication," and "interpersonal skills" are what really promote them in their career and "get things done." According to many scholars and practitioners in consulting fields, these professional qualities and soft skills can make the difference between an ordinary practitioner and a truly effective and successful professional when consulting with clients (Aldhizer III *et al.*, 2002; Block, 2000, 2001; Dallimore & Souza, 2002; Freedman & Zackrison, 2001; Murphy, 2005).

As suggested by the study participants from both the USA and China, the ability to listen carefully and thoroughly is one of the most important and difficult skills to master in consulting. It takes time to develop listening skills, but these skills will enable the consultant to hear correctly what has been said and, most important, what has not been said. One of the study participants, a professor of instructional technology, repeatedly emphasized the importance of listening skills in his interview and strongly suggested "develop[ing] your listening skills. Get to where you can really hear what people are saying and hear what people are not saying as well." (Dr. B)

Collaboration. Although there are situations both in the USA and China, where an individual instructional technology consultant works on a project, the complexity and scale of the problems to be solved in today's organization often require consultants to collaborate and work together with other consultants as a team. The multifaceted and multi-leveled nature of instructional technology consulting indicates that instructional technology consultants can collaborate to work at different levels of consulting. For example, a consultant whose expertise is in task level performance analysis consulting might collaborate with another consultant who is adept at building a trusting relationship with the clients at the cultural level of consulting. American study participants suggest that experienced instructional technology consultants constantly re-examine themselves, reflecting upon their consulting practice and evaluating their consulting competence. A better understanding of oneself helps instructional technology consultants expand their consulting capabilities through collaborations with others. In this respect, the Chinese instructional technology consultants need to learn from American consultants how to expand their consulting capabilities through the collaboration with other instructional technology consultants.

For American consultants to practice consulting in China, the study suggests that they need to learn how to immerse into their Chinese client organizations so that a strong partner-like cliental relationship can be built with the Chinese clients. As Chinese culture is very collective, feminine, and long-term oriented (Thompson & Ku, 2005), the Chinese clients tend to expect professional "guidance" and "leadership" from the consultants, and tend to regard

their consultants as their partners rather than invited business professionals who are paid to solve their problems. Li (2003) in the description of his consulting experiences points out that in China, consultants are expected to be teachers and advisers first. Therefore, a more participative approach is needed for American instructional technology consultants to practice consulting in China.

Two limitations of this study should be mentioned here. First, this study included only five American participants from the southeast USA and only three Chinese participants from China. Although the themes that emerged from the data analysis are strong and obvious, more study participants are needed in order to confirm the findings of this study. Second, the interviews were conducted by different researchers who were not equally experienced in conducting interviews. The study participants were not equally prompted to tell and reflect upon their lived experience of instructional technology consulting in these interviews.

Conclusion

This study reveals the essence of instructional technology consulting and its multifaceted and multi-leveled nature shared by the study participants from both the USA and China. Instructional technology consulting is to solve problems and create advancement opportunities for the clients, meet expectations, apply creative and practical strategies, work with a team, build trusting relationships with clients, deal with ethics issues, and it is a fun, intrinsically rewarding, and a manifestation of a love for learning.

From literature reviews to the research findings, a common theme emerged regardless of the area of expertise in consulting: being an effective consultant requires crucial soft skills in addition to the technical and specialist competences required of an instructional technology consultant. Instructional technology consultants today are expected to work across industry sectors and understand how business is conducted in the global markets with different cultures. Consultants who are equipped with these valuable soft skills are the ones who know how to establish durable client relationships that will result in return business. The study participants from both the USA and China emphasize that proficient technical skills are important in consulting, but the ability to listen, communicate, be a team player, and understand customer needs will set one consultant apart from the others.

The study of instructional technology consulting is ongoing and this paper reports research findings based on the data collected in 2006. With our better understanding of instructional technology consulting, it will be beneficial to go back to these study participants to further explore their lived experience and continue to expand knowledge in this area.

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Social capital and technology instruction

Amy Tracy Wells, Doctoral Candidate

Hsin-Yuan Chen
Department of Counseling, Educational Psychology, and Special Education
Michigan State University
East Lansing, MI 48824-1120
wellsat@msu.edu
henhs11@msu.edu

Abstract

Focusing on social capital theory, this research details 8 case studies conducted with 4 Asian-American and 4 Caucasian-American teenagers living in university towns in the Midwest. Survey and observational data were analyzed to determine the participants' access to and use of technology in school and at home. We conclude that school-based instruction in technology is limited or absent in the observed population. From this perspective, we identify technology as a constitutive element of social capital and briefly mention the implications of our findings for intergenerational stratification.

Introduction

Studies about the formal instruction of and use of technology in schools have documented limited gains in both these areas (Zhao & Frank, 2003; Zhao, et al., 2002, Cuban, 2001). In 2003, after billions of dollars had been spent on putting technology into schools, Zhao & Frank concluded that the modest technologies of email, telephones and computers are those most frequently used by educators. Whereas once it was believed that with funding and training educators would teach students about technology, this has not been the case (Cuban, 2001). This in spite of the fact that the Bureau of Labor Statistics' *Occupational Outlook Handbook* (2003) states that "employment in computer systems design and related services will grow by 39.5 percent and add almost one-fourth of all new jobs in professional, scientific, and technical services (by 2014)."

Given the importance of technology in today's society, the current study suggests that access to technological expertise through informal relations is a critical element of social capital and seeks to determine how this capital is transmitted to certain populations. We use an adolescent-centered focus wherein the teenagers are regarded as knowledgeable participants (Geertz, 1988). As a result, the technologies, activities and goals of the teenagers themselves represented the primary data (Hatch, 2002). This research makes several contributions to the literature. The rich narrative case and cross-case narratives of the participants explore what technologies are and are not being used in school and at home. In contrast to much of the social capital literature, this research focuses on participants with higher social capital. We conclude by arguing that this access to social capital contributes to intergenerational stratification in technology use.

Social capital

French sociologist Bourdieu (1986) presented the theoretical components and concept "social capital". He believed that social class decides and changes the cultural resources that individuals can access in their home environment and helps to define "social capital" (Lareau, 2003). Specifically, he stated that families provide "resources" of different types, amounts and qualities, which he called "capital", that produce necessarily different social and cultural "benefits" (Bourdieu, 1977; 1984; Portes, 1998; Lareau, 2000). For example, Horvat, Weininger & Lareau (2003) demonstrate that middle-class parents react differently from working-class and poor parents to problematic school situations. Broadly, they demonstrate that middle class parents "…mobilize the information, expertise and authority needed to contest the

judgments of school officials…" (319), while working class parents responded on an individual level (i.e., writing a note to the teacher). These two different responses, which were independent of race, produced different outcomes for each of the two groups. They conclude, with Stanton-Salazar (1997), that a constitutive element of social capital is social position and that social capital theory is central to discussions of social stratification as an intergenerational phenomenon.

However, though the theory of social capital is "…one of the most successful 'exports' from sociology to other social sciences…" (Portes, 2000, 1) parts of the theory are unclear and even contradictory (Portes, 1998; Dika & Singh, 2002, Horvat, Weininger & Lareau, 2003). As Portes (1998) first noted several issues require exploration including the elements of social capital, how social capital can be used, and the consequences of social capital. Dika & Singh (2002), after reviewing the use of social capital in educational literature, note that the current use of qualitative research is encouraging as it may aid the clarification of the theory as a whole.

Whereas much of the social capital literature in education focuses on the absence of institutional support and parental efforts to attain it, this research documents the inverse. We begin instead with adolescents' who have high social capital, including access to technologies but minimal institutional support and little interest in obtaining such support. Specifically, the data shows that these adolescents do not have access to meaningful instruction (e.g., programming languages etc.) or technology while at school. However, the parents in this study instead of trying to marshal institutional support respond by providing technologies directly to the adolescents themselves. Access to the technologies and the guidance of their parents and friends allow them to develop technological expertise informally outside of school. On the basis of these results, we discuss social capital theory and in particular stratification, or individual mobility.

Methodology

Participants

In order to evaluate the students in a peer context, we selected eight high school students who shared some common characteristics (see *Table 1:* Demographic information of participants). The eight individuals included four males and four females. Half of the students were Asian-Americans and half of them were Caucasian-Americans and were chosen based on their relative economic affluence and parents' educational attainment. All participants were from two midsize Midwestern university towns, whose public high schools are considered strong academically.

Participants were between the ages of 14 and 17 and in grades 9, 10 and 11. All participants were from households in which at least one parent held a Bachelor's degree and 84% were from households in which one parent held a Master's degree. In contrast, only 24% of the U.S. population holds a Bachelor's degree and only 6% holds a masters degree (Census, 2003). In 50% of the participants' households, the father held a PhD, in 62.5% of the households, one parent had a master's degree and in 37.5% of the households, one parent had a bachelor's degree. Household incomes ranged between $40,000 to in excess of $75,000 in contrast to the median U.S. household income of $46,326 (Census, 2005).

Table 1: Demographic information of participants							
Name	Race	Sex	Age	Grade	School Type	Parental degrees	Household income[1]
Abby	Asian American	F	14	9th	Ann Arbor District Public High School	Father: Ph.D. Mother: M.A.	>$75K

[1] >$75K, $60-75K<, $40-60K, $20-40K and <$20K

Andy	Asian American	M	16	10th	Ann Arbor District Public High School	Father: B.S. Mother: some college	$40-60K
Barbara	Asian American	F	17	10th	Ann Arbor District Public High School	Father: M.S. Mother: B.A.	>$75K
Brian	Asian American	M	17	11th	Ann Arbor District Public High School	Father: Ph.D. Mother: M.A.	$60-75K<
Candace	Caucasian American	F	15	10th	East Lansing District Public High School	Father: Ph.D. Mother: B.S.	$60-75K<
Charles	Caucasian American	M	15	10th	East Lansing District Public High School	Father: Ph.D. Mother: M.S.	>$75K
Darlene	Caucasian American	F	14	9th	East Lansing District Public High School	Father: B.S. Mother: M.A.	$40-60K
David	Caucasian American	M	16	11th	East Lansing District Public High School	Father: Ph.D. Mother: Ph.D.	>$75K

The following figures apply to the schools attended by the participants. In 2005[2] the schools had a range of 12% to just less than 14% of students receiving free or reduced lunches. The range of SAT scores in 2005 was 1169 to 1099 in contrast to a state average of 1147 and a US average of 1028. The ACT and AP scores were similarly higher in relation to both state and US averages.

Procedures

The authors individually surveyed and observed the participants in their homes and working on their computers. Two types of data were collected: survey responses and observational data. The survey included 73 questions with 24 yes/no answers, 45 short answer[3] and 6 open ended answers divided into six general categories: demographics; access; hardware; chat, phone, email, text messaging, and IM; games, e-space and television; and education. The categories were designed to assess access to and the frequency of use of specific technologies and how these technologies related to their education.

Results

All participants, as our case studies revealed, have very few economic and educational constraints. All are from relatively affluent and highly educated households, attend and perform well academically at excellent schools, and have access and opportunities to explore and use a variety of technologies in supportive home environments. This population affords us a perspective on technologies that are chosen for them by their schools and technologies the students chose themselves. For example, as a group, the primary

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[2] All data except the average national AP score in this paragraph are from SchoolMatters (http://www.schoolmatters.com/)
[3] Including how often something happens, how important something is to the participant or a location question.

technology they have access to during school and for their personal use are calculators and textbooks with only two having irregular access to a computer. That is, aside from offering basic keyboarding or basic word processing, their schools did not offer hardware and software classes that were compelling to this group. Inconvenience (e.g., computers that needed to be checked out or ran poorly) and lack of access (e.g., no wireless connections or no password for wireless access) were the primary factors cited for a lack of computer use in their school routines on the part of the participants. Some of the participants were required however to use a word processing, presentation program and/or an online content management system for their homework in certain classes.

Though this absence might be explained by factors such as a lack of time in the school day, insufficient instructor knowledge and/or student knowledge often times exceeding that of the instructor, it is striking given the students' perception of technology. For example, when asked "how important do you think knowing how to use computers and the internet will be to your future education?" and "how important do you think knowing how to use computers and the internet will be to your job plans later in life?" all participants felt they would be somewhat to extremely important and yet only the most rudimentary how-to classes existed to support the participants. In addition, all had significant access to technology for educational and entertainment purposes outside of school. In essence, computer-based technology has one value for the students and their parents and another value for their educators.

As a group, they demonstrated a facility and comfort with technology that could not be explained by their exposure through either formal training or access to technologies in their school. Rather, their knowledge appeared to be developed in informally through social networks (i.e., parents and friends) and through self-study. It is also important to keep in mind that this same group all had unfettered access at a minimum to a computer, access to the internet, a calculator and IPod or other MP3 device in their home. In addition, 72% of the participants had access to one or more home entertainment systems such as XBox, Playstation, Game Cube, Game Boy, DS (Dual screens) or Wii. Though their ages only ranged from 14 to 17, these participants have been going online for anywhere between 5 to 11 years. For all participants, the technologies they have access to are part of the everyday tools that make up their landscape. This is important as proficiency with and access to a wide variety of technologies form their actual resources, an important element of social capital (Bourdieu, 1986).

DISCUSSION

Schools serve a variety of purposes including preparing students for life-long learning, and preparing students to participate in society and in the work force. However, when technology instruction and technology itself is largely absent from schools, adolescents' with and without social capital are differently prepared for life outside of school. The net effect of this is that schools risk contributing to intergenerational stratification and leaving some students behind.

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Digi-Journeys: Engaging Preservice English Teachers in Reflective Practice with Digital Storytelling

Jennifer S. Dail, Kennesaw State University
Vivian H. Wright, The University of Alabama

Abstract

In this study, preservice English teachers tracked and reflected on their professional growth through a series of digital images accompanied by music and text in motion. The researchers dubbed this reflective process as "Digi-Journeys." Preservice teachers were not given a pre-determined structure for how to think through the process; rather they were given the freedom to depict their growth through critical reflection. The researchers found that Digi-Journeys illustrated the preservice teachers' growth and demonstrated a shift from teacher-centered instruction to student-centered instruction.

Introduction

As two teacher educators involved in teaching methods courses at a major southeastern university, we constantly seek innovative ways to critically engage preservice teachers in reflecting on their new classroom teaching experiences. One of us works with instructional technology within the framework of the methods courses while the other specializes in English instruction. This research emerged from our search for innovative methods of reflection for our preservice teachers that fit within best practices.

Teacher education programs promote reflective practice to teach preservice teachers the concept of best practice whereby teachers continually evaluate the effects of their instructional methods and actions on students, parents, and the school community (Krol, 1997). Reflective practice often takes the form of written journals because they tend to be accessible and easier for students to maintain. However, as discovered through feedback in our own methods courses, while preservice teachers see the value inherent in reflective journals, they find written journals tedious by the conclusion of a ninety-hour placement. As a result, we sought to integrate an equally accessible yet more creative means for promoting this best practice with our preservice English teachers.

Self-reflection is an integral part of teaching, and when paired with visual imagery (e.g. through use of digital photography and video), it allows diverse student populations to see their progress (Salpeter, 2005), to better link theory with practice, and to monitor best practice (Wursta, Brown-DuPaul, & Segatti, 2004). Reflection is a key element in teacher expertise, and it occurs when individual teachers have the ability to notice their own role, which can often be accomplished through the means of video technology (Sherin & van ES, 2005). With easy access to multimedia tools, an emphasis on learning how to use and integrate technology in teaching and learning, and an increased interest in digital storytelling in many disciplines, digital storytelling seems a natural method of reflection for preservice teachers.

Background

Reflective Practice

Reflection has special meaning when applied to classroom practices. In this context, reflection works to close the gap between what teachers do in their practice and the actual outcomes; it recognizes that intended outcomes may not match with actual outcomes. Additionally, reflection requires that teachers think about the possible disconnect between intentions and results in a lesson, and it is this thought process that brings a deeper level of meaning to the teaching and learning experience (Dewey, 1938). According to Dewey (1916), this thought process and the seeking of knowledge is integral to development. He asserted that all learning begins only when people realize they are comfortable that their ideas are inadequate for a task at hand. It is then that teachers must use the process of reflection to find a way to change for the better. In this way, reflection plays an essential role in teaching; in order to be successful teacher, reflection must be a fundamental part of the teaching experience. As teachers gain experience by trial and error, reflection allows for growth (Gibbons and Jones, 1994). According to Cambron-McCabe (2000), experienced teachers gain knowledge of their craft through systematic and informed reflection on their work. These teachers are critical in their reflection; they use reflection that ties theory and practice together. The process of reflection possesses an aesthetic aspect, which can provide teachers with one for the most

authentic and practical means of reflection and learning (Eisner, 1998). Aesthetics are integral to the process of perception and of imagination, and visual imagery plays a role in these processes.

Both perception and imagination hold real-world implications in the process of learning, which in turn stems from experiences (Dewey, 1938; Schlechty, 2002). Eisner (1998) states, "All experience is the product of both features of the world and the biography of the individual" (p. 34). With this framework, reflective thinking can be seen to hold the learners accountable while still enabling them to portray their experiences in a light that they feel will best represent them.

Forms of Reflection

Multiple methods of reflection are available to teachers, including journaling, conferencing, and videotaping. Organizations such as the National Board for Professional Teaching Standards (NBPTS) rely on the method of videotaped reflection in order for practitioners to review their own teaching methods' strengths and weaknesses so that they might make changes to improve their classroom practice. These videotaped teaching segments become a central artifact in their teaching portfolio. Videotaped reflection has been a method of reflective practice for teachers since the 1960's (Sherin & van ES, 2005). Videotaped reflection serves as a catalyst for effective assessment of teaching, particularly student teaching (Jensen, Shepston, Connor, and Killmer, 1994). Using video as a means of self-study allows teachers to reflect on a single situation numerous times. Additionally, Sherin and van Es (2005) point out, "Video can help teachers learn to notice, that is, to develop new ways of 'seeing' what is happening in their classrooms" (p. 476). This process helps teachers at all levels in the profession, from novice to veteran, to critically reflect on and improve their practice. Sherin and van ES also note the importance of video reflection because it acts as a "permanent" (emphasis added) record of teaching and allows teachers to develop new ways of seeing what happens in their classrooms.

Elements of Digital Storytelling

Photo albums and the telling of stories through pictures and/or photographs have been around for ages (Lambert, 2002). In an evolving technological age, the trend of storytelling is becoming digital. As the Institute for New Media Studies (2004) notes, "The digital frontier is a dynamic new space for storytelling but its potential has yet to be realized" (¶ 1). Digital stories present a way for teachers to draw upon their natural inclination to tell stories within the aesthetic framework of reflection. Digital reflections can also minimize the negative aspects of videotaped reflection that include cumbersome tapes and equipment as digital photographs do not require the same physical space.

A well-told digital story takes a series of still images and combines them with a narrated soundtrack in order to tell a story (Institute for New Media Studies, 2004; Kajder, Bull, & Albaugh, 2005). The storytelling itself must be kept at the forefront of the process; the story that the photos are telling must be the reason for the creation of the project (Kajder, Bull, & Albaugh 2005). The story and pictures must stir emotions and connect with life (Lambert, 2002). This does not mean that producers of digital stories must excessively utilize flashy transitions and loud music; in fact, according to Lambert, using spectacle diminishes the storytelling process. Spectacle includes, but is not limited to, the loud pulsating music and flashy transitions. Anything that covers up a weak presentation, which is devoid of meaning, turns it into a digital spectacle rather than a digital story.

Purpose of this Study

The purpose of this study was to examine how a group of preservice English teachers used digital stories to critically reflect on their journey to becoming classroom teachers. The researchers have dubbed this reflective process through digital storytelling as "Digi-Journeys." The research question guiding our inquiry was: How do pre-service teachers portray their growth in a clinical placement through the medium of digital storytelling?

Methodology

The participants for this study were eleven preservice English teachers enrolled in teaching methods coursework at a southeastern university. Of the eleven participants, ten were female and one was male. All participants were Caucasian with the exception of one African American female. For the purpose of this study, pseudonyms are used in data presentation. The methods block consists of four courses (secondary English methods, content area reading and literacy, clinical experiences, and testing and measurement). The clinical experience

component of the methods coursework requires that the preservice teachers complete ninety hours of contact/teaching time in an assigned area school as well as a culminating electronic portfolio demonstrating technology skills and classroom technology integration. One of the assignments in the electronic portfolio for all university methods students is to demonstrate knowledge and skill in using digital photography and video technologies. During previous semesters, students were required to take, label, and display a series of photographs from their clinical placement, a process resembling scrapbooking. Additionally the English professor's research on teaching her methods class had shown that the students began to find reflective journaling tiresome. Therefore, in an effort to make the digital photography component and the reflection component of the portfolio more meaningful for the preservice teachers in their developmental journey, the instructor chose to shift the digital photography assignment to a digital story as a method to foster reflective practice among her methods students.

The class was assigned the task of taking digital photographs (students also had the option of scanning photographs to create digital files) throughout their clinical placement. At the end of their clinical placement the students chose three to four photos from the first month of teaching, three to four photos from their second month of teaching, and three to four photos from the last month of teaching for a minimum total of ten photographs. Students then imported these photos into an accessible (and free Microsoft download) program called Photo Story 3. The students were asked to use the digital images and other elements of media, including text, music, and motion to reflect on their teaching journey over the semester. Using Photo Story to combine all these multimedia elements, the final product was produced and then saved as a Windows Media Player movie.

In giving this assignment to the students as part of their methods course, the instructor told them to take many photos over the three-month course of their placement but not to take them with the intention of telling any particular story. The idea was for the students to use the digital cameras to chronicle various aspects of their placement and then at the conclusion of it, as they sat down to synthesize what they had learned about becoming teachers, to see what story they could tell with their photos. From the inception of the assignment, the students knew they were ultimately looking for a story to emerge. The tactic of dividing the placement into three segments with a minimum photo requirement to represent each segment served as a means to provide structure for the students and a framework for thinking about their professional growth. It helped to prevent students from realizing that they had another assignment due and from simply taking photos on one or two days to fulfill that requirement; instead, they had to critically think about this assignment throughout their clinical placement.

Additional considerations included informing the preservice teachers about the policies of taking recognizable photographs in school settings and encouraging their compliance with all policies concerning taking photographs in a school setting. The preservice teachers were also informed of copyright laws and fair use policies to adhere to when creating their Photo Stories. While the use of this software program logically dubs the finished product a "photo story," the researchers dubbed the process of reflecting on teaching experiences and creating the ensuing digital photo story Digi-Journeys instead. The researchers wanted the preservice teachers to view their experience as more than a singular story but, rather, the first of many on their journey in becoming successful classroom teachers.

The researchers realized there was potential for discrepancy between what the preservice teachers intended to convey through their Digi-Journeys and what was actually conveyed. Therefore, the participants also wrote a statement describing their intention in creating their Digi-Journey. This provided a means for the researchers to cross-reference their perceptions of individuals' Digi-Journeys with the intention behind the creation of each one. However, the researchers did not read these statements until they had reviewed and analyzed the Digi-Journeys themselves.

Data Analysis

The researchers analyzed the Digi-Journeys in an effort to track the preservice teachers' growth over the course of the ninety-hour clinical placement. A rubric focusing on the categories of text selection, music and other audio selection, picture/image selection, and design was created. These four categories align with The Institute for Media Studies' (2004) elements of digital storytelling and were used to assess the preservice teachers' growth as classroom teachers based on the choices they made.

When analyzing the category of text selection, the researchers viewed the Digi-Journeys to see if they said something about each preservice teacher's growth rather than simply providing a description of occurrences or a description of the pictures themselves. In analyzing the category of text, the researchers also looked at the word choices the preservice teachers made. For example, were they using transition words to create a coherent story, or were they using descriptive phrases to describe individual pictures? In examining word choice, the researchers also

considered whether or not the preservice teachers utilized titles and subtitles in order to create a sense of story versus a sense of labeled photos.

The analysis of the category of music proved the most subjective. When analyzing this category, the researchers considered the way in which the music or audio selection enhanced or complemented the story. They also considered how the tempo of the music contributed to the pace of the story the participants were trying to tell.

When analyzing the category of picture/image selection, the researchers considered a variety of elements including the depiction of variety and of action in the classroom versus passive participation. The researchers also considered how the pictures were sequenced to show a shift in the preservice teachers' experiences in the classroom (i.e., from passive scenarios to active participation). In viewing the Digi-Journeys, they also considered whether or not the pictures were arranged in a sequence to convey a storyline. In analyzing all of these elements, the researchers were considering whether or not the pictures represented digital storytelling versus digital spectacle (Lambert, 2002).

When analyzing the category of design, the researchers considered if the Digi-Journeys conveyed a recognizable beginning, middle, and end as text-based stories do. Additional considerations focused on how various design elements, such as choices in font, music, color, and motion, either enhanced or detracted from the story. The broad consideration in this category was one of whether or not the story and the purpose were lost within the "bells and whistles."

The researchers viewed the Digi-Journeys multiple times, recording notes in each of the aforementioned categories and noting additional trends that emerged among the collective group. After recording notions for each category for individual Digi-Journeys, the researchers compared what they had viewed and analyzed with each preservice teachers' intention statement. The researchers also recorded notes from these statements as they paralleled or contradicted the analysis. After the researchers analyzed the individual Digi-Journeys, a table comparing the individuals' choices for each of the categories of analysis was created, allowing the researchers to note common trends and exceptionalities.

Results

Elements of Story to Create Sequence

Because the preservice teachers participating in the study are in the area of English, they have a strong awareness of the conventions of stories from their English coursework during their program preparation. As a result, many of the Digi-Journeys exhibited clear conventions of stories, a trend that emerged when the individual stories were analyzed as a collective group. For example, five participants used title frames and five participants used conclusion frames to indicate a beginning and/or end of the story. Of the five participants in each of those groups, only two used both a title and a conclusion frame. Two participants, Amy and Emily, used the word "story" in their title frames. Most of the participants who included a conclusion frame wrapped up their Digi-Journey with the statement, "The End." Two had creative conclusion frames that explicitly spoke to their growth as teachers. By directly speaking to their growth as teachers, these two participants demonstrated a high level of critical thinking in their reflection. Sarah actually used two conclusion frames with the first utilizing the traditional "The End" statement. Then she transitioned to another conclusion frame that said, "Or, the beginning!" Throughout their methods courses, the students are exposed to the metaphor of teaching as a journey, as set up by Christenbury (2000) in her book *Making the Journey: Being and Becoming a Teacher of English Language Arts*. Sarah's statement clearly embodies this metaphor and shows reflection on this concept and her place in the journey of becoming a teacher.

While elements of story do not directly relate to the reflective process in a traditional sense, for these preservice teachers they do tie the reflection of practice and growth into the content they teach. The inclusion of text to signify sequence of story also demonstrates the role of cueing the reader– an application of visual literacy on the part of the participants. Finally, it shows that the participants are considering how to best portray their growth to viewers as they apply traditional conventions of story to cue the reader and clearly portray themselves (Eisner, 1998).

Another element of story that participants implemented in their Digi-Journeys to create a sense of sequence was the use of transitional words and phrases. Four participants clearly used these, and each of these four participants proved successful in establishing a clear sequence of events. Six of the participants utilized complete sentences in creating their story. One participant, Megan, even implemented a variety of end-mark punctuation to convey her growing sense of excitement as she began to "catch on" and grow in her confidence as a teacher. For example, Megan began by stating early in her story, "Students are slow to ask for help." She then moves to

declaring, "Students are actually reading!" and "Student motivation is increasing!" This alludes that Megan was trying and experiencing success with strategies that actively involve students in the classroom learning environment.

Subjects of the Stories

Perhaps the most revealing element of the Digi-Journeys created by the preservice teachers was the focal subjects of the stories themselves. The preservice teachers had two choices on which they could focus the subject of their stories: themselves as the teacher or their students as learners.

Of the eleven participants, eight focused on both themselves and their students as subjects, while two focused solely on themselves and one focused only on students. Of the eight who focused on both themselves and the students, three had a clear shift in the focal subject as their placement progressed and they grew as teachers. For example, in early pictures, Megan showed herself in front of the class disseminating information, and in later pictures she showed herself circulating the room and interacting with students. The use of the images with the shift in focus clearly showed her starting her placement as the director of learning and shifting into a role where she was a facilitator of learning.

Sarah's Digi-Journey provided a contrasting example of how a participant used a shift in subject to illustrate growth through the selected photos. Sarah began by showing herself as subject focusing on teacher tasks, such as filing, grading, and planning lessons. She then shifted to show the students engaging in the activities she had created. Another participant, Julie, clearly saw herself as the facilitator of learning from the beginning. Her photos showed the students as the primary subjects and her, as the teacher, facilitating their learning.

Table 1 details how all of the participants utilized various elements or conventions of story in creating their Digi-Journey. When analyzing whether or not the participants depicted the teacher or the students as the subject, the numbers one and two were used to indicate which subject they focused on first, if there was a shift, as previously discussed.

Table 1

Analysis Matrix of Elements of Story

Participant	Title Slide	Conclusion Slide	Transition Words	Complete Sentences	Teacher as Subject	Student as Subject	Varied End-Mark Punctuation
Rebecca		X		X		X	
Amber		X	X	X	X1	X2	
Melissa			X		X	X	
Carrie	X	X		X	X	X	
Meredith				X	X		
Sarah		X			X1	X2	
Amy	X	X			X		X
Emily	X		X	X	X	X	
Megan	X			X	X1	X2	
Michael				X	X		
Julie	X		X		X	X	

Integration of Music

Interestingly, none of the participants implemented any music selections outside of those embedded in the Photo Story program. Because we emphasize issues of copyright and fair use, especially as it pertains to technology integration, we questioned whether or not this could be attributed to the participants' concerns about violations of copyright. However, despite using the embedded music choices, many of the participants did change selections at various points in their Digi-Journey to emphasize a shift in their view of themselves as teachers. For example, in her Digi-Journey, Amber told the story of how she began teaching, talking to the students, and receiving minimal

participation. As she shifted her role to that of a facilitator, she changed the music selection to one with a faster tempo, reflecting a new-found energy of her classroom.

Intention in Creation of the Digi-Journeys

The participants were asked to write a statement of their intention of what they were trying to convey in their Digi-Journey. The researchers then compared the statements to what they perceived to be the message in each story. After reviewing the Digi-Journeys and then comparing them to the statements of intention, eight of the eleven participants' intentions matched their Digi-Journey. One of the remaining three, Michael, wrote, "I was just really showing some different pictures. I am not really sure what I was trying to convey." His lack of focus in telling his story clearly parallels his minimal use of elements of story in Table 1 as compared to the other participants.

Upon viewing Meredith's Digi-Journey, the researchers felt that she had created a digital product to showcase her abilities as a teacher versus telling the story of her growth through her clinical placement. Meredith reported in her intention statement, "I was trying to show a variety of activities that students were engaged in during class time." The reason the researchers questioned the alignment of the statement with the Digi-Journey is that clearly it was not viewed as portraying her growth, but it was unknown if she perceived the "variety of activities" to show her growth from implementing one type of activity to another. This was the same type of question that arose with Amy, the third participant of whom the researchers were uncertain. The issue of intention versus product message presents a limitation of our inquiry.

Discussion

With the exception of two participants, Michael and Amy, the preservice teachers showed growth in reflecting on their clinical experiences; although, some showed it more explicitly than others. The group, as a whole, showed a shift from teacher-centered instruction to student-centered instruction. This was evidenced when the participants segued from highlighting themselves as the subject to focusing on students as the subject. Many of the participants, such as Sarah, also began by focusing on themselves struggling to learn the day-to-day tasks required of teachers (i.e., taking attendance and planning for instruction) before focusing on the students as the subject. This is consistent with research showing that as novice teachers evolve in their teaching confidence, their focus shifts from themselves to the students and the instructional environment (Sherin & van Es, 2005).

As indicated in the data analysis, the preservice teachers implemented many elements of story in their Digi-Journeys. In a methods course, this assignment could also be utilized in reviewing the conventions of stories with the preservice teachers, who often need a gloss review of subject matter content.

Wursta, Brown-DuPaul, and Segatti (2004) pointed out that best practices can be monitored with digital photography. Through the combined use of digital photography and reflective storytelling, the preservice teachers were able to pictorially review their experiences in their clinical placements. They could examine where they were struggling in classroom day-to-day management, where they were not involving students in instruction, and where they were serving in the role of the director. Preservice teachers often have not yet developed the skills to simultaneously facilitate class instruction and monitor students' nonverbal feedback. By seeing these aspects of their instructional practices in their digital photos, the preservice teachers were able to realize where their instruction was leaving students unmotivated, to ask questions about how they might better involve the students, and to change their instructional practices and move into the roles of facilitator versus director.

A real question that arises is one of how the preservice teachers will go about reflective practices when in the classroom and out of the university environment. When compared with video taping technologies, the use of digital photography could prove more efficient and accessible to classroom teachers wishing to implement digital stories for reflective practice (Burns & Koziol, 2006).

Conclusion

Digi-Journeys did prove an effective means of encouraging preservice teachers to reflect their growth during their clinical placements. They allowed the preservice teachers to do more than tell what is going on in their classrooms to the supervisors who cannot be there on a daily basis. As demonstrated in the data collection, there can emerge a disconnect between what the preservice teachers intend to convey in their stories and what the university supervisors perceive; therefore, additional methods of reflection such as journals can be incorporated into methods courses. University supervisors should implement a balance of reflective methods. Doing so will aid students in reflecting via multiple modalities and provide both students and university supervisors with a more robust perspective of preservice teachers' growth.

Based on student feedback, the preservice teachers did not find the practice of reflecting via digital storytelling to be as tedious as continuous journaling of experiences. Additionally, while the reflective focus in the methods courses used the medium of digital storytelling, the students were still required to write some reflections, albeit fewer than those enrolled in the methods courses in previous semesters. With the lowered requirement for written reflections combined with the Digi-Journeys, the preservice teachers complained less about using reflection methods than did their predecessors. Fewer student complaints alone do not serve as a basis for making pedagogical decisions, such as a reduction in the number of written reflections submitted; however, in conjunction with the level of critical reflection provided by the preservice teachers, it proves an added benefit for the teacher educators. The participants' feedback indicated that they enjoyed the process of chronicling their teaching through photography and reflecting on the photos to create their Digi-Journeys.

A method that many teacher educators utilize in their own instruction is modeling pedagogical approaches the preservice teachers might use in their own classrooms to promote critical literacy. Digi-Journeys not only allow preservice teachers a new mode to critically reflect on their practice and growth, but they allow a model for applying digital storytelling in their own instruction to push their students' development of technological, visual, and textual literacy. Digi-Journeys offers teacher educators a method for modeling the production of a critically literate product for preservice teachers while gathering necessary data to evaluate their growth and teaching them about reflective practice.

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Collaborative Learning in Educational Technology

Yu-Feng Wu
Department of Educational Technology
University of Northern Colorado

Abstract

The study researched the application of collaborative learning strategy in undergraduate classes of a preservice teacher training program. With the computer-based and multimedia enhanced lessons, students worked collaboratively to improve and re-design an ill-designed PowerPoint presentation. By focusing on the learning outcome and evaluating participants' performance on their assigned projects, the main purpose of this study was to observe and document the effect of the use of collaborative learning in the undergraduate classroom. The result of this study showed no significant difference on students' final grades between the non-collaborative learning and the collaborative groups. Findings also revealed that even no significance on the student performance, a higher percentage of students expressed a positive attitude toward the use of collaborative learning setting in their class. Recommendations for future researches and educational implication are also discussed.

Introduction

Just as Marc Prensky has recently raised the issue in "Digital natives, digital immigrants", the debate of strategies to teach the new generation shows the great consideration from educators nowadays. "Today's students are no longer the people our educational system was designed to teach" (Prensky, 2001). What strategy could we apply to educate the new generation? In this scenario, the best answer to the question would be that it depends on the instructional goals, the students, the contents, and the teachers. However, the next best answer may be "students teaching other students" (Mckeachie & Svinicki, 2006). "Students teaching other students" can be regarded as peer tutoring that is a type of collaborative learning, in which students tutor one another as they develop specific skills (Choudhury, 2002). Collaborative learning provides an alternative teaching and learning approach that students take proactive roles in thinking, questioning, and sharing knowledge (Luca & Clarkson, 2002). "There is wealth of evidence that peer learning and teaching is extremely effective for a wide range of goal, content, and students of different levels and personalities" (Johnson et al., 1981).

According to existing research, collaborative learning can be defined as "an activity that is undertaken by equal partners who work jointly on the same problem rather than on different components of the problem" (Brandon & Hollingshead, 1999). The approach of collaborative learning as an instructional strategy has been well documented not only in the interactions among instructors, students, and various groups, but also in the improvements in learning achievements and outcomes. The study by Johnson, Johnson & Smith (1991), as evidence, indicates that "collaborative learning promotes higher achievement, higher level reasoning, more frequent generation of ideas and solutions, and greater transfer of learning than individual or competitive learning strategies" (Johnson, Johnson, & Smith, 1991).

In addition, the perspective of zone of proximal development (ZPD) from Vygotsky (1978) and the social constructivism theory are also related to collaborative learning. The ZPD describes "the distance between the actual development level as determined through problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1978, p.86). According to Vygotsky, students are more capable to accomplish more difficult tasks when they have assistance from other individuals and work collaboratively. The concept of collaborative learning was constructed based upon students help each other through social interaction within ZPD. On the other hand, based upon the perspective of social constructivism, students seem more aware than their teacher of what other student's questions or problems and can give more precisely help that focus better on the misconceptions (Webb & Farivar, 1994). Further, social constructivists content that people often cooperate together to make better sense of and develop new knowledge about their world (Cheng, 2006). When working collaboratively with others, people acquire more effective learning strategies and solve problems more successfully (Gillies & Ashman, 2003).

In order to best fit the collaborative learning as teaching method in a computer-based learning environment, and further, based upon that recent studies have stressed the importance of projects-development learning in computer-based learning environments, this study combines the current trends to observe the relationship between projects-development and the strategy of collaborative learning for students. "Computer-mediated learning is

suitable for project-based learning because it provides ample resources, allowing students to do their own planning and present new forms of knowledge, which expands the mechanisms for collaboration and communication" (Laffey, Yupper, Musser, & Wedman, 1998). Questions to be asked in this study:

1. Do the students under collaborative learning environments perform significantly better than those who work individually?
2. Do students who work collaboratively have a positive attitude toward the small group setting?
3. Do apply collaborative learning in instructional technology education is an effective instructional strategy?

Methods

Participants

The participants in this study consisted of students from two sections of educational technology undergraduate classes including 38 students who are currently taking courses in the Spring 2007 semester.

Materials

Pre-Instruction

The pre-instruction was how to design a well-constructed and multimedia-integrated PowerPoint presentation. Students in these two classes received an approximately six-week lesson that follows a proper sequencing instruction on how to design PowerPoint presentation. The six-week lesson was lectured by the order of instructional steps that follows:

1. Instruction of basic skills of a PC.
2. Instruction of producing animations in PowerPoint.
3. Instruction of integration of video and sound in PowerPoint.
4. Instruction of characters of a well-designed PowerPoint presentation.

Ill-designed PowerPoint Presentation

After the pre-instruction regarding well-designed PowerPoint presentation, students were assigned an ill-designed PowerPoint presentation. Examples of characteristics of an ill-designed PowerPoint presentation: content is not at all related to any kind of classroom instruction; no web resources are documented or are not related to the presentation topic; less than five slides; no graphic objects; slides are cluttered with too many lines of text or many graphics; not using text and background formatting at all; not using transitions and animations at all.

Grading Rubrics

The grading rubric emphasized the following seven categories: content selection, resources used, number of slides, number of video object, number of graphic objects, slide design, text and background formatting, and transition and animations. Each of the categories had four levels of scores indicating: non-proficient (1 point), partially proficient (2 points), proficient (3 points) and advanced (4 points). The total points possible were 32 points.

Attitude Survey

The student attitude survey contains twelve five-choice Likert-type items and three open-ended items. Each item ranks from one to five that given by the participants also represents scores from five (strongly agree) to one (strongly disagree) that allow for estimating their corresponding attitude toward each item. Example questions were asked: I learned a lot in this small group setting; I would like to use this strategy for my future teaching. The second part was three open-ended questions regarding student perceptions toward collaborative learning and suggestions on how to improve the setting in which they had worked. The survey was only assigned to the class using a collaborative learning setting. The student attitude survey was re-designed based on an existing research (Sullivan, & Marinicak, 2002).

Procedure

There were 12 students and 26 students in the two classes. The class that had 12 students worked individually whereas the other class with 26 students worked collaboratively in 13 groups. After the instructor and students finish the whole pre-instruction of how to design a well-constructed, multimedia-integrated PowerPoint presentation, students were assigned an ill-designed presentation. Students needed to improve and modify the presentation based upon the pre-instruction. After students completed the project and returned to the instructor, a survey was given to students for indicating their attitudes toward the collaborative learning environment and their general attitudes toward this setting. Regarding the grading procedure, the post-productions were graded by the instructor and an additional guest grader.

Results

There are three sections of analysis the results of data. The first section is the statistical process that answered the research question one.

Research Question One:

Do the students under collaborative learning environments perform significantly better than those who work individually?

The statistical analysis indicated that no significance was found on the performance between the two groups of students who worked collaboratively and individually. The total means of the collaborative group and the non-collaborative group were 27.73 and 27.10, respectively. No significance was found, t (23) = -0.448, $p = 0.66$. Levene's test for equality of variances was not significant; suggesting that equal variance between the two groups was evaluated. Although no significant difference was found for the treatment effect on student performance, the total mean score was higher in the collaborative group compared to the non-collaborative group. Please see table one for the descriptive statistics for the non-collaborative and the collaborative groups.

Table 1 Descriptive Statistics for the Non-collaborative and the Collaborative Groups

Group	Total Mean	SD
Non-Collaborative Group	27.10	2.14
Collaborative Group	27.73	1.91

Note. Total points possible = 32

The second section discusses the result for research question two.

Research Question Two:

Do students who work collaboratively have a positive attitude toward the small group setting?

The student attitude survey was only applied to the collaborative group and with twenty completed survey returned. The average score of the twelve Likert-Scale questions then was calculated to indicate student attitude. With the calculated value higher than 3 indicates that students had a positive attitude toward the collaborative learning setting. The second section of data analysis had a result of M=3.74 indicates positive student attitude toward the setting. Please see table two for the descriptive statistic for student attitude survey.

Table 2 Descriptive Statistic for Student Attitude Survey

	Mean	SD
Attitude Survey	3.74	0.97

Note. Total point possible = 5

With the ranking of students' responses for each survey item, the highest three items were "I was actively involved during our teamwork in the small group setting"; "I can think of ways to apply what I learned in this small group setting to other situations"; "I worked collaboratively with my partner during our teamwork". The highest three items revealed the positive effects of engaging students in the small group educational setting. Also, it is encouraging to see the forth high item "I would like to apply this small group learning for my future teaching" reflected by the students who will be future teachers. Please see table 3 for the list of revised student attitude survey item.

Table 3 List of Revised Student Attitude Survey Item

Item	Average
4. I was actively involved during our teamwork in the small group setting.	4.55
10. I can think of ways to apply what I learned in this small group setting to other situations.	4.15
5. I worked collaboratively with my partner during our teamwork.	4.1
8. I would like to apply this small group learning for my future teaching.	4.05
9. I like this small group setting for learning.	3.85
12. What I learned in this small group setting is relevant to my future teaching.	3.8
6. There was enough opportunity to interact with my partner.	3.65
7. I would recommend this learning structure to other students.	3.55
11. What I learned in this small group setting is relevant to my learning.	3.55
2. I feel better to work with my partner in terms of project learning.	3.4
3. The small group setting was a good way for me to learn	3.4
1. I learned a lot in this small group setting.	3.2

The last section answered research question three and analyzed student attitude survey qualitatively.

Research Question Three:

Do apply collaborative learning in instructional technology education is an effective instructional strategy?
With the purpose of cutting into the right angle for picturing the theme of how students interacted with the collaborative learning setting, and then taking one more step for understanding how students perceived if collaborative learning was an effective pedagogy, the responses for open-ended questions of the student attitude survey were analyzed by two sections. The first section analyzed the first two open-end questions:
1. What did you like best about the small group setting for learning?
2. What did you like least about the small group setting for learning?
For question number one, words usage by the students to delineate how they liked best about the use of collaborative learning as instructional strategy can be categorized by two patterns. The most frequently used pattern was a "positive learning strategy" (65%) and followed by "positive learning efficiency" (22%). Please see table 4 for a list of word usage by the students.

Table 4 Keywords used by students to delineate how they liked best about the small group learning

	Learning Strategy (65%)	Learning Efficiency (22%)
Words Used	Collaborate idea	Easier
	One on one learning	Quickly
	Social learning	Efficient
	Communication	Free
	Peer teaching	Sharing work
	Sharing ideas	Own pace
	Explore learning	Online meeting

Opportunity to interact	Good partner
People think differently	

For question number two, 65% of the students indicated that they had a difficult time to schedule for meeting. Out of the comments of not being able to schedule for meeting, students also indicated that difficult to work together because "work not evenly" (10%), "different skill level" (10%), "pre-assigned topic" (10%), "different style of creativity" (5%), "different academic standard" (5%) , "prefer work alone" (5%) and "not enough computer" (5%). Conclude from the responses of question number two, the major reason that students liked least about the small group setting can be fixed by setting the work time during regular class meeting time.

The second section analyzed open-ended question number three.

3. Do you think the use of small group setting is an effective instructional strategy in technology education?

The second section encoded students Yes/No responses regarding the third open-ended question. 80% of the students indicated that collaborative learning is an effective instructional strategy. Quotes from some of the responses:

> I think it's the best way!!! ....When you are in a class, it's really embarrassing to ask questions to something that most people know. And……the instructor has 30 other students to tend to and answer questions to besides the person who doesn't know it. But, one on one is great because that solves all of those problems.
> I do think it is very effective….This gives the opportunity for someone to teach things and others to learn. Everyone has the opportunity to learn new things.
> I do think that small groups are a good thing because it allows the students to use peer teaching. I also think that it is good because it allows the students to go at their own paces and to accomplish the activities goals without putting a lot of stress on time.
> I think in technology education this is a great strategy.…. It also gives you a chance to interact with other classmates which I think is very important. You can learn just as much from them as you could a teacher, sometimes even more.
> Yes. I think that it is hard to remember so much technological information, and with the help of a partner you have someone to ask if you forget something. I also think that people think differently; some people are creative and artistic, and some people are computer-smart. Combined, these two types of talent can work to create the best possible outcome.

Discussion

The statistical analysis on research question one revealed no significant difference between the non-collaborative group and the collaborative group. Although the collaborative group did not have an statistical effect on student performance in the undergraduate educational technology courses, it is encouraging to find that the collaborative group students performed better on the total project score than the non-collaborative group.

To conclude, the collaborative group students performed a better achievement than the non-collaborative group students which also corresponds to an exiting body of knowledge that evaluated the effects of the use of collaborative learning strategy (e.g., Ochoa, 2005; Summer, 2006; William, 2004; Uribe & Sullivan, 2003). On the other side, 80% of the students recognized collaborative learning as an effective instructional strategy. The result also took one more step to demonstrate that in the 65% of the students who indicated difficulties during the process, 84.6% of them still hold a positive attitude and recognized the effectiveness of collaborative learning as an instructional strategy.

Even though a strong and sound literature review indicates the body of knowledge supports and concludes the positive effectiveness of using collaborative learning as an instructional strategy, the result of this study still did not reveal a significant difference on students' scores of final performance. The reasons could be concluded as follows: the consideration of the time effect for the collaborative setting; the appropriateness of the student project selection in the experimental setting.

The time factor seems to be the most frequent problem that might cause the non-significant result. It could be discussed by two parts. First, the course period did not have enough time for peer meeting. Most of the students in these educational technology courses also have jobs of teaching at the same time during the semester. According to the student, "I am struggling to get through this semester's student teaching. It is a huge time commitment and a lot of work". They reflected that to set up a meeting schedule for both of the group members during outside of class time was nearly impossible. These undergraduate courses only have fifty minutes every week and the experimental

period for this study had only lasted for six weeks, respectively. As the U.S. Department of Education (2001) contented, that regular and frequent working sessions result in greater gains.

Second, students need to spend more time for processing their projects. One of the student said, "more class time for group members to familiar with face to face work would be very helpful." According to the research by Uribe and Sullivan (2003), they showed that compared to non-collaborative group, participants in the collaborative group spent significant more time on completing the group project. It could be conjectured that more courses meeting time and more frequent schedule for students to spend more time on their project could expect a more significant outcome.

The generally high scores on student projects might result in difficulties to estimate student performance. We then can take one more step to consider that the appropriateness of the student project selection in the experimental setting. In most of the cases, in order to avoid generally high scores, the project could be a more complicated assignment that essentially required more skill. At this point of view, an only time-consuming but simple and easy project that used in this study might not be able to show a revealing significant difference between the treatment and the control group.

It is worthwhile to discuss that students mentioned in their feedbacks for the small group learning, students who were more knowledgeable in terms of software skills taught one another. Forman and Cazden (1985) reflected that peer tutoring requires a different level of knowledge between the tutor and the tutee so the more knowledgeable individual can tutor the less knowledgeable. Falchikov (2001a) also demonstrated peer tutoring can occur in the same class group setting and with similar expertise and developmental skills. Moreover, not only the less knowledgeable individual benefit from the collaborative learning process, the students acted as the role of tutors could even learn more than the less knowledgeable individual (Benware & Deci, 1984).

Implications for Further Research

Many universities develop educational technology courses in the past ten years, and mostly the courses were developed to improve teacher education and instructional design. However, the new emerging area still needs an effective pedagogy for both teaching and learning (e.g. instructor preparation and student learning.) According to Loverro (2006), the need for developing a pedagogy for educational technology is necessary and emergent. This study suggested the use of small group learning with a project-based instructional strategy.

This study had noticed that different project or task may have different effect on the student collaboration. Investigations that have similar setting but focus on computer-based and multi-task project collaboration could be more precise on depicting the effect of using collaborative learning as instructional strategy. Furthermore, another benefit could be found by the additional investigation is that by setting computer-based and multi-task collaboration experiment, it could be useful for researchers or instructional designers to understand what certain type of project is suitable for computer-based collaborative learning, and as well as in the educational technology class.

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How Do Instructional Designers Use Theory? A Qualitative-Developmental Study of the Integration of Theory and Technology

Stephen C. Yanchar, Joseph B. South, David D. Williams
Brigham Young University

Brent G. Wilson
University of Colorado—Denver

An array of theories and models regarding learning, instruction, and design have been developed within the academic setting to inform instructional design practices (e.g., Driscoll, 2000; Gagné, 1977; Gibbons, 2003; Glaser, 2000; Reigeluth, 1983, 1999; Snelbecker, 1974). Many have observed that such theories are centrally important to instructional scholarship and practice because they provide a means of helping scholars envision new possibilities for research and practice, generating researchable questions and testable hypotheses, organizing diverse concepts and observations into coherent accounts, developing taxonomies, describing and/or explaining phenomena, offering guidelines for effective practice, guiding the innovation and design of technology, and facilitating communication within and across discourse communities (Gibbons, 2003; Reigeluth, 1997; Seels, 1997; Snelbecker, 1974; Wilson, 1997).

It might be said more generally that there is no escaping theory in the process of disciplined inquiry and in the development of increasingly effective forms of practice. As a number of authors have observed, methods of scientific and technological research, as well as the everyday work of practitioners in a variety of fields, are given shape, meaning, and purpose by the theories and assumptions that undergird them. Although much of this work has focused on the theory-laden nature of scientific methods and research practices (e.g., Burgess-Limerick, Abernathy, & Limerick, 1994; Hesse, 1980; Yanchar & Williams, 2006), it has also been observed that technological research rests on assumptions and values about the nature of knowledge, human functioning, and progress (Vincenti, 1990), as do various practical applications (Bucciarelli, 1994; Schön, 1983; Slife, 1987).

Given the importance of theory to research and practice, it is not surprising that many authors within the instructional design literature have called for a more developed theoretical base within the field (e.g., Seels, 1997). More thought-provoking and more troubling, however, is the view that practicing designers often find formal theory to be irrelevant, too difficult and abstract to apply, or only occasionally useful. Even leading theorists in the field have observed that theory in general—notwithstanding its inescapability—is often not recognized as important by practitioners. For example, Wilson observed that there is a "generalized contempt for theories and scholarship" (1997, p. 24). And Reigeluth wondered why "many people avoid and denigrate theories" (1997, p. 42) when theories, in some form or another (e.g., formal theories, personal theories, a background of theoretical assumptions), are used ubiquitously.

Some have commented that academic researchers have not historically produced theories that are helpful to practicing designers. Rowland (1992) suggested that scholars in the field of instructional design "may be holding on to traditional views that no longer represent the requirements of practice" (p. 66) and that theories are often "impractical and unrealistic" (p. 67). Perez and Emery (1995, p. 62) concluded that much of what instructional designers need to know is "not currently reflected in theories of instruction." And Wedman and Tessmer (1993), who decried what the considered to be the inflexible nature of many instructional design models, argued that most of those models are based on a set of assumptions "which appear to be incompatible with practice" (p. 53).

To be sure, a few theoretical models or theory-based sets of principles have been put to use by practitioners (e.g., ISD, ADDIE, Gagne's instructional events model) with varying degrees of success (Zemke & Rossett, 2002), but as some have noted, practitioners tend to use these models inconsistently and selectively include certain principles or activities while omitting others viewed by the originating theorists as important (McDonald, 2006; Wedman & Tessmer, 1993; Zemke, 1985). In this sense, it appears that even instructional design models with some amount of utility must often be modified or adapted (even radically) by designers to

render them applicable in context. As Wilson stated, "It's no wonder ID theories aren't more used, because they tend to be static and abstract, not fitting the situations very well" (personal communication, November 2, 2006).

While there is clearly a sense of unease about theorizing per se and the use of theories in the field of instructional design, there is little published research on how practicing instructional designers actually view and use formal instructional design theories in their everyday work. Neither are there detailed analyses of the impact of implicit theoretical assumptions on design practices. Examinations of the actual practice of instructional design have typically focused on the ways that instructional designers spend their time (Cox & Osguthorpe, 2003; Kenny, Zhang, Schwier, & Campbell, 2005; Roberts, Jackson, Osborne, & Somers Vine, 1994), make decisions in the design process (Wedman & Tessmer, 1993; Zemke, 1985), and solve instructional design problems (Nelson, Magliaro, & Sherman, 1988)—often studying novice problem solving (Kerr, 1983) or comparing novices and expert problem solving strategies (Rowland, 1992). None of these studies provided an in-depth investigation of practitioner perceptions and use of formal design theories.

One study that comes closer to providing an examination of designer views and uses of theory was conducted by Christensen and Osguthorpe (2004), who, in a survey of practicing designers, found that certain well-known theories or models (e.g., Gagne's instructional events model, Merrill's component display theory, and Keller's ARCS model) were more widely endorsed than others (e.g., layers of necessity, cognitive apprenticeship, constructivism). But the Christensen and Osguthorpe study did not investigate issues such as the experience of designers attempting to use theory, the disposition of designers toward formal theories of learning and instruction, the manner in which designers use various theories for certain tasks, the basis for using certain theories or models in certain ways, and assumptions about academic theorizing. Thus, a detailed and contextualized understanding of practitioner views and uses of theories—formal or implicit—is still not available in the literature.

Research into instructional designers' experiences with, and uses of, theory can aid the discipline not only by describing how designers apply theories or struggle with those applications, but also by identifying potential problems with formalized theories of learning, instruction, and evaluation—that is, problems with the very manner in which formal theories are constructed and disseminated. More specifically, the understanding that would ensue from such research can lead to better understandings of professional practice, facilitate the application of formal theories of learning and instruction, provide a deeper understanding of the limits and shortcomings of formal theories, foster the development of more applicable theory, clarify the role of implicit theoretical assumptions, and inform the training of instructional designers.

We attempted to help fill this gap in the research literature by exploring how instructional designers actually view and use theories of all sorts in their work. Our theoretical frame of reference on this project is most closely related to that of practice theory (e.g., Schatzki, 1996, 2000) and the general hermeneutic-phenomenological tradition as developed in the human sciences (e.g., Colazzai, 1978; Giorgi, 1975; Giorgi & Giorgi, 2003; van Manen, 1990; Packer & Addison, 1989; Westerman, 2006). Research in this tradition aims to provide thick descriptions of human activity in context and generate rich understandings of peoples' experiences in a variety of real-world practices. From this theoretical standpoint, our study had the following four aims:
1. To provide general insight into the lived experience of instructional designers.
2. To provide insight into practitioner views of, and assumptions about, formal theory (its nature, purposes, value, limitations, weaknesses, need for improvement, etc.).
3. To provide insight into practitioner applications of formal theory (how it tends to be used, how central or peripheral it is to instructional design in general, how helpful or unhelpful it is for specific applications, etc.).
4. To provide insight into the relationship between theory and technology (how they might limit or facilitate the use of one another in various ways).

Although our study is still in progress, this report reflects our methodological framework, our specific inquiry strategy, and our tentative results based on most of the data that we planned to collect. Future steps involve interviewing two (or possibly three) more designers, ensuring trustworthiness (e.g., member checking, peer debriefing, etc.), and further data analysis.

Method

General Inquiry Overview

We employed a qualitative inquiry strategy—informed by phenomenological (Colazzai, 1978; Giorgi, 1975; Giorgi & Giorgi, 2003) and ethnographic (Spradley, 1979) research traditions—that emphasized semi-structured interviews and examinations of design artifacts (actual online courses, learning modules, etc., created

by the designers we interviewed). Given our methodological framework, we did not assume that our results would be objective reflections or mappings of participants' inner experiences or overt behaviors, but rather interpretive and negotiated accounts, based partly on participants' involvement in the study (their answers to questions, their work artifacts) and partly on our involvement (our assumptions, framing of the study, actual questions, ways of engaging participants in dialogue, data analyses, etc.). In this regard, our results and conclusions constitute a type of shared understanding between researchers and participants. Given our methodological framework, we have sought to identify evocative themes and generate insights regarding our topic of inquiry, rather than map an independent reality (fact gathering) or produce lawful (or statistical) generalizations as in positivist-oriented research. Inquiry of this sort we conducted strives toward "perspicacity" (Stewart, 1998, p. 47) or "transferability" (Lincoln & Guba, 1985, p. 124); that is, the formulation of contextual interpretations that may be insightful to others working in other contexts, without assuming that those interpretations are generalizable in a lawful sense (proven by the originating researcher).

Participants

We attempted to represent some of the diversity of the field, including designers who are involved in high-volume production, custom design work, university design work; highly technical training, and corporate ("soft-skills") training. The study to this point has included four participants, two females and two males. One participant worked in a high-volume design organization, two worked in a custom design organization, and one worked in a university instructional design shop. All participants had advanced degrees in instructional design.

Interview Procedure

For each participant, we conducted three semi-structured interviews. The interviews were always conducted on separate days. The duration of the interviews varied considerably; some lasted about a half hour, others lasted over an hour. Generally speaking, interview length varied according to participants' willingness to speak in-depth about their work and the manner in which they use various conceptual tools such as theories, models, and design principles to facilitate their problem solving and decision making.

In the first interview (for each participant) we queried into participants' training, everyday work experiences, and practical involvement in the design process. We asked questions such as: "Why did you enter the field?" "How did you become trained as a designer?" "How long have you been doing instructional design and in what settings? "Tell me about a recent project you worked on. Describe the experience from beginning to end. Please help me understand why you did it that way." The purpose of this interview was to gain a general understanding of the designer's lived work experience and a sense of the context in which they work.

In the second interview we asked specific questions about the participants' uses and views of conceptual tools such as theories, models, and principles. We invited participants to discuss a specific project in this regard, by making the following request: "Tell me about this course, including why it was made, audience, other stakeholders, situational constraints, etc. How indicative is this of your work as a designer?" We then tried to connect this project with the participant's practical involvement with theory, by asking questions such as: "Tell me why you designed the course this way. What procedures, processes, strategies, theories, principles, etc. did you use? Why this combination of features? What guided your decision making?" Where possible, we tried to see how participants applied a given theory or principle by asking them to show us evidence by examining the artifact(s) with the participant. To further investigate participants' views and uses of theory, we asked questions such as, "What do you think of theory in general?" "What guides the selection of theories for certain tasks?" "Could formal theory be improved in some way?" "Does technology ever constrain how you design or use theory?" "Could your training with theory have been more helpful?"

In the third interview we followed up on unresolved issues and queried into interesting themes that emerged in the prior two interviews. We also gave participants an opportunity to make comments about the prior interviews, add anything else they wanted to, and respond to some of the themes that we had tentatively identified in the prior interviews (across all participants). Our aim in the third interview was to ensure that we had obtained a rich description of participants' work experience and views.

Data Analysis Procedure

As in many qualitative studies, our data analysis procedures (drawn from hermeneutic-phenomenological and ethnographic research methods; Giorgi, 1975; Giorgi & Giorgi, 2003; Packer & Addison, 1989; Spradley,

1979; van Manen, 1990) principally involved the identification of themes present in the responses provided by participants. We primarily employed the ethnographic data analysis approach outlined by Spradley (1979), supplemented where necessary by techniques drawn from Giorgi (1975) and van Manen (1990). Spradley's approach entails the iterative thematization of participant experiences through "domain," "taxonomic," "componential," and "theme" analyses. These analyses produce a progressively refined view of the participants' experiences, as (a) general concerns and issues are identified and analyzed (domain); (b) meaningful patterns and hierarchies of concepts associated with those concerns and issues are formulated (taxonomic); (c) patterns and concepts are compared and contrasted (componential); and (d) general themes are identified, based on the other three levels of analysis (theme). Throughout the data collection and data analysis procedures we sought to produce trustworthy (i.e., "valid") results by utilizing well-accepted qualitative procedures designed to ensure that data are treated as fairly as possible. These procedures include techniques such as prolonged engagement, persistent observation, triangulation, peer debriefing, negative case analysis, and maintaining an audit trail (see Lincoln & Guba, 1985, for more on trustworthiness in qualitative research). As we finalize our data, we also plan to engage in additional member checks and progressive subjectivity checks as well as a transferability and dependability audit.

Results

Preliminary findings tend to cluster around four themes: practitioners' reflections on their training in formal theory, the role of formal theory in practice, practical considerations that impact the extent of formal theory use, and some common aspects of formal theory that tend to limit its application. Each theme is briefly discussed below. Participants had little to say about the interplay between technology and theory in their work, so we do not discuss that issue in this report.

Theory Training

All participants agreed that their training in formal theory was valuable. At a fundamental level, it provided them entry into the field of instructional design as a professional and, now that they are in the field, credibility when working with clients. All agreed that their training offered them useful frameworks with which to think about their work and helpful approaches to use when designing instruction. However, there was a general sense among participants that their theoretical training had lacked sufficient practical application of theoretical knowledge. They felt that the theories written by the theorists lacked sufficient practical examples of their applications, that the professors teaching the theories did not fill in these gaps sufficiently, and, most of all, that they, as students, did not have enough experiences applying theory with real world clients on real world projects while still under the guidance of their professors. These deficiencies in their training, they felt, made it difficult to transition to professional work and, one suggested, is one of the reasons that theory is not applied as much as it might otherwise be. She said that some of her classmates had failed to thrive as practitioners because they simply couldn't understand how to apply what they had learned effectively to their day-to-day work.

Role of Theory in Practice

These practitioners reported that, to produce good instructional products, a given instructional designer needed a combination of innate talent, practical experience in the field, the ability to apply formal theory to their work, and other key skills (skills such as writing, editing, communication, message design, multimedia design, project management, etc.). While listing the application of theory among the factors for success, most practitioners also told us that they really only reference formal theory when defending a design decision that they had already made to someone questioning their approach. Most of the time, they said that they rely on "*informed intuition*" to make design decisions. That is, when considering a design decision, they tended to do what they feel would be best for the situation, trusting that their instinct appropriately reflects their theoretical training and experience. When faced with a particularly perplexing problem, these practitioners primarily referenced peers or mentors for help. Two of them also consulted non-scholarly articles from trade magazines and websites, or book chapters summarizing research findings. One actually referenced books or articles written by theorists, but did this only rarely.

Practical Considerations

The extent of the use of theory is impacted by the practical values within the culture of the workplace. The main pressure these instructional design practitioners experience is making the client happy. This usually requires delivering a reasonably competent product on time and on budget. Generally, clients fund little or no formal evaluation of learning outcomes and may or may not share any internal assessment data they collect afterwards with the designers. Few clients will fund the development of learner assessment beyond fairly simple practice and recall activities embedded in the instruction. And not every client even measures whether the end user is satisfied with the product. Clients tend to want measures that confirm that a learner has been through the content, not whether or not the learner has mastered the content.

The practitioners we interviewed, however, felt a strong personal and professional obligation to advocate for features and approaches that, in the designers' view, would most benefit the learners' ability to understand and apply the content; and the instructional designers would actively try to influence business decisions to accomplish this goal, with varying degrees of success. Unfortunately, their direct contact with the learners and ability to conduct relevant needs analyses was almost always limited or non-existent (there were a few notable exceptions). Generally, the client represented the learners' needs, abilities, and disposition to the instructional designers. This lack of contact, then, limited the instructional designers' ability to really know if their design approach was going to be successful until after the fact, and only then if data was collected on satisfaction and/or outcomes. In some exceptions, a pilot of the materials would be used early on to assess learner reactions. This always led to what the designers considered to be significant design improvements.

Under these kinds of working conditions, instructional designers have little incentive to consider the theoretical soundness of their work and none of them listed theoretical soundness as an indicator of success. Most designers felt that if they had managed go beyond the minimal requirement of making the client happy to actually making the client's learners happy with their learning experience, then they had achieved all that could really be expected of them. The actual measurement of high-fidelity, higher order learning outcomes and whether these translated into performance improvement was usually beyond the scope of their work and influence.

Limitations of Theory

From these practitioners' perspective, even when they would like to apply theory, theories tend to be too abstract to apply easily to their work. Practitioners feel that they personally bear the full burden of translating it from the academy to the workplace, and are not always able to make the necessary connections. Second, most felt that a given theory tends to have a narrower range of application than the theorist might suggest, and consequently were reluctant to fully buy in to the theorists' claims. All of the interviewed practitioners saw themselves as *eclectic* in their practice, drawing upon useful ideas from theoretical works they had encountered in their training as needed, with no particular allegiance to a given theorist or approach. If something seemed like it would work in a given situation, it was used; if the situation changed, so might their theoretical approach. Additionally, practitioners felt that theories lacked awareness of, flexibility toward, and strategies to address common workplace constraints such as those of limited time, limited budget, limited access to learners, limited opportunity to iterate designs before delivery or revise after delivery, lack of control over the kinds of assessments administered to learners, etc.

Discussion

Our preliminary analysis does not allow us to draw final conclusions; however, trends in the data point to some potential insights for understanding practitioners' daily practice and their use of theory. While expecting some constraints in everyday practice, we were surprised at the very sparse attention given to theory by our respondents. Strongly associated with initial training, respondents gave little indication of attempts to keep up with theoretical changes in the field, or follow theoretical discussion in the literature. Rather, theory was a fairly static entity – something taught in graduate school, which only partly fit the realities of everyday practice. Participants might reference theory when challenged on a decision or practice. We also were intrigued to see how theory was sometimes personified in the form of a professor or mentor seen as embodying a particular theoretical stance. Such a mentor might be consulted on an intractable problem, and in this way theory would continue to inform practice.

We offer a few suggestions for responding to these early findings. First, it may be helpful to practitioners if theoretical training incorporated *more practical examples of theory* use as well as provided *more opportunities for students to work in real work settings*, applying theory with the help of professors and mentors. Second, *we need to better understand the "informed intuition"* that appears to guide instructional decision-making in practice to better identify the key influences behind these processes that govern real world design and how theoretical training and expertise influences those processes. Third, theories may be more useful to practitioners if the theorist provided *more practical examples if its use and addressed how best to adjust the application of the theory to typical real world constraints*. Finally, current practical values in the work environments for many instructional designers limit their ability to fully understand the needs of learners at the beginning of a project, and similar factors prevent the collection and use of rich learning outcome data at the end of the project. Advocates of professional practice may want to determine *how best to influence the work culture of instructional design* to encourage better grounding in learner needs and outcomes. This grounding seems to be a core value of the instructional-design profession, and could more clearly differentiate a professional standard from practices commonly observed in the field.

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