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This is my first editorial of IRRODL as one of the two co-editors with Dianne Conrad. As she did previously, I would like to take this opportunity to thank Terry Anderson for all the work he has done in building IRRODL into a world class scholarly journal, a leader in our field. And neither of us could manage this feat without the professional assistance of Brigette McConkey, IRRODL's managing editor.

The articles in this issue of IRRODL have been grouped into two sections. The first provides us with research findings of interest to educational administrators and consists of articles on capacity building and leadership as well as more technical research on computer security and modeling. The second section is concerned with teaching and learning and consists of articles on training and teaching methods followed by research studies related to interactivity and social media.

Capacity building/leadership

Administration

Capacity building includes the development of leadership skills focusing on overcoming the obstacles preventing institutions from achieving their goals. Rubin and Fernandez introduce this section with an article stressing the importance of teacher as leader, arguing that teacher presence can have positive effects on student cognitive and social presence in class groups. The Babu et al. case study describes an elearning program on gender, crisis prevention, and recovery that could help reduce the brain drain in developing countries. The Sáez López article analyzing the concepts, attitudes, and practices of students in Spanish universities describes an experiment that demonstrates the need for training students in online searching. Shaw and Kennepohl report on a survey of senior undergraduate students and their instructors taking on research projects. Their results demonstrate that students became more interested in research; and teachers attested to the development of student cognitive abilities and their independent thinking skills. Abu-Al-Aish and Love propose a model to determine factors influencing the acceptance of mobile learning, finding that expectancies, lectures, service quality, and innovativeness were all significant factors affecting behavioural intention to use mobile learning.

Computer security and modeling

Online learning administrators need to be more aware of issues surrounding computer security and computer modeling. In their paper, Chen and He use blog mining as well as a traditional literature search to determine the awareness of security risks in online environments, noting that security is not considered to be a top priority. On the other hand, Amigud conducted a survey of five distance education programs on their learner authentication strategies, confirming that at least in this one problem area, secure identification is possible at a distance. The Yildiz et al. paper describes a fuzzy model program designed to accurately predict students' performance, concluding that the most accurate results came from the model that was based on experts' opinions.

Teaching and Interactivity

Teaching

Using a qualitative meta-ethnographic approach, Mbati explored student experiences using social media, finding that online discussion forums are ideal for the stimulation of learning in elearning programs. Shattuck and Anderson explored whether a training course had any impact on teaching practice. They recommend design principles for instructor training. Mavroudi and Hadzilacos adopted a learning needs approach to study the design of courses for elearning. They combined learner, context, and needs analyses into a coherent framework for replication.

Interactivity

Inter-personal interaction has been identified by many researchers as an important learning variable that can be supported online using social media. Castaño-Muñoz et al. studied thousands of students in three universities and the results have implications for determining the optimum level of interaction when designing courses. The contentious issue of peer feedback is examined by Ching and Hsu in their investigation of graduate students. Their research concluded that learners were generally supportive of their peers' work and helped advance their thinking. The importance of caring is the subject of the Velasquez et al. paper. In their phenomenological analysis, they argue that technology choices are integral to creating caring environments in an online setting.

I would like to end this editorial with a sincere thank you to all the researchers, reviewers, sponsors, and others who make IRRODL what it is. And let's not forget our +5000 subscribers and other readers. As the year 2013 comes to an end, I would request reviewers to update your interests and authors, who have not already done so, to volunteer yourselves as reviewers using our online application. We try to keep reviewers to one review per year and not more than two. So, happy new year to everyone and all the best in 2014.

Athabasca University

THE INTERNATIONAL REVIEW OF RESEARCH IN OPEN AND DISTANCE LEARNING

The Teacher as Leader: Effect of Teaching Behaviors on Class Community and Agreement

 

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Abstract

This article examines the effects of teaching behaviors in online university classes, focusing on the agreement among class members. Literature on group leaders' effects on group agreement about workplace climate is reviewed. Hypotheses are generated about the effects that teachers of online courses, as class leaders, have on both the level and agreement about the community of inquiry. They are tested with a sample of 874 students in 126 online courses. The aggregate class level and strength of agreement about the teaching presence have significant effects on the level and agreement about cognitive presence and social presence. Although the aggregate levels and agreement about community of inquiry are related, different patterns emerge.

The paper explores the interaction effects of level and agreement, finding that in classes with high levels of teaching presence, the higher the agreement about teaching presence, the higher the agreement about cognitive and social presence especially for classes reporting stronger levels of cognitive and social presence. In classes with lower levels of teaching presence, agreement has a different effect.

Keywords: Community of inquiry; online learning; class agreement; aggregate perceptions; class leadership; social presence; teaching presence; cognitive presence

Introduction

Teachers of online classes lead classes to create a community of inquiry (CoI) wherein participants interact to jointly construct knowledge (Anderson, Rourke, Garrison, & Archer, 2001; Garrison, Anderson, & Archer, 2000, 2010a). One unexplored element in this process is the strength of agreement among students in the class, and the effect that *communally* held perceptions of teaching presence have on social and cognitive presence; this study addresses that gap, holding that both the levels of teaching, social, and cognitive presence and the extent to which students agree or disagree about these levels are important aspects of the learning environment.

Literature Review

The CoI framework views online classes as socially constructed virtual communities that consist of three major elements: teaching presence, social presence, and cognitive presence (Garrison et al., 2000; Rourke, Anderson, Garrison, & Archer, 1999). Teaching presence refers to instructors' support for the class and learning through designing course materials and learning activities, guiding discussion, administering the course, and providing feedback (Anderson et al., 2001; Arbaugh, 2007; Garrison & Cleveland-Innes, 2005). Social presence involves the development of emotional connections, trusting relationships, and identification among members of the online class (Richardson & Swan, 2003; Swan & Shih, 2005), while cognitive presence is the extent to which students construct meaning that is transferable to new situations, involving the learning activities of practical inquiry: facing a triggering event, exploring concepts, integrating and evaluating possibilities, and attaining resolution (Kanuka & Garrison, 2004). The teacher's design of the work done in a class, and leadership of students through the learning process, parallel the processes used by group leaders to support both collegial interaction and individual performance in work organizations (Luke, 1997; Pounder, 2008). Both leaders and teachers set and reinforce group climate, set expectations, assess work, and provide support and feedback (Gillespie & Parry, 2009; Shea, Li, Swan, & Pickett, 2005). While there are certainly differences between teaching a class and leading a work group, including the time frame and the significance of rewards, there are many similarities.

Leaders and Agreement Among Group Members

When leaders are more effective in guiding and supporting group members, they can create stronger agreement among the group members in their perceptions of the climate (Bliese & Halverson, 1998; Feinberg, Ostroff, & Burke, 2005). The dispersion or agreement about climate perceptions held by organizational group members have similar effects to the dispersion or agreement among university class members; for example, the effects of the amount and the agreement about satisfaction among members of a class team on absenteeism are similar to the effects of satisfaction with a work group (Dineen, Noe, Shaw, Duffy, & Wiethoff, 2007). Therefore, findings on the effects of leadership on group agreement and outcomes may be applicable to the effects of teaching on student agreement and outcomes.

The behavior of group leaders affects both the nature and the agreement among group members about the work, and these shared views frame members' understanding of the work environment and predict their actions in many ways (Dragoni, 2005; Feinberg et al., 2005; Schneider & Reichers, 1983). For example the behavior of group leaders strongly affects the group members' shared perceptions of appropriate behavior about safety, which predict accident rates (Zohar & Luria, 2005, 2010). Both the average level and the agreement about group leaders' emphasis on high quality service predict customers' perceptions of the quality of service provided (Schneider, Salvaggio, & Subirats, 2002). The strength of group consensus on leadership and peer relations predicts psychological well-being of group members (Bliese & Halverson, 1998).

Employees who have closer relationships with their leaders, characterized by better communication and more trust, report a more positive work climate, including factors such as the clarity and structuring of work, ability to make decisions, teamwork and intergroup cooperation, and support from management (Ford & Seers, 2006). Such employees also have higher levels of agreement with one another, and more agreement with their leaders' perceptions about the workplace (Kozlowski & Doherty, 1989).

Leaders who are transformational, developing trusting and open relationships with their employees, create both more positive group climates and greater agreement among group members about the climate (Cole & Bedeian, 2007; Feinberg et al., 2005; Zohar & Luria, 2010). Key transformational leadership behaviors that produce a shared and positive climate include behaviors that parallel teaching presence, including communicating group goals (Cole, Bedeian, & Bruch, 2011a; Schneider, White, & Paul, 1998; Zohar & Luria, 2005) and providing information (González-Romá, Peiró, & Tordera, 2002).

Similarly, instructors lead classes using different approaches, some more transactional and some more transformational (Pounder, 2008). Students interact both for social purposes and to complete their tasks. The interaction and trust among class members are reflected in the CoI concept of social presence, while the relationship, active guidance, and support from the teacher in the online learning experience are reflected in teaching presence.

Class Community: Class Level Versus Agreement

The CoI reflects interaction among online class members, which influences the individual learning experience (Shea et al., 2010). As such, it can be measured by examining the aggregated descriptions of class members. Prior research has aggregated student perceptions of traditional classroom environments, conditioned on empirical evidence that class members share common views of the teacher or class environment, and that perceptions distinguish classes from one another (Lüdtke, Trautwein, Kunter,

& Baumert, 2006). Aggregated student perceptions have been viewed as highly valid measures of teacher behavior and the class environment (Kunter, Baumert, & Köller, 2007).

However, few studies have considered the effect of agreement among students in online classes. The aggregated class level and agreement, although often related, reflect very different phenomena, and very different patterns can emerge in students' descriptions of their classes. For example, if the average class rating on teacher presence is a three on a scale of one to five, it might be concluded that the teacher had an average level of teaching presence. However, this would only be the case if there is agreement within the group, which would produce very low standard deviations. Alternatively, there might be some students who view the teaching behaviors as excellent and others who do not; the most extreme differences of opinion would produce strongly bimodal distributions, and a very high standard deviation. Table 1 illustrates some possible distributions that produce an average score of 4.0, along with the corresponding standard deviations. Each distribution indicates a different strength of community in the class.

Table 1

Different Group Distributions that Produce a Mean Score of 4.0

Group	1	2	3	4	5	Mean	SD
1	0%	0%	0%	100%	0%	4	0.00
2	0%	0%	50%	0%	50%	4	1.05
3	0%	0%	20%	60%	20%	4	0.67
4	0%	0%	30%	40%	30%	4	0.82
5	0%	20%	0%	40%	40%	4	1.15
6	20%	0%	0%	20%	60%	4	1.63
7	10%	20%	0%	0%	70%	4	1.63

Clearly the optimal course reflects both a high average score *and* strong agreement; in such a case, a strong community has been developed and the class agrees that it is positive. It must be noted that, because of restriction of range, the level and agreement of group-level variables are likely to be correlated toward the extremes. In order to have an average score of either a five or a one on a five-point scale, there must be complete agreement, while aggregated scores toward the center of a scale may reflect higher or lower degrees of agreement (Cole, Bedeian, Hirschfeld, & Vogel, 2011b; Lindell & Brandt, 2000). Therefore the interaction between the agreement and average level of presence should be considered when examining the community in online courses. Research on organizational climate has often found such interaction effects (Lindell &

Brandt, 2000), particularly when examining the group level and agreement about the leader's behavior affecting group outcomes (Cole et al., 2011a; Zohar & Luria, 2010).

Agreement about the learning environment in online courses is fundamentally different from levels. Traditionally, research on online courses considers only the level of the learning community – the individual scores that students report on the measures of teaching, social, and cognitive presence. The agreement among class members, or the strength of the community, has not been extensively examined, and is likely to have more complex relationships with various aspects of the learning environment. High agreement does not imply high levels, as class members may agree about low levels of a variable. To understand the nature of the learning community in an online class, both the aggregate levels and the agreement at any given level should be considered.

The Effect of Teaching Presence Levels and Agreement on Community

When teachers design application-oriented learning activities, clearly describe their expectations, guide students through exploring differences of opinion, focus the class and provide helpful feedback, students develop deeper learning and can integrate ideas, solve problems, and apply concepts in the future (Akyol & Garrison, 2011; Bangert, 2008; Shea et al., 2005). This careful design of courses and engaged, student-focused teaching creates more clarity about learning activities, and supports active discourse and critical analysis that create higher levels of cognitive presence. It has already been established that individual perceptions of teaching presence predict individual perceptions of cognitive presence (Garrison, Cleveland-Innes, & Fung, 2010b; Joo, Lim, & Kim, 2011; Shea & Bidjerano, 2009a, 2009b). This study extends this research to the class level, proposing that the aggregate, shared perceptions of teaching presence levels, and agreement about them, create aggregate perceptions of cognitive presence.

Student-oriented teaching that involves clear specification of tasks, encouragement, feedback, guidance, and communication is parallel to transformational leadership. In online courses, teaching behaviors include activities such as providing specific assignments, posting regular announcements, actively guiding discussion, and providing public and private feedback. Active teachers probe for deeper understanding, contrast student perceptions to uncover complexities, and guide students to engage with one another to consider alternative perspectives and applications (Bangert, 2008). This will draw students into higher levels of integration and more application of concepts, producing higher levels of cognitive presence for the class as a whole. Most of these behaviors are public, and students share perceptions through comments in online discussions about instructor behavior and course design. Higher levels of teaching presence and greater agreement among class members about the teaching behaviors are likely to lead to higher levels of cognitive presence.

Hypothesis 1: The higher the aggregate level of teaching presence and agreement among students in an online class, the higher the aggregate level of cognitive presence.

Teachers can design courses to support student interaction through discussions, group assignments, and other learning activities. They can set requirements for discussion responses or integrate task and social activities, and create areas for informal interactions (Ke, 2010; Rovai, 2007; Swan, 2004). Teachers can also actively facilitate courses to support student interaction by posting comments and questions that encourage students to communicate and by grading students based on their engagement with others (Rovai, 2007; Shea et al., 2005). They can model open communication and self-disclosure, and reward students for building a connected community.

Teaching that is based on open relationships, clarity, and communication, like transformational leadership, should strengthen the relationships among the members of an online class. This should create a stronger learning community, with high aggregate class levels of social presence and agreement about those levels, which reflect trust, openness, and identification with the class. The causal impact of teaching presence on social presence has already been empirically supported for individual perceptions (Garrison et al., 2010b; Shea & Bidjerano, 2009b), both in terms of designing courses to support discussion (Akyol & Garrison, 2011; Ke, 2010) and directed facilitation and instruction (Joo et al., 2011; Kim, Kwon, & Cho, 2011). The aggregate levels of teaching presence for a class, and agreement among students, should be associated with high levels of social presence.

Hypothesis 2: The higher the aggregate level of teaching presence and agreement among students in an online class, the higher the aggregate level of social presence.

Active, engaged, and open class leadership and the resulting closer relationships should lead to more interaction among class members with their instructor, as well as with one another and the course content. This should produce both more positive and more closely shared views among class members about the teacher's behavior. When classes encourage students to engage in deep learning, both the aggregate level of teaching and the agreement among students about those behaviors should predict stronger agreement among students about cognitive presence. The strength of the learning community, reflected in the agreement among students, would independently reinforce all its elements including communal critique and understanding; in these engaged classes, agreement about teaching presence begets agreement about cognitive presence.

However, this would only occur when a strong community of inquiry exists. Faculty may structure the class well, administer it effectively, and respond to students without guiding deep understanding, critical inquiry, and application (Richardson & Ice, 2010); they can engage in many teaching behaviors but not support higher levels of cognitive presence (Rourke & Kanuka, 2007). As a result, some students may individually wrestle with concepts, integrate and apply information, but they would not do this work together, creating lower levels of agreement about cognitive presence. In addition, teachers may support critical analysis and application for some students more than others through private feedback. On the other hand, some students may choose to not participate in course activities. Both differentiated teaching support and student variation in engagement would produce less agreement about cognitive presence.

Hypothesis 3: The higher the aggregate level of teaching presence and agreement among students in an online class at a given level, the higher the agreement about cognitive presence.

Similar phenomena can occur for social presence. In some classes, the students are closely connected; they collaborate, share ideas, trust one another, and identify with the class. Typically, such active and supportive learning communities are created by teachers who design effective learning activities, guide discussion, and encourage discourse and exploration. While there are certainly individual differences among students, teachers who engage in many active teaching behaviors and treat students fairly should create a stronger virtual community, wherein students are more likely to communicate their perceptions and reactions, develop trust and cohesiveness, and identify with the class. Sharing these perceptions should lead to greater agreement among students about social presence.

When teachers do not demonstrate strong teaching presence, a different dynamic is produced. Social presence should be more variable, as there is less of a unifying and guiding force supporting interaction. Some students communicate and share with their peers, while others may engage in less communication due to limitations of time, personal preference, confidence, or comfort with technology-mediated communication. The positive effect of agreement about teaching presence should only exist in classes where teachers engage in active direction, and students respond positively by jointly sustaining a learning community through their interaction. In classes that have lower aggregate levels of social presence, agreement among the students about teaching presence would indicate that they all perceive a lack of active support and/or lack of clear course structure. Disagreement, on the other hand, means that some students report active support while others do not. When social and teaching presence levels are low, high agreement about teaching presence indicates consistently limited active facilitation, likely leading to low levels and agreement about social presence.

Hypothesis 4: The higher the aggregate level of teaching presence and agreement among students in an online class at a given level, the higher the agreement about social presence.

Methodology

Sample

Data were collected over the course of three years from 126 fully online sections in five colleges in a large Midwestern university. There were 874 student responses, although some responded more than once if they took multiple classes that participated in the study.

Data were collected from graduate courses in the Schools of Public Service (4% of the classes), Commerce (0.8%), and Education (4.8%) as well as two undergraduate programs in Computer Science (0.8%) and an interdisciplinary school for adult students (89.7%). Most (90.5%) were undergraduate courses. Students ranged from 19 to 69 years old, with an average of 35.5. Nearly two-thirds, or 64.7%, were female and 35.3% were male. The vast majority, 83.3%, had taken prior online courses, with a mean response of between four and five prior courses.

Data Collection Procedures and Measures

CoI was measured by the standard validated questionnaire (Arbaugh, 2007; Swan et al., 2008). Participation in the study was voluntary for teachers and for students; response rates averaged 35.5% per class, and the average number of participants per class was 6.9. Coefficient alphas were .95 for the 13-item Teaching Presence scale, .89 for the 9-item Social Presence scale, and .93 for the 12-item Cognitive Presence scale.

Class scores for teaching presence ranged from 3.32 to 5.00, with a mean of 4.20; social presence scores ranged from 3.11 to 4.78, with a mean of 4.02; and cognitive presence scores ranged from 3.49 to 5.0, with a mean of 4.15. This restriction of range indicates that no classes had low levels on these variables. Dummy variables were created to distinguish higher from lower levels. Values between 4.0 and 5.0 on each scale were coded as 1, while those between 3.0 and 4.0 were coded as 0. Three control variables were also included in the study: student gender, age, and the number of previous online courses taken. The number of prior online courses was measured by ten options ranging from “none” to “nine or more.” Control variables were aggregated across each class to represent the overall group (Conway & Briner, 2012; Dineen et al., 2007) by calculating the percentage of the class that was female, the average student age, and the average number of prior online courses taken. It should be noted that the average number of online classes may be underestimated, because the actual highest number of online courses taken may be higher than nine.

Data Aggregation

In order to determine whether there is sufficient within-class agreement and between-class differentiation to aggregate within classes, there must be evidence that 1) students agree sufficiently within classes to have some degree of confidence that a class-level CoI exists; and 2) classes differ from one another on their views of the CoI (LeBreton & Senter, 2008; Lüdtke et al., 2006). The intra-class correlation 2 (ICC(2)) was calculated for teaching presence, social presence, and cognitive presence to measure within-class agreement, and intra-class correlation 1 (ICC(1)) was calculated as an index of between-class differences (Biemann, Cole, & Voelpel, 2012; Conway & Briner, 2012; Glisson & James, 2002; LeBreton & Senter, 2008; Lüdtke et al., 2006; Zohar & Luria, 2010).

The ICC(2) was 0.82 for social presence and teaching presence, and 0.88 for cognitive presence, all far exceeding the .70 minimum and indicating within-class agreement. ICC(1) was .39 with an *F*-ratio of 5.44 (p < .001) for social presence; 0.40 with an *F*-ratio of 5.60 (p < .001) for teaching presence; and 0.39 with an *F*-ratio of 5.45 (p < .001). The *F*-ratios were all highly significant, and the ICC(1) values were far above the minimum effect size of .05 (Biemann et al., 2012; LeBreton & Senter, 2008). This indicated that classes differed significantly in teaching presence, social presence, and cognitive presence.

Class-level variables were created to measure 1) the amount of class-level on teaching presence, social presence, and cognitive presence; and 2) the strength of class agreement on each of these. The class amount was measured by the mean score on each of the three scales (Cole et al., 2011b). This is referred to as the "aggregate class level" of each presence. The class consensus was measured by the standard deviation (SD) of the scale scores for teaching presence, social presence, and cognitive presence, multiplied by -1.0. The SD was chosen because it is a fairly robust measure of agreement (Roberson, Sturman, & Simons, 2007), and it is frequently used as an index of attitude dispersion and its converse, agreement, in composition research (Cole et al., 2011a; Dineen et al., 2007; Ford & Seers, 2006; Schneider et al., 2002). Multiplying the SD by -1 simplified interpretation and created an index of agreement rather than dispersion (Bliese & Halverson, 1998; Cole & Bedeian, 2007).

Analyses and Results

The means, SDs, and correlations among all study variables are presented in Table 2. The mean class level of teaching presence was correlated at .57 (p < .001) with the transformed (negative) SD of teaching presence, measuring agreement.

Table 2

Descriptive Statistics and Intercorrelations Among Class Variables

	Mean	SD	Tch Pres Mean	Cog Pres Mean	Socl Pres Mean	Tch Pres Agrnt	Cog Pres Agrnt	Socl Pres Agrnt	% Female	Avg Age
Teach Pres Class Mean	4.20	.35								
Cog Pres Class Mean	4.15	.27	0.56 ***							
Social Pres Class Mean	4.02	.31	0.29 **	0.66 ***						
Teach Pres Agreement	-.65	.32	0.57 ***	0.22 *	.00					
Cog Pres Agreement	-.54	.23	0.46 ***	0.52 ***	0.25 **	0.57 ***				
Social Pres Agreement	-.56	.20	0.19 *	0.31 ***	0.42 ***	.09	0.39 ***			
% Female	65.47	20.22	-.02	.05	.02	.05	.04	.08		
Average Age	36.02	5.03	-.12	.11	0.19 *	-.16	-.02	.10	-.05	
Avg Online Courses Taken	6.04	2.10	-.15	.13	0.24 **	-0.22 *	-0.19 *	.05	-.02	0.40 ***

*** $p < .001$; ** $p < .01$; * $p < .05$; # $p \leq .10$
N = 126 classes

Hypothesis 1 held that the higher the aggregate level of teaching presence and agreement among students in an online class, the higher the aggregate level of cognitive presence. Regression analysis was used to identify the independent effects of the aggregate level and agreement about teaching presence on the aggregate level of cognitive presence. The level of teaching presence, dummy coded to separate high and low levels, agreement (-SD for the class), and interaction were entered simultaneously along with a set of control variables: percent female in the class, average student age, and the average number of prior online classes taken. This process holds each predictive variable constant in assessing the effects of the others. Results are shown in Table 3.

Table 3

Effect of Class Levels and Agreement about Teaching Presence on Levels of Cognitive and Social Presence

Dependent Variable		Std. Error	Standardized Beta	Adjusted R^2	Sig.
Cognitive Presence Level (Class Mean)	(Constant)	0.20			***
	Percent Female	0.00	0.09		
	Average Age	0.01	0.09		
	Avg N Online Courses	0.01	0.19		*
	Teach Pres Agreement	0.10	-0.08		
	TP Mean	0.12	0.85		***
	TP Mean x Agreement	0.16	0.46		*
				0.21	***
Social Presence Level (Class Mean)	(Constant)	0.25			***
	Percent Female	0.00	0.05		
	Average Age	0.01	0.12		
	Avg N Online Courses	0.01	0.23		*
	Teach Pres Agreement	0.12	-0.08		
	TP Mean	0.15	0.36		#
	TP Mean x Agreement	0.20	0.15		
				0.07	*

*** $p < .001$; ** $p < .01$; * $p < .05$; # $p \leq .10$
N Classes = 126

Hypothesis 1 was supported, because the regression predicted a significant amount of the variance in the mean levels of cognitive presence (adjusted R^2 = 0.21, F Change = 6.64, p <.001). The dummy-coded mean level of teaching presence had a positive effect on the mean level of cognitive presence (beta = 0.85, p <. 001). The interaction between class agreement and level also had a significant effect (beta = 0.46, p < .05). This indicates that in classes with strong levels of teaching presence (TP Mean = 1), the stronger the agreement, the higher the levels of cognitive presence. With this effect statistically held constant, the agreement on teaching presence only captures agreement in classes where teaching presence is low (TP Mean = 0); the beta weight is negative indicating that stronger agreement leads to lower cognitive presence. However, the effect did not reach statistical significance. The overall effects of agreement about teaching presence on cognitive presence for classes with high versus low levels of teaching presence are shown in Figure 1. In addition, one of the control variables, the average number of prior online courses taken, significantly predicted cognitive presence (beta = 0.19, $p < .05$).

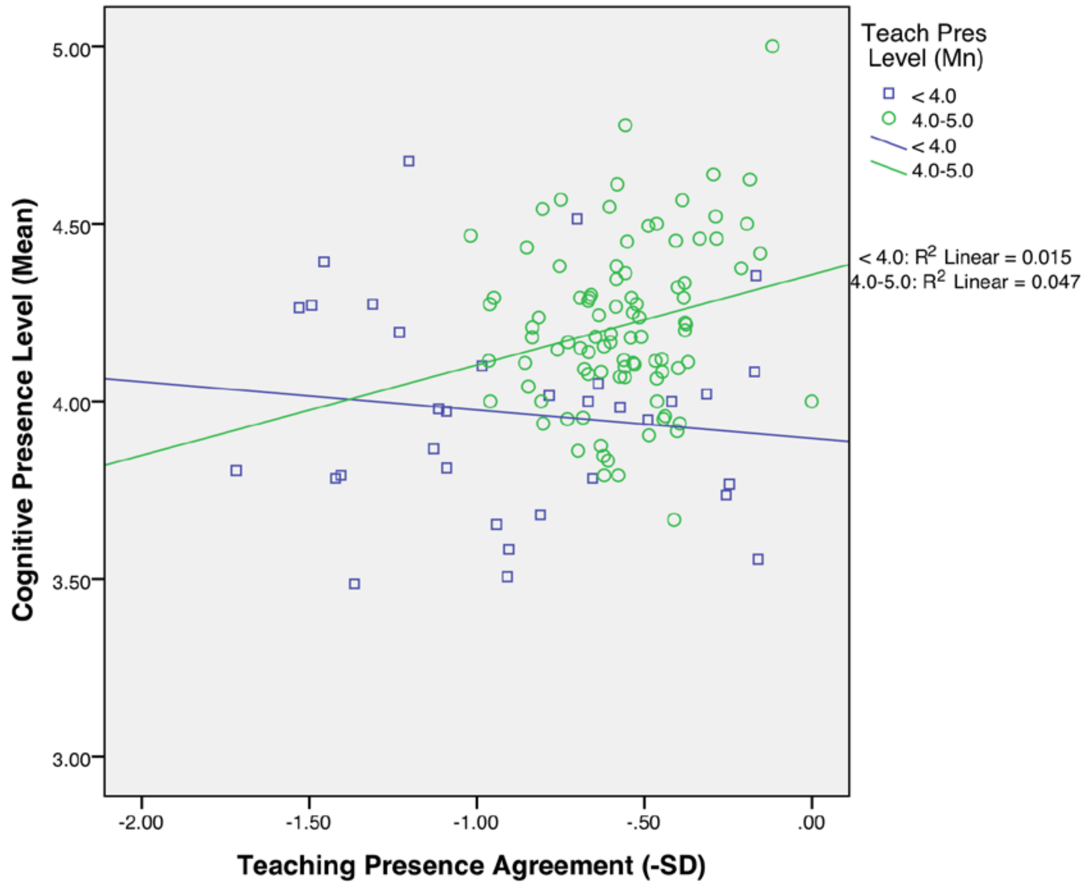

Figure 1. Effect of teaching presence agreement on cognitive presence level by teaching presence level.

Hypothesis 2 held that the higher the aggregate level of teaching presence and agreement among students in an online class, the higher the aggregate level of social presence. It was also tested with regression analysis, with the results presented in Table 3. Hypothesis 2 was partially supported; together the variables significantly predicted the mean level of social presence in online classes (adjusted $R^2 = 0.07$, F change = 2.49, $p < .05$). However, only one of the individual predictors was significant, and that only marginally: the dummy-coded class average of teaching presence had a marginally significant effect on the average level of social presence (beta = 0.36, $p = .10$). Agreement about teaching presence in classes with higher levels (TP Mean x Agreement) had a non-significant but positive effect (beta = 0.15), indicating a trend in the predicted direction. The remaining variance predicted by agreement about teaching presence in classes with low levels of teaching presence had a negative effect (beta = -

0.08), mirroring the findings for cognitive presence. The overall effect of agreement about teaching presence on class level of social presence, distinguishing between the relationships in classes with high versus low levels of teaching presence, is shown in Figure 2. The average number of online courses taken by the class members had the second strongest effect on social presence (beta = 0.23, p < .05), and the only statistically significant one.

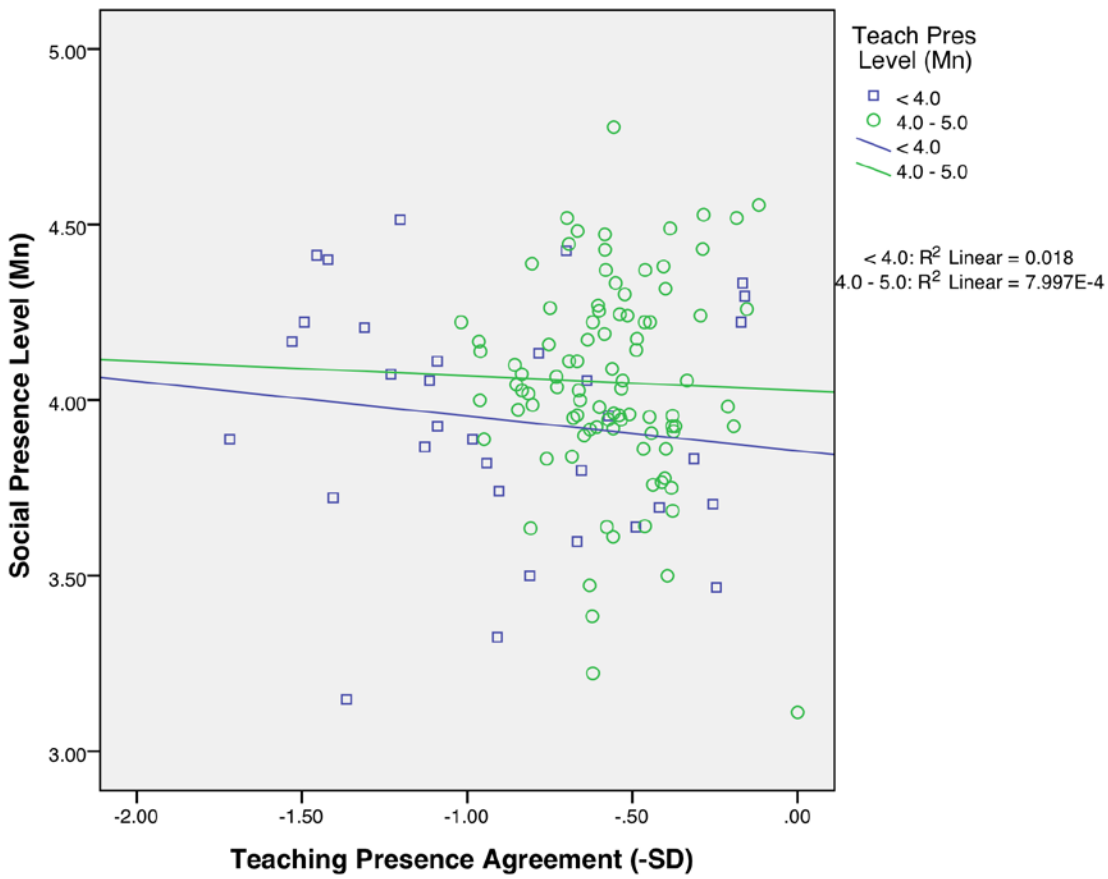

Figure 2. Effect of teaching presence agreement on social presence level by teaching presence level.

The remaining hypotheses focused on predicting class agreement rather than levels. Hypothesis 3 held that the higher the aggregate level of teaching presence and agreement among students in an online class at a given level, the higher the agreement about cognitive presence. This was tested with regression analyses that separately considered classes with high versus lower levels of cognitive presence, following Shea and Bidjerano (2009a) because of the different phenomena represented by agreement in classes with high levels as opposed to lower levels. Classes with an average level over 4 on cognitive presence (n = 91) were analyzed separately from classes with an average level between 3 and 4 (n = 35); both results are presented in Table 4.

Hypothesis 3 was strongly supported; 23% of the agreement on cognitive presence in classes with strong levels of cognitive presence was predicted by the model (R = 0.53, adjusted R^2 = 0.23, F = 5.59, p < .001), and the effects were even strong in classes with low levels of cognitive presence (R = 0.77, adjusted R^2 = 0.50, F = 6.61, p < .001). The individual effects of teaching presence level and agreement were not as strong but had predicted trends. In classes with strong levels of cognitive presence, the average level of teaching presence had a positive but non-significant effect (beta = 0.26, p = .26). Agreement about teaching presence had a significant effect on agreement about cognitive presence both for classes with high teaching presence (beta = 0.48, p < .05) and for classes with low teaching presence (beta = 0.26, p < .10).

In classes with low levels of cognitive presence, the level of teaching presence had no effect on agreement about cognitive presence (beta = -0.17, p = .68), while agreement about teaching presence had a very strong effect on agreement about cognitive presence (beta = 0.77, p < .001). In these classes, the average age of the students also had a positive effect on cognitive presence agreement (beta = 0.29, p < .10). The average number of prior online classes taken had a negative effect on cognitive presence agreement, although it was not significant (beta = -0.22, p = .16). The more prior online classes students had taken, the less they agreed about cognitive presence in these classes with lower levels.

Table 4

Effect of Class Teaching Presence on Agreement About Cognitive Presence

Dependent Variable		Std. Error	Standardized Beta	Adjusted R^2	Sig.
Cognitive Presence Agreement with High Levels (Class Mean Between 4 and 5) (N = 91)	(Constant)	0.18			*
	Percent Female	0.00	0.02		
	Average Age	0.00	0.03		
	Avg N Online classes	0.01	-0.05		
	Teach Pres Mean	0.11	0.26		
	Teach Pres Agreement	0.09	0.26		#
	TP Mean x Agreement	0.13	0.48		*
				0.23	***
Cognitive Presence Agreement with Low Levels (Class Mean Below 4.0) (N = 35)	(Constant)	0.26			#
	Percent Female	0.00	-0.07		
	Average Age	0.01	0.29		#
	Avg N Online classes	0.02	-0.22		
	Teach Pres Mean	0.23	-0.17		
	Teach Pres Agreement	0.11	0.77		***
	TP Mean x Agreement	0.35	-0.08		
				0.50	***

*** $p < .001$; ** $p < .01$; * $p < .05$; # $p \leq .10$
$N = 126$

Hypothesis 4 held that the higher the aggregate level of teaching presence and agreement among students in an online class at a given level, the higher the agreement about social presence. Regression analyses were conducted separately on classes with high (n = 67) and lower (n = 59) levels of social presence, again distinguished by mean scores over 4.0; results are presented in Table 5. This hypothesis was partially supported. For classes with higher levels of social presence, more than 15% of the variance in agreement was predicted (R = .48, adjusted R^2 = 0.16, F = 3.03, $p < .05$). In classes with lower levels of social presence, about 8% of the variance on agreement was predicted, which is marginally significant (R = 0.42, adjusted R^2 = 0.08, F = 1.86, p = .11).

Table 5

Effect of Class Teaching Presence on Agreement About Social Presence

Dependent Variable		Std. Error	Standardized Beta	Adjusted R^2	Sig.
Social Presence Agreement with High Levels (Class Mean Between 4 and 5) (N = 67)	(Constant)	0.19			***
	Percent Female	0.00	0.07		
	Average Age	0.00	0.04		
	Avg N Online classes	0.01	0.30		*
	Teach Pres Mean	0.12	0.54		#
	Teach Pres Agreement	0.09	-0.17		
	TP Mean x Agreement	0.14	0.76		**
				0.16	*
Social Presence Agreement with Low Levels (Class Mean Below 4.0) (N = 59)	(Constant)	0.25			**
	Percent Female	0.001	0.06		
	Average Age	0.01	0.24		
	Avg N Online classes	0.01	-0.28		#
	Teach Pres Mean	0.14	0.41		
	Teach Pres Agreement	0.12	0.08		
	TP Mean x Agreemt	0.20	0.19		
				0.08	

*** $p < .001$; ** $p <. 01$; * $p < .05$; # $p.\leq 10$
N = 126

In classes with high levels of social presence, the level of teaching presence had a marginally significant effect on social presence agreement (beta = 0.54, $p < .10$), and the agreement on teaching presence in classes with high levels, as measured by the interaction term, was highly significant (beta = 0.76, $p < .01$). Interestingly, the agreement on teaching presence on classes where its level was low, indicated by the beta weight for teaching presence agreement with the interaction term held constant, had a negative but non-significant effect (beta = -0.17, $p = .32$). In addition, the number of prior online courses taken had a significant effect of increasing agreement on social presence (beta = 0.30, $p < .05$).

In classes where the level of social presence was lower, neither the level nor agreement about teaching presence reached significance in predicting the agreement on social presence. The only marginally significant effect was found for the average number of prior online classes, which had a negative beta weight; the more prior online experience students had in classes with low levels of social presence, the less the agreement about social presence (beta = -0.28, $p < .10$). With prior online experience held constant, average age approached significance in the other direction (beta = 0.24, $p = .12$). The overall formula was marginally significant (adjusted $R^2 = 0.08$, $p = .11$).

Discussion

This study examined the effect of teachers as leaders in online classes, focusing on their ability to create teaching presence and, through it, a strong and cohesive community of inquiry. It explored aspects of the CoI that are seldom studied: the effect of aggregated class-level perceptions of teaching presence, agreement about that level in the class, and the interaction of both class level and agreement in the online class community. It found that, much as effective leaders create both high levels and consensus among work groups (Bliese & Halverson, 1998; Feinberg et al., 2005), effective teachers also create both high levels and consensus. Further, the average level and within-group agreement about teacher behavior have interactive effects on the class environment and outcomes (Cole et al., 2011a; Cole et al., 2011b; Dineen et al., 2007).

Overall, the average level of class perceptions of teaching presence were related to their agreement, and zero-order correlations indicated that the higher the level of teaching presence the class reported, the higher levels of cognitive presence and social presence the class reported, as well as more agreement about all three. Teaching presence was more closely related to cognitive presence than to social presence, consistent with some previous research (Shea et al., 2005). In addition, correlational analysis found no zero-order relationship between the class agreement about teaching presence and either the class level or agreement about social presence. Of the control variables, only average age and prior online experience were related to the CoI; classes with older students were more likely to have higher levels of social presence, as were classes where students had more online experience. However, having more online experience was negatively associated with agreement about teaching and cognitive presence.

Hypotheses 1 and 2 examined the effects of teaching presence on the class levels of cognitive and social presence, and were supported by regression analysis. Both the aggregate level of teaching presence and interaction between the level and agreement about teaching presence predicted the level of cognitive presence in online classes. This indicates that when students agreed that a teacher was actively guiding learning in a well-structured class, it created more class engagement and application of the content. However, when teachers did *not* demonstrate much teaching presence, class agreement about their teaching reduced cognitive presence, although this negative beta weight was not statistically significant.

The effects of teaching presence on social presence levels were weaker, although still significant. When the class as a whole perceived their teacher as demonstrating presence, students communicated with and trusted one another more, although the effect was only marginally significant. The interaction between the level and agreement on teaching presence did not significantly affect social presence levels, although the trends were in the hypothesized directions: For courses where students reported many teaching behaviors, agreement about those high levels had a positive effect on social presence levels, while agreement about lower levels of teaching presence had a negative effect on social presence.

The effects of teaching presence on agreement among students about cognitive and social presence also were significant (Hypotheses 3 and 4), although again stronger for cognitive presence. In classes where students reported much engagement with course concepts, integrating and applying them to solve problems (high cognitive presence), agreement about the teacher's design and instructional guidance, particularly when students perceived them to be effective, led to strong agreement about critical engagement with the course content. However, when students did not engage extensively and deeply with the course materials (lower levels of cognitive presence) and they felt that teachers did not design or support courses well (low teaching presence), the amount of agreement about the lower levels of teaching strongly predicted agreement about the lower levels of cognitive engagement.

In classes where students reported high levels of social presence, both the level and the agreement about high levels of teaching presence (interaction term) predicted agreement about social presence. This indicates that in close-knit learning communities, the open communication and sharing of information among class members created stronger agreement among students about both the teaching presence and the connections they share, reflected in high levels and agreement about social presence (Bangert, 2008). However, this effect disappeared, and in fact became negative, although not significant, when teaching presence was low: In classes with strong social presence, if teachers did not actively support students (lower teaching presence), then agreement about the teacher's behavior predicted *disagreement* about social presence, although the effect was slight.

In classes where there was little social interaction and communication, on the other hand, the teacher did not seem to have much effect; neither the level nor agreement about teaching presence affected the agreement about social presence. The only factors that neared significance were personal attributes: In classes where students had less online experience, there was more agreement about the lower levels of social presence.

This supports the effect of both teachers and students on the online experience. For example, social and cognitive presence are affected by students' self-regulation, which Shea and Bidjerano (2010, 2012) have referred to as "student presence." Students also differ in their expectations and desires for interaction, and may respond differently to the same teaching behaviors (Swan & Shih, 2005). For some students, active teacher guidance may be welcome and create more focus and deeper connection, while for others students it may be perceived as intrusive and produce resentment. The likelihood of students' perceiving and responding differently was supported by the strong effects of group demographics that were found on both the level and agreement about social and cognitive presence; average student age and, even more significantly, average experience with online classes increased the classes' social and cognitive presence. While prior research has examined individual student demographics (e.g., Kim et al., 2011; Shea & Bidjerano, 2009b; Shea, Li, & Pickett, 2006) little research has examined the effect of group demographics; this study supports that notion that the class composition affects the individual's experience.

Overall, it is evident that the causal effects of teaching presence on social and cognitive presence that have been found within individual students also exist at the aggregate or class level, supporting the concept of the teacher as class leader. However, the phenomena in online classes with high levels of learning community are different from those in classes with low levels, and class levels interact with agreement.

Limitations of the Study and Future Research

This study is limited by several factors. First, all data were collected in a single university, although different schools and pedagogical approaches were represented. However the majority were in an interdisciplinary program with a constructivist pedagogy and standardized courses. Nearly all students were adults, and the average levels of CoI were fairly high. All of these factors may limit the generalizability of the findings.

Future research should consider the effects of both the group level and the group agreement on the outcomes of online learning. For example, it might explore the effects of both class level and agreement on student satisfaction and learning in online classes, to identify the importance of peer agreement on individual student outcomes. Another promising area is the effects of agreement in online classes in different disciplines, extending the research that has found individual-level differences (Arbaugh, 2005; Arbaugh, Bangert, & Cleveland-Innes, 2010).

Conclusions

This study examined the effect of shared group perceptions of teaching on other aspects of the CoI, considering separately the group level and agreement. It found that the previously supported effect of teaching presence on cognitive and social presence, as perceived by individuals, also exists at the aggregate or class level. However, when teachers do little to support learning, agreement is associated with negative effects on the learning community. Class composition, in terms of student age and experience with online learning, affects both social and cognitive engagement. The independent effect of class agreement on outcomes supports the notion that peers' perceptions, and in particular the strength of their agreement, can improve or hinder the learning environment; examining only the perceptions of individuals leaves out key aspects of the community.

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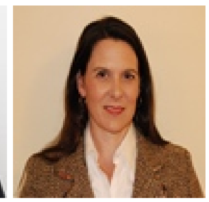
IRRODL
THE INTERNATIONAL REVIEW OF RESEARCH IN OPEN AND DISTANCE LEARNING

Open Distance Learning for Development: Lessons from Strengthening Research Capacity on Gender, Crisis Prevention, and Recovery

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Abstract

This paper documents the experience and lessons from implementing an e-learning program aimed at creating research capacity for gender, crisis prevention, and recovery. It presents a case study of bringing together a multidisciplinary group of women professionals through both online and face-to-face interactions to learn the skills needed to be a successful researcher. It reviews the issues related to distance learning programs with particular reference to the e-learning courses and highlights the constraints and challenges in implementing them. Lessons from the experience for future development of similar courses indicate that participant profiling prior to the course, user friendliness of technology, meeting various learning styles, encouraging and rewarding online exchanges, commitment of course moderators, a variety of learning materials, and mixed approaches to learning are some of the factors that can enhance the success of e-learning programs. The paper concludes that enhancing skills of developing country researchers through e-learning programs can increase learning accessibility to those living and working in remote and conflict ridden areas, and bring together a network of professionals to interact and exchange experiences on common problems and solutions.

Keywords: Distance education; e-learning; gender research; Africa

Introduction

Gender mainstreaming, a process of assessing implications of policies and programs on men and women to ensure gender equity, has been a priority in different areas of development since the 1990s (UN, 1997). However, this concept was quite neglected in crisis prevention and recovery, where communities, regions, and nations attempt to design programs to improve the livelihoods of a population that is recovering from natural and man-made calamities. With the United Nation's Resolution 1325 on women, peace, and security, and the United Nation's Eight Point Agenda, the practice of gender mainstreaming in crisis prevention and recovery is increasing. Despite this growing awareness and practice, the ability to respond effectively with programs and policies during crisis is highly limited by the scarcity of gender-specific or related research and analysis in crisis prevention and recovery. This is partly due to lack of capacity to develop research proposals and raise resources for the implementation of the research projects. This paper documents the lessons learned from an effort to narrow this capacity gap through a combination of distance education and face-to face approaches.

Through intensive training and mentorship with developing country researchers and junior faculty, the collaborative effort described in this paper responded to the glaring absence of intellectual leadership on gender dimensions of crisis prevention and recovery, especially from within affected communities in developing countries. Decades of crises in several developing countries in Africa have left many research and academic institutions in dearth of material, human resources, and social capital (Fukuyama, 2004). This has negatively influenced gender-related research with respect to training women researchers, setting research priorities, and accessing research funds and other knowledge resources such as conferences, journals, and publications. Although gender mainstreaming itself cannot remedy these long-standing and cumulative impacts, this collaboration aimed at ensuring those most affected by crises share in the process of building new knowledge and in shaping intellectual and research agendas. Further, it aimed at strengthening research capacity through a combination of distance education using digital approaches combined with the face-to-face building up of practical capacity for research proposal development.

This paper documents the experience and lessons from implementing a combined e-learning and face-to-face program aimed at creating research capacity for gender, crisis prevention, and recovery (G-CPR).

Distance Learning Programs and Development

The Need to Assess the Effectiveness of Distance Learning Programs

Capacity development strategies increasingly recognize that reaching out to a larger number of participants through innovative delivery of educational programs is vital for speedy strengthening of local capacity. Successful open distance education programs in the last three decades have spawned greater interest in the use of information and communication technologies in the design and delivery of capacity development programs (Gulati, 2008). However, challenges to expansion of courses and curriculum to information and communication technology (ICT) based delivery methods have come from different directions (Okonkwo, 2012). Skeptics continue to question the quality of electronically delivered educational programs. It is not always clear how the participants who get their education through online courses fare compared to those who receive face-to-face course content in formal settings (Ogunsola, 2010). The debate is nowhere more prominent than in the international development community, where there is a need to improve local capacity of professionals in developing countries who live and work in remote and conflict ridden areas. In addition, assessment, analysis, design, and implementation of programs and projects have become critical for increasing the effectiveness and sustainability of intervention programs that attempt to enhance the capacity for crisis prevention and recovery (Leary & Berge, 2006).

Challenges in Implementing Online Educational Programs

Nevertheless, research and educational institutions and capacity development programs have attempted to spread their reach to unreachable populations through various forms of distance education for decades beginning with the first generation method of printed correspondence learning methods. With this same primary goal of expanding their reach to previously unserved populations, during the mid to late 1990s, there was a renewed explosion of distance education using e-learning, or online/web-based learning delivery methods (Mandinach, 2005). The proliferation of web-based learning has been spurred in part by technological advances and economic considerations as institutions look for more cost effective methods of reaching ever greater populations (Potashnik & Capper, 1998; UNESCO, 2002). The quantity of potential learners continues to increase as developing countries improve their technological infrastructure and more people have internet and broadband access.

Further, as technological advances in media opened up new avenues for distance education, the involved institutions sought to move beyond the more basic delivery characteristics of flexibility in time, place, and pace to address issues such as advanced interactivity in learning in what is now termed the fifth generation of distance education (Taylor, 2001). However many institutions are still in the initial stages of incorporating web-based, open, and distance learning into their repertoire of capacity strengthening and higher education programs. Web-based learning creates new variables, constraints, and issues, making it fundamentally different from face-to-face learning environments (Mandinach, 2005; Veletsianos & Kimmons, 2012). As they gain experience incorporating web-based learning into their existing programs, institutions will begin to find their niches in the new online learning environment. Yet, documentation of the issues, constraints, and challenges in implementing online courses continue to be limited in developing countries.

Learner Characteristics and Demand for Web-Based Education

The demand for web-based education has been increasing along with the growing emphasis on the role of continuing education for sustaining gains from development assistance. Lifelong learning through continuing one's education has become a competitive necessity. As a result, the profile of the typical learner who seeks open and distance education is changing. So is the type of learning activity that best suits such needs. Learners are older now that there is a greater demand for professionals to continue learning and expanding their skill set well into adulthood. The motivations that drive adult learners are different from traditional school-age learners, as is what they typically want to get out of a learning opportunity. Adult learners are particularly motivated by interests in professional advancement and want to make use of their own life experiences and be able to directly apply learning experiences to their professional challenges (Howell, Williams, & Lindsay, 2003). Moreover, adult learners are particularly interested in the implications and applications of what they are learning (O'Rourke, 2003). These learners are most interested in short courses and executive mid-career style courses that will fit their needs but not interfere too much with their busy lives. Online, web-based learning is well-suited to these learners with its wide range of potential learning tools and capacity to directly relate to their professional lives (Freeman, 2004).

Competitiveness and Quality of Learning Materials

In the mid to late 1990s, many capacity strengthening and higher education institutions rushed to fill this new demand for continuing education. The first generation of online learning (or the fourth generation of distance education) was based on translating traditional face-to-face, classroom instruction to be posted on the internet (Johnson & Aragon, 2003). These courses are characterized predominantly by plain text materials and resources from traditional classroom materials being posted online. The flow of communication is in one direction, from the instructor to the students. As online course designers expanded their understanding and knowledge of the full capacity of web-based learning management system programs, the flow of communication has shifted to a multi-directional, free flow of information generating from both learners and instructors and flowing between learners and instructors/tutors and amongst learners themselves (UNESCO, 2002). With the proliferation of institutions developing web-based learning programs (e.g., higher education institutions, capacity strengthening institutions, international development institutes, and private sector organizations, etc.) the market for these programs is becoming highly competitive (Smyth & Zenetis, 2007). Specialization in distance education programs is taking place as institutions attempt to meet the demands of specific segments of the learner population (Howell et al., 2003). As more courses, degrees, and universities become available through web-based, distance education programs, there will be an increase in the demand for high quality course offerings and lower tolerance for those of poor quality. Related to the growing competitive environment in web-based learning programs is a growing trend toward developing institutional partnerships in order to design, develop, and deliver online courses (Howell et al., 2003; UNESCO, 2002). Partnerships are emerging between colleges and universities as well as with private organizations, international development institutions, and institutions dedicated to capacity strengthening.

As discussed above, web-based, distance learning programs enable institutions with capacity strengthening programs to reach learners that might not be able to participate in more traditional short courses and other face-to-face learning activities. Although female professionals face similar challenges as male professionals with respect to capacity development, women are particularly disadvantaged due to their limited mobility and additional household responsibilities. Given the challenges of time and space, not to mention the active schedules, heavy workloads, and travel schedules of typically targeted learners, capacity strengthening workshops often are not able to get the people they most want because the targeted learners cannot be physically present for a one- or two-week short course. In addition, the ebb and flow of donor interest in funding capacity strengthening components in projects as well as the lack of sufficient in-house resources often prevents institutions from conducting the full number of capacity strengthening workshops and short courses in the number of countries that is needed to make a significant impact.

Distance Learning in the Context of International Development

International organizations have shown a high level of interest in incorporating web-based, open, and distance learning programs to expand the delivery of workshops, short courses, and training programs. The key reason for the development of distance education programs is expanding the institution’s reach to a larger pool of target learners. Online learning activities enable the institution to broaden its reach to target learners, limited only by the internet connectivity of the targeted geographical location. A global trend is the rapidity with which many developing countries have embraced the potential of open and distance learning and are incorporating information communication technologies (ICT) as a strategy to alleviate problems of access, equity, and quality (UNESCO, 2002). As developing countries improve the national ICT infrastructure, international development organizations are able to access ever more remote rural areas, and with lower unit costs than traditional face-to-face workshops, they are able to offer courses on a greater range of subject matters while reducing capacity strengthening expenses (Freeman, 2004).

Web-based, open, and distance learning programs can also be used to complement other programs initiated by the institutions. For example, in recent years there has been a surge in the number of portal-based projects. The long-term plans for these portals often propose the integration of capacity strengthening components such as short courses on the various subject matters addressed by the portal contents. Furthermore, web-based learning can be used to complement any program; it is not limited to those projects related to or using ICTs.

Another reason for development organizations' interest in web-based learning is that using online technologies to offer distance education programs presents an opportunity to build and strengthen networks of learners around a central theme. One of the methods to build sustainability into development programs is through the creation of in-country, stakeholder networks. Online courses often incorporate discussion forums to stimulate dialogue on a particular subject matter between learners; this flow of communication and ideas can further strengthen networks and develop a deeper sense of identity as a member of a particular network.

This paper using a case study examines recent experiences in offering web-based learning opportunities. It asks what is known about the past successes of online learning programs and how this knowledge might help in the future applications of web-based learning for international development. In what follows a case study of the recently offered e-learning to build research capacity is described for potential lessons.

A Case Study of an E-Learning Program on Gender, Crisis Prevention, and Recovery

An online proposal development course was developed and piloted to a group of selected partners of the International Development Research Centre's (IDRC) "Women's, Rights and Citizenship Program in Africa and the Middle East". Key components of the course included problem formulation and conceptualization, development of research questions, choosing the appropriate methodology, and drafting a peer-reviewed research proposal. The project involved three sets of strategic activities.

The first set of activities included the preparation of online materials and consultation with a group of well-established researchers for improving the course content and including relevant literature on gender, crisis prevention, and recovery (G-CPR). The second activity involved implementation of an online course on an open source platform. The third set of activities included bringing the participants together through an onsite workshop for face-to-face discussions on their draft proposals—an output of the e-learning course—and adding value to the content of the proposal by offering suggestions and comments on the content. These activities were followed by an evaluation by the participants of the course to receive their feedback for the further improvement of the course content.

The E-Learning Course on Proposal Development

The e-learning program described here responded to the institutional and funding challenges faced by younger female and male researchers who want to spend extended periods of time engaged with the conceptual, epistemological, and methodological challenges of gender, crisis prevention, and recovery. By strengthening the skills of young researchers and junior faculty, thereby strengthening their professional profile, and increasing their access to intellectual and financial resources, this course would play a crucial role in ensuring that the field of gender, crisis prevention, and recovery would be informed by those most affected by crises and would have a committed and uniquely qualified cadre of researchers for decades to come.

In a research field largely dominated by northern institutions, southern researchers and practitioners often lack the necessary capability to voice their concerns on gender and crisis. One of the major obstacles to building their research capacity is the availability of funds for nurturing those who have talent and an inclination for a research career. They lack the skills needed for fund raising such as proposal writing and are unfamiliar with the complex rules and conditions of the grants they are applying for. This applies even more for women whose specific perspectives have long been ignored in both southern and northern contexts. Consequently, their valuable knowledge easily gets lost and remains undocumented. Meanwhile interactions with donor agencies remain imbalanced and are characterized by limited ownership of southern partners as well as a lack of response to the actual needs on the ground.

In order to respond to the lack of fund raising skills, the major objective of this collaboration was to build southern capacities in designing research proposals on topics related to gender, crisis prevention, and recovery. Strengthening researchers' skills in proposal writing is a sustainable way of helping them to access grants that will increase knowledge and understanding and enable profound analyses of G-CPR related themes. With these skills, southern researchers will be able to develop high-quality proposals that not only increase the chances of funding and actual implementation but also the standards of the research itself. Given the theme provided by IDRC, a funding agency, and the growing attention paid to women's participation in politics, this proposal course was tailored in this specific area by providing examples relating to women's political participation. The course built on a growing body of practice that has provided important insights about the challenges of addressing gender issues, responding to women's unique needs, and supporting their contributions in recovery processes. Further, literature related to feminist methodology and women's political participation formed the foundation for the entire course, the assignments, and the readings.

Although women and communities most affected by the crises have been engaged and consulted in the development of programs and policy responses through rapid needs assessment and 'lesson-learned' case studies, it is sobering to note that very few southern researchers have been the lead authors, researchers, or principal investigators. Consequently, their ability to frame the research questions, choose the appropriate methodologies, and correctly interpret the findings remains under-developed. The approach to the development of the course is based on the belief that support for proposal development among southern researchers is a crucial step in helping overcome the obstacles that have limited the contributions of southern intellectuals and researchers in shaping the policy, research, and program responses of the ‘international’ community and their reliance on well-established international non-governmental organizations as ‘executing’ partners.

Course design and content development.

An online proposal development module was developed to meet the needs of the target audience, to address thematic priorities of IDRC’s program on Women’s Rights and Citizenship in Africa and the Middle East, and to advance the mission of the Global Center of Research on G-CPR. The course was customized to develop a full-blown research proposal in the area of “Young Women’s Political Participation in Conflict-Affected Areas in Africa and the Middle East.” Regional experts in the field of gender and crisis prevention in Asia and Africa were consulted to provide input for the course and to propose case study materials. Using an interactive process, the course was designed to engage participants with one another and course facilitators, to develop the basis for a comparative framework, and to strengthen regional and cross-regional collaboration.

A course moderator moderated the course and was available to the course participants through email, chat in discussion forums and Skype, and phone conversations. Related course readings before and after the course lessons and the course readings formed the integral component of each week’s course lessons. Similarly, a follow-up process for evaluation, providing personalized and individual guidance to participants in finalizing their project proposals, and presentation of the fully developed proposal by the course participants in an on-site workshop formed the specific component of the course design and a mechanism for enhancing and improving the effectiveness of the course. Further, to increase the effectiveness and efficiency of the outcomes of the online course and workshop, one to one supervision both from the course moderator and from thematic resource persons formed the strategic element of the course design.

Course objectives.

This e-training course aimed to provide hands-on technical assistance in the development of action research proposals. This course also sought to provide the opportunity for researchers in the G-CPR network to use a real-life proposal in their course work and emerge with a high quality proposal that can be submitted for peer review and further consideration.

Specific objectives included:

- to develop skills for preparing policy research proposals,

- to understand the elements of a winning proposal,
- to analyse some examples of good proposals,
- to gain practical skills for organizing the components of a proposal,
- to review some of the existing resources for proposal writing.

Logistics for the online course.

The course ran for four weeks and its lessons and modules were organized on a weekly basis. This helped to facilitate active dialogue between participants and the course moderator as well as provide an organized structure to the dialogues. However, participants were encouraged to work at their own pace and during the hours most suitable for their schedule. It was suggested that lessons be discussed and any questions be raised regarding specific lessons during the week in question.

An assignment was given to the participants at the completion of each lesson to test the participant's understanding of the lesson concepts. Participants were asked to turn in their assignment to the course moderator prior to moving on to the next topic. All participants were encouraged to participate in open dialogues that took place in the form of open forums or chats. Due to the time difference between the participants and the course moderator, forum chats or direct email correspondence formed the main basis of communication.

Table 1

Course Schedule

Timeframe	Activity
August	Review online course outline, incl. discussions over email and phone
	Submit feedback, case studies and/or past successful proposals for online course
16 Aug-10 Sept	Four week online proposal development course
August	Review draft workshop outline, incl. discussions over email and phone
August 30	Submit feedback, case studies and resources for on-site workshop
Sept 10	Finalize workshop outline
Sept 21-23	Three day face-to-face on-site proposal development workshop

The course was targeted at advanced and starting researchers who seek to translate their experiences into academic research. Applicants at least had a master's degree and showed interest and/or experience in gender and crisis related issues. It was envisioned however that these areas of interest would be broadly sketched to encourage creative and interdisciplinary approaches to further expand this field of knowledge.

Selection of participants.

Nineteen participants were selected by IDRC through a careful review process. Three specific criteria were used to select the participants: They must come from an organization that deals with gender mainstreaming in relation to crisis prevention and recovery, they must be women, and they must have a master's degree and above on a subject related to gender issues. However, special consideration was given to proposed research ideas that integrated gender perspectives, had policy relevance and potential contribution to the field, and had a clearly articulated methodology and feasible objectives. Care was also taken to ensure a diverse group of participants in terms of backgrounds and professional expertise.

Advisory group and resources for proposal development.

An advisory group was established to provide guidance on the development of an online research proposal development course. A multidisciplinary group of advisers, with expertise in feminist methodology, theory, gender analysis, and relevant regional and thematic areas were asked to

- review the overall course outline, sequencing, and scope;
- provide case studies and/or examples of successful gender research proposals for possible use or reference in the online proposal development course and/or the on-site Cairo workshop; and
- review and provide written feedback on submitted course assignments for lessons 3, 7, and 12,which focus on the following components of a research proposal: literature review, conceptual/theoretical framework, research question, objectives, methodology, and the proposal abstract.

Each advisor was assigned a country team to review the IDRC research partner's draft proposals thoroughly and to facilitate the on-site workshop. The relationship established with the advisors in this collaboration can be further developed and used in future training designed to strengthen the capacity of researchers and practitioners working in conflict affected, developing, and transition countries. The advisors were expected to contribute not more than 18 hours of time via email exchanges and phone conversations.

Face-to Face Workshop

In order to improve the draft proposals prepared by the participants of the e-learning course, a face-to-face workshop was held in Cairo, Egypt. The workshop brought together the teams of 15 researchers from Egypt, Ethiopia, Malawi, Kenya, Sierra Leone, Sudan, and Tunisia. While the two participants of the Cairo workshop were not able to attend the online proposal development course the remaining 13 participants participated in the online course. It provided an opportunity for the participants to present the draft proposals and to receive feedback from the resource persons. In addition, the workshop also helped the participants through various thematic presentations on the issues, the method, and the communication aspects of research on gender and crisis and recovery. Participants also brought out the constraints and challenges they faced in taking the e-learning course.

The value addition to the proposals from the face-to-face workshop was clear from several angles. First, participants valued the direct feedback from the thematic experts who commented on the proposals after the presentation by the researchers. Second, the additional knowledge that the participants gained from the thematic presentation helped to fill the thematic gaps and strengthen the content of the proposal further. Third, the workshop was an opportunity to exchange ideas and challenges faced by the researchers in the development and implementation of research activities. It was clear that there were several common challenges confronting the researchers in the developing countries. How individual researchers in specific countries overcome these challenges gave a new perspective to others. Fourth, meeting the representatives of the sponsors in person and hearing their expectations helps to increase the chance of funding, if the researchers in revising the proposals address the concerns raised. Finally, the presentations on research and communication methods helped participants to learn research approaches and incorporate them in their revised proposals.

Evaluation of the E-Learning and the Face-to-Face Workshop

Course evaluation by the participants is a key feedback mechanism for improving the course content, pedagogy, and delivery methods. An evaluation questionnaire was developed and emailed to all the participants of the e-learning course and the participants of the face-to-face workshop. Follow-up phone calls were made asking for evaluations from the participants. There were a total of 21 participants in the online proposal development course and the Cairo workshop. A total of 14 completed evaluations were obtained that included two evaluations from the participants who attended only the Cairo workshop, three evaluations from the participants who attended only the online proposal development course, and the remaining nine from the participants who attended both. The responses from the participants and the notes taken during the phone calls were analysed for common patterns of suggestions and feedback from the participants. Key outcomes and lessons suggested by the participants were documented. The results of the evaluation are discussed below under different headings.

Course content, assignments, and reading material.

The majority of the participants found that the course contents were useful, clear and comprehensible, presented in a logical sequence, and relevant to their area of proposal development. However, almost 17% of the participants felt that more information should be incorporated in the lessons along with contextual, practical, and relevant examples. Although most of the participants agreed that the course lessons were sufficiently detailed and inclusive for proposal writing, a need for lessons on measuring the impacts, data-analysis techniques, and use of the software (SPSS, STATA) was also brought up and highlighted in the evaluations. Further, a deeper orientation in research design and methods, particularly action based, was also called for.

Almost 83% of the participants agreed upon the clarity, comprehensibility, and relevance of the reading material to the proposal development. On the other hand, the survey responses showed the demand for a relatively simple and low volume of reading materials, although the proportion for such demand constituted not more than 16%. While all the course participants agreed upon the relevance of course assignments, only 67% agreed upon the easiness of the course assignments.

At the completion of the online course, almost 45% of the participants revised their research objectives and methodology. Eighteen percent of them revised their research questions and revisited literature to back up the research questions. Although these are the areas mainly revised by participants after taking the course, the participants found the course lessons helpful to improve their research design, budget, and data collection tools. Adding simple, relevant, and easy reading materials, backing up course lessons with more relevant, contextual, and practical examples and illustrations, and providing more coordinated and longer mentorship from the advisors could help improve the effectiveness of the online proposal course.

Structure of the course and online platform.

Almost 75% of the participants contended that the course should be less intensive and should span more than four weeks. Further, in order to write a proposal concurrently with the course lessons, the course should run for more than eight weeks. Around 67% of the participants agreed that there would be a benefit in peer reviewing each other's assignments during the open course and many are willing to invest time to do this.

Although many participants found that the Moodle e-learning platform was easy to access and navigate, the problem of insufficient internet access and slow speed was the main hurdle for them throughout the course. Despite this problem of slow internet speed and limited access, 67% of the participants expressed their interest to participate in another online course offered through the Moodle platform.

Role of the moderator.

The course moderator played an important role in the learning process. In addition to being on constant watch for learning support needed by the participants, the moderator also played the role of knowledge manager, sharing the issues, constraints, and challenges faced by one participant with all others and inviting responses for solving issues from the participants. Given the challenges of poor internet connectivity, the role of moderator in keeping the participants on the same page is crucial for the success of the program. The course moderator also needs to be well versed in the content to give regular feedback and answer questions from the participants as they come up during the e-learning program. Moderating online courses with participants from developing countries requires flexibility and empathy to understand the challenges they face. Regular encouragement and motivation is also needed from the moderator.

Advisory group member.

Around 75% of the participants constantly communicated with their advisor through emails, Skype, and phone regarding the proposal content and the course assignments. The participants who communicated with the advisor found that the advisor's comments were clear and comprehensible and demonstrated substantive proposal writing experience. Of those who communicated with the advisor, almost 89% revised their proposal to include the advisor's comments and suggestions. Based on the advisor's suggestions and comments, the most revised sections in the proposal included research methods, objectives, data collection tools, defining target population, and sample size.

Online course outcomes.

All participants concurred that participating in an online course was a good investment of time. Around 91% of the participants recorded 4 on a scale of 1 to 5 — with 1 being the lowest score and 5 being the highest score — for the effectiveness of the course. The recommendations from the participants for further improvement of the course included:

- providing simple and more reference materials,
- extending the time span of the course,
- extending the due date for submitting assignments,
- extending interaction with the advisor and peer group,
- facilitating peer review of the course assignment and the proposal,
- including more examples in the lesson.

Workshop.

Around 91% of the participants felt that the location of the workshop was well chosen and well organized. A majority (91%) of them agreed that the objectives of the workshop were relevant, clear, and realized fully. Most of them found that the presentations made during the workshop were clear, comprehensible, and relevant to their work. The most useful and liked presentations, based on the survey response, included “Result dissemination and research methodologies” and “Exploring gender mainstreaming through the lens of a gender and crisis prevention and recovery framework”. Although the workshop was acclaimed in meeting participants’ expectations, around 10% of the participants commented on inadequate opportunities to make comments and contribute to discussions. Similarly, around 37% felt that time allocated to discuss each team’s research project was inadequate.

The workshop was able to contribute to developing an understanding among the participants of possible methods and ways of comparing regions and to generate new thoughts on researching young women’s political comparisons. Further many participants mentioned they would apply the lessons learned from the workshop in various forms and approaches, which could include revising the draft proposal, using the experiences of other countries on similar issues, and drawing cross-country comparable results, among many others. All participants showed a willingness to forge relationships with cohort members through continuous communications. In addition, the workshop provided a platform to establish a cross-country network for four countries: Ethiopia, Egypt, Sudan, and Tunisia. This network was established through the initiative of the team of researchers belonging to the respective countries. They plan to meet four times within a span of two years to discuss possible ways of advancing research and to share experiences and resources. The recommendations from the participants for further improvement of the workshop in future included: providing more time for individual project discussion in small groups and maintaining and fostering the network of partners and researchers working on similar issues across regions.

This evaluation did not assess the final proposals prepared by the participants as they were handled by the donor. However, feedback from the experts who were hired by the donor indicated that the quality of the proposals improved substantially to the extent that the proposals were ready to be considered for funding.

Lessons for Future Capacity Development Programs

Several key lessons emerged from the implementation of the e-learning program described in the case study above.

Understand the capacity needs of the learners: Designers of the e-learning programs need to fully understand the background and the needs of the learners in order to increase the relevance and the utility of the program. Matching the skills needs with the content could optimize the learning speed and make the learning process effective.

Make the learning program user friendly: Adult learners are increasingly becoming accustomed to internet based learning platforms. Yet efforts to increase the user friendliness of the e-learning modules can help reduce the fear of the technology and focus on the content of learning. Highly complex algorithms to retrieve, store, and use course contents reduce the frequency of access and hence the efficiency of learning.

Cater to different types of learners: Learners have varying degrees of absorptive capacity depending on their ways of learning. While it is difficult to distinguish the type of learners during the e-learning program, one way to reach out to all learners is to provide a variety of learning activities that cater to different types of learners. Modules should help visual and auditory learners. Those who prefer hands-on experience should be equally accommodated to achieve maximum results through the learning programs.

Encourage and reward online exchanges: Self- motivation remains a major challenge in an e-learning program. There is need for constant attention to inclusion of activities that bring the participants to the course and reward them for their efforts. This is a particular challenge in the courses that do not offer credits that could be used towards larger accomplishments such as a diploma or a degree. Involvement of the course moderator to engage the participants effectively throughout the course is an important success factor. Encouraging online exchanges among the participants that keep them actively engaged in the course will be essential for the success of the program.

Schedule flexibility: Flexibility of course schedule is crucial for the learners of different speed to catch up with the course content offered at various points in time. Extended time may be important for the participants who are already engaged in professional activities during the day. Spreading the course assignments throughout the course period gives an opportunity for the moderators to be in regular touch with the participants and increases the active engagement of the participants.

Commitment of the course moderator: Commitment and enthusiasm of the course moderator will determine the pace of the activities in an e-learning program. Given the communication is mainly through written form, the choice of the words and the style of communication need to exhibit the commitment of the facilitator or the moderator. Experienced moderators have the ability to show such commitment through their communications.

Make additional resources available: Adequacy and variety of learning resources determine the success of e-learning programs. E-learning programs could use the open source learning materials that are made available by other programs as global public goods. Learning the same content from different sources helps learners to understand the difficult concepts much faster.

Mixed approaches to learning: A major objective of distance learning programs is to reduce the cost of learning by allowing participants to stay on their jobs and in their own living environments without disturbing whatever they are doing.. Yet, an element of face-to face interaction can increase the benefits of the learning process multi-fold. However, incorporating the face-to-face element will depend on the availability of resources and the ability of the participants to pay for such an approach.

Sustainability of the approach: A key lesson learnt from the exercise relates to sustainability. This approach of combining e-learning with the face-to-face workshops is more feasible financially when the program is implemented within a country. Regional and global level courses will incur high costs in bringing the participants together, unless the international travel is funded by the donor agency. However, country level programs can replicate the model with participants covering the cost of their travel. A suggestion made by the participants was that the creation of a national level network of learners who could gather during the meetings of their professional association would help in reducing the cost of face-to-face meetings. Finally, the success of the e-learning program depends crucially on the persistence of the participants and their commitment to learning, particularly in the context of poor connectivity due to low bandwidth and other logistics. Thus the choice of participants is a key for the success of the program and the program needs to be demand driven.

Concluding Remarks

Building a new field of research and practice will require a strong cadre of highly skilled senior and junior researchers across fields and disciplines to undertake high quality, policy relevant scholarship. The e-learning course described above is a result of the recognition of the extreme scarcity of interdisciplinary graduate training in field-based feminist research methodologies on gender and security.

The e-learning course on proposal development was offered to potential recipients of research grants from IDRC. The objective of the course was to equip 21 researchers with skills and knowledge of proposal development so that they could raise resources for their own research. A major benefit of developing such skills is to increase the ability of the local researchers to sustain their research interests and skills as well as to prevent the brain drain that results from low utilization of well-trained individuals and low remuneration and research opportunities. Developing skills for proposal writing would help in raising the resources for the research and at the same time reduce the chance of the researcher leaving the research profession or the country due to lack of opportunities. An outcome of the e-learning program was to generate about seven peer-reviewed research proposals on “Young Women’s Political Participation in Middle East and North Africa Region”. The model of combining the e-learning with the face-to-face workshop as described above helped to reach these outputs and outcomes. The workshop organized at the completion of the online course provided a platform to bring together like-minded researchers and helped in establishing a regional network in the issues and areas of common interest leading to the sharing of resources and experiences.

While the use of e-learning as an educational delivery mechanism is still nascent in sub-Saharan Africa (Okonkwo, 2012), experience from the above program shows that it has high potential to reach out to a large number of learners with limited resource costs. However, the problem of slow internet connectivity and difficult access to the internet, at times, frustrate the learners and demotivate them to participate in e-learning (dela Peña-Bandalaria, 2007). This pilot course also provided the lesson that the course should span at least eight weeks in order to allow participants to develop the proposal concurrently as part of the learning process. In addition to the proposal development course, the participants also brought up the demand for courses such as measuring impact, detailed data analysis techniques and methodology, and using econometric and statistical software for data analysis. Further research is needed to identify the best combinations of e-learning and the face-to face program, best mode of delivery, best combinations of reading materials and the discussion sessions, and ways to improve motivation among the distance learners. In this context, the importance of promoting opportunities for developing course contents as open educational resources and using them effectively in the distance education programs cannot be overemphasized.

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Appendix A

Course Schedule for the Four Week Online Course

Week One

During this week, participants will be introduced to each other and to the online course. In the first lesson, we will introduce the purpose of research proposal, qualities of successful research proposals, the IDRC proposal requirements, and evaluation criteria for the proposal. The second lesson will provide an overview of how to situate research concept notes within a critical review of relevant literature across disciplines. Based on review of relevant literature and contemporary policy debates, the third lesson will focus on formulating problem-centred and participatory derived research questions and objectives.

Lesson 1: Introduction to Research Proposals

Lesson 2: Analysing the Context and Concept: Reviewing the Literature on Young Women's Political Participation in Crisis Affected Countries

Lesson 3: Formulating Research Questions and Objectives

Week Two

In the second week, we will begin with the ethical considerations for the research in relation to ensuring access and research permissions, data safety, and security of research and study populations. The fifth lesson will look into key elements needed to present the proposed research design. The sixth lesson will review key elements necessary for describing research methodology, with a focus on data collection.

Lesson 4: Research Ethics

Lesson 5: Research Design

Lesson 6: Method: Data Collection

Week Three

Building on second week lesson, the third week will introduce how to communicate key factors relevant to data analysis in a research proposal, describes you how to create the work plan taking into account every contingencies that may arise in the field, and discusses on how to identify relevant constituencies and dissemination strategies.

Lesson 7: Methods: Data Analysis

Lesson 8: Project Schedule

Lesson 9: Research Results: Outputs, Evaluation, and Dissemination

Week Four

In week four, we will begin with how to present information on staffing, partnerships and project management in clear and concise manner. Lesson 11 will provide you some tips for preparing convincing budgets. The last lesson emphasizes the importance and discusses an art of writing appealing abstract, the very first section of a proposal.

Lesson 10: Project Management and the Research Team

Lesson 11: Proposal Budgets

Lesson 12: Proposal Summary

Participants are further encouraged to use any proposals that they might currently be working on in the completion of lesson exercises or discussion in the forums for advise and suggestions on improvement by the course moderator and other participants. The online course was followed by a complementary 3-day on-site workshop.

Appendix B

Cairo 3-Day Workshop Agenda and Objectives

IDRC Research Initiative on Democratic Governance, Women's Rights and Gender Equality in the MENA region, Eastern and Southern Africa:
Young Women's Political Participation

Day 1

9:00-10:00 - Introductions and Welcome
Participants introduce themselves
What motivates you to work in this area of research?

10:00-11:00- Introductions Continued
IDRC, SSRC, and IFPRI
Background on each institution
What inspired each institute to join in this collaboration
Expectations and objectives of this collaboration and workshop

11:00-1:00-Obstacles to Women's Political Participation – Global Literature and a Local Context
Identifying and comparing trends and lessons learned at the national, regional and international levels
Overview of the literature and comparative debates
Objectives
To take stock of current issues at the global level
To review selected results from recent research
To contextualize the issues and results for the benefit of the current proposals
Main Points
Why a comparative framework matters
1st and 2nd generation research questions: Politics, Participation, Gender, and Youth
General trends and conceptual frameworks
What do research teams want to see happening in their own countries?

1:00-2:00 lunch

2:00-3:30- Women and Political Participation in Eastern and Southern Africa
Overview of the literature and contemporary debates
Presentations and discussion based on the review conducted by participants in the region
Objectives
To address specific issues related to Eastern and Southern Africa
To understand research projects' context and relevance
To prioritize research questions and identify specific research objectives
To begin a discussion of target users
To have research team members engage one another in active discourse
Presentation and Discussion Format:
Each team will make 15-minute presentations.
These presentations should be based on the literature reviews conducted by each research team in preparation for their proposal development.
If using a PowerPoint presentation, it should be no more than 10 to 12 slides.
The presentations should focus three main topics:

1. The current literature and debates on women's political participation in the region with particular emphasis on the country (for example, the Malawi Research Team would present on Southern Africa with particular focus on Malawi)
2. Key research findings – What is known from past research conducted on this topic in this particular region/country?
3. Research gaps – What new knowledge is needed in order to increase young women's political participation in this region/country? How do you prioritize these research gaps?

3:30-4:00 Coffee Break
4:00-5:30 -Women and Political Participation in Middle East and North Africa
Overview of the literature and contemporary debates
Presentations and discussion based on the review conducted by participants in the region
Objectives
To address specific issues related to Eastern and Southern Africa
To understand research projects' context and relevance
To prioritize research questions and identify specific research objectives
To begin a discussion of target users
To have research team members engage one another in active discourse
Presentation and Discussion Format:
Each team (Tunisia, Egypt, Sudan) will make 15 to 20 minute presentations.
These presentations should be based on the literature reviews conducted by each research team in preparation of their proposal development.
If using a PowerPoint presentation, it should be no more than 12 to 14 slides.
The presentations should focus three main topics:

1. The current literature and debates on women's political participation in the region with particular emphasis on the country
2. Key research findings – What is known from past research conducted on this topic in this particular region/country?
3. Research gaps – What new knowledge is needed in order to increase young women's political participation in this region/country? How do you prioritize these research gaps?

<u>Day 2</u>

9:00-9:45-Increasing Young Women's Political Participation: Conceptual and theoretical models of democratic governance
An introduction to and discussion on the debate on current issues and models
Objectives
To review current conceptual thinking
To highlight key research questions
To facilitate comparability of the proposed research projects
945-10:00 Coffee Break
10:00-11:00 -Increasing Young Women's Political Participation: Exploring gender mainstreaming through the lens of a gender and crisis prevention and recovery framework
Objectives
To address key issues of gender mainstreaming in Africa and the Middle East in the context of crisis prevention and recovery
To contribute to and build upon the current conceptual thinking surrounding democratic governance and increasing women's political participation
To facilitate comparability of the proposed research projects
To bring in a global policy environment perspective
11:00-1:00- Research Methodologies and Risk Analysis
Objectives
To review approaches/methodologies
To discuss possible synergies in approaches and methods
To identify challenges and risks in meeting objectives
How do the research teams make methodological decisions based on their risk analyses?
1:00 -2:00 Lunch
2:00-5:00-Strategies for Policy and Change Action
Mini group discussions on expected research results, effective dissemination strategies and the comparability of anticipated outcomes
Objectives
To discuss anticipated challenges and expected research results

How do researchers strategize at local, national, and regional levels?
To identify key stakeholders, targets, and end users at local, national, regional and international levels
To share outreach experiences and review dissemination strategies
To facilitate comparability of the proposed research projects
Making an impact on the ground and developing networks
Youth and the politics of the present
3:30-4:00 Coffee Break

Day 3

9:00-12:00-Two Parallel Individual Project Sessions
Individual Project Discussions
Objectives
To reflect on days 1 and 2
To bring the focus back to the IDRC research project proposal
To discuss weaknesses/roadblocks and brainstorm ways to improve
To identify elements of a comparative framework within the ESA and MENA region
To discuss next steps and review logistics
12:00-1:00-Comparative framework
Identify key threads at sub-regional level
Find commonalities through which research teams can support one another
Discuss weaknesses in proposals that need strengthening
Solidify a core sub-regional network
1:00-2:00 Lunch
2:00 -4:00

Plenary discussion and Concluding discussion(s)

THE INTERNATIONAL REVIEW OF RESEARCH IN OPEN AND DISTANCE LEARNING

Reviews and Practice of College Students Regarding Access to Scientific Knowledge: A Case Study in Two Spanish Universities

  

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Abstract

This study analyzes the concepts, attitudes, and practices of 327 pedagogy students from two major Spanish universities related to the process of finding academic information utilizing open access. A training program has been developed through an innovation project (PIMCD) to address the problem of the lack of university training designed to enable students to access reliable sources of scientific knowledge. A mixed questionnaire with a pretest-posttest design, applying a descriptive analysis, a factor analysis, and a Wilcoxon test was administered to students. The results show that it is essential to provide information and training to encourage university students to learn how to find and manage rigorous and reliable sources of information. While searching for academic information, Spanish students tend to focus on the use of Google and, to a lesser extent, Google Scholar. Although there are no significant limitations of access to Spanish language articles, students' attitudes remain very positive towards the concept of open access. In short, in accordance with the study results, the promotion of educational activities relating to the search for and selection of information and the use of reliable and rigorous academic content is highly recommended in the university context.

Keywords: ICT; open access; educational innovation; training

Introduction

Currently, obtaining access to knowledge is relatively easy due to the large number and variety of studies available on the Internet. “Today the average researcher at a university has instant access to a much broader range of journal articles than ever before during the print era” (Björk et al., 2010).

It should be noted that studies published in various scientific journals are funded with public money. Therefore, from an ethical perspective, content should be available to any reader. However, this does not occur as a result of several factors.

Currently, a considerable number of scientific journals demand subscriptions and fees for access to their articles. This situation has caused concern when publishing due to the fact that the majority of the work (i.e., creation and revision) is done freely by the community. Editors take advantage of this situation by charging fees to access articles and journals, thereby profiting from the editing process.

One possible solution is found in open access, which is the practice of providing free and unrestricted access to peer-reviewed articles in scientific journals over the Internet. Open access arose in the 1990s as a reaction to the increase of subscription prices at a rate considerably higher than inflation. In recent years, there have been open access publishers who simply act as suppliers. Through the Directory of Open Access Journals (DOAJ), it is possible to access over 5,000 peer reviewed journals.

Theoretical Framework

The Budapest Open Access Initiative details the importance of this approach and defines open access:

> By "open access" to this literature, we mean its free availability on the public internet, permitting any users to read, download, copy, distribute, print, search, or link to the full texts of these articles, crawl them for indexing, pass them as data to software, or use them for any other lawful purpose, without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. The only constraint on reproduction and distribution, and the only role for copyright in this domain, should be to give authors control over the integrity of their work and the right to be properly acknowledged and cited. (Open Society Institute, 2002, p. 1)

The Bethesda Statement on Open Access Publishing (2003) details the conditions that open access must have. The Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities (2003) establishes open access as a worthwhile practice, ideally requiring the active commitment of all individual producers of scientific knowledge and holders of cultural heritage.

Furthermore, although most studies conclude that open access improves the diffusion of research (Swan, 2010), others argue that open access, that is, free dissemination, undermines copyright law. In addition, problems may arise in the process of peer review. Some organizations, such as the International Publishers Association and the Association of American Publishers, are not in favor of open access.

Open Access Advantages

Open access facilitates the availability of research results and encourages an increase in research productivity. Internet search engines and the posting of articles in open access repositories greatly increase the accessibility of publications. Several studies (Antelman, 2004; Craig, Plume, McVeigh, Pringle, & Amin, 2007; Harnad & Brody, 2004; Lawrence, 2001; Norris, Oppenheim, & Rowland, 2008; Wagner, 2010; Zhang, 2006) have highlighted a significant increase in citations of articles under this policy.

The main advantage of open access is that it facilitates the availability of articles over the Internet, thereby increasing the likelihood that the study will be viewed and cited. Accordingly, open access promotes the possibility of reaching a wider audience (Shields, Rangarajan, & Stewart, 2012).

Other studies highlight the benefits of open access related to the acceleration of the citation of research (Eysenbach, 2006; Institute for Scientific Information, 2004), even in low-income countries (Evans & Reimer, 2009; Norris, Oppenheim, & Rowland, 2008; Zhang, 2006). “As we see OA articles are distributed much more widely and have equal or better likelihood of being cited by other scholars” (Anderson, 2013, p. 90).

The research goal of Swan (2010) was to determine whether there was an overall increase in citations for an open access body of literature. Swan’s research reveals 27 studies concluding that open access increases the rate of citation considerably. However, four studies conclude that open access does not result in an increase in citation rates. Therefore, the data clearly support the use of open access. Open access articles have a greater research impact than articles that are not freely available (Antelman, 2004).

Journals have an essential function in the diffusion of knowledge through research. “Article downloads and citations measure two different dimensions of scientific knowledge transfer. The first measures general interest in a particular new piece of knowledge; the second measures the incorporation of that knowledge into a new document” (Davis, 2011, p. 2132).

Despite the scientific evidence suggesting that open access increases the citation of articles, some authors argue that it is difficult to determine whether the relationship between open access and citations is causal, or whether the relationship is merely spurious (McCabe & Snyder, 2011). “It is not surprising that providing free access has little (if any) effect on article citations” (Davis, 2011, p. 2133).

The essential factors influencing the rate of citation are the quality, relevance, originality, and influence of the study (Swan, 2010), although it is evident that there are a variety of factors affecting citation and readership. “Free access to scientific articles increases readership (as measured by article downloads) and reaches a broader audience (as measured by unique IP addresses) but has no effect on article citations within the first 3 years after publication” (Davis, 2011, p. 2132).

Open Access in the University Setting

There is evidence regarding the benefits to practice and research resulting from the accessibility of good quality student research utilizing institutional digital repositories. Seventy percent of researchers use Google or Google Scholar as a primary tool for finding information. Norris, Oppenheim, and Rowland (2008) used a combination of different search engines and reported that 86% of articles could be found using either Google or Google Scholar. For reasons of economy, Google is a good option.

With the improved availability of research, there are a number of groups, such as college students, who benefit from this approach. Considering the advantages and simplicity of Google searches, access to scientific knowledge is relatively effortless. “The real beneficiaries of open access may not be the research community, which traditionally has excellent access to the scientific literature, but communities of practice that consume, but rarely contribute to, the corpus of literature” (Davis, 2011, p. 2133).

Open access provides advantages to teaching and learning processes in the university context, as it encourages the use of the scientific knowledge available in all subject areas. “We are in the midst of a rapid transition from closed to open access publishing. This disruptive transition benefits ordinary citizens and scholars” (Anderson, 2013, p. 93).

Students can access research to support or supplement the knowledge they are acquiring in their disciplines. New technologies and communication mechanisms have led to an increase in the significance of student work. Student papers may contain knowledge and information that, given the right circumstances, should be shared with the world (Levin, Burbules, & Bruce, 2005).

It is noteworthy that students need information and access to knowledge in their fields. Students need access to the latest research in their disciplines to have a complete education in their fields of study. Limited access is a serious problem for students, because under these circumstances, they only have the option of working with the information available, and may not have access to the most relevant knowledge.

Open access is important to ensure that students develop quality research and are not artificially limited. "Quality student research is an underused resource that needs to find its rightful place in the knowledge realm" (Shields, Rangarajan, & Stewart, 2012, p. 20). Student work, aided by open access, can enhance the reputation of an institution and contribute useful knowledge (Lynch & Lippincott, 2005).

Only the largest, most well-funded institutions have the opportunity to provide their students with the information and knowledge they need and the latest research in their fields of study. As a result, there is inequality of access. "I would only add that the importance of creating open access to these different landscapes and links will certainly be a boon for those faculty and students who do not otherwise have access to journals or indexes" (Willinsky, 2006, p. 170).

Aims

The main objective is to analyze the knowledge, attitudes, and practices utilized by college students to find academic information in journal articles and to assess the possible benefits of open access.

The specific objectives are:

- Check the functionality of free information access in the university.
- Assess the attitudes of college students who attended the open access training program included in the applied innovation project (PIMCD).
- Detect the open access training needs of students in the university.
- Analyze the practices of university students as they develop information seeking methods.

Method

Participants

The study sample consists of 327 university students belonging to eight different groups of first and second degree courses in pedagogy. Two hundred twenty-one students attend Complutense University in Madrid and 106 students attend Murcia University, two major universities in Spain. In the sample, 76.5% are female students and 23.5% are male students. The contingency analysis is not detailed because there are no significant differences regarding gender, group, or college.

Procedure and Instruments

The present study proposes two dimensions which address the research objectives through a quasi-experimental method. Perceptions and practices reported by students are analyzed utilizing this process. This kind of research is intended to describe the individual experience in particular environments (Creswell, 2003).

The study is part of the innovation project (PIMCD) approved in the academic year 2012-2013 at Complutense University in Madrid, entitled *Uso de las redes sociales, las herramientas de Acceso Libre, el "ABP", las tutorías y el autoaprendizaje para evaluar las competencias en el grado.*[1]

The project includes a four month training process during which students engage in activities and case studies and attend sessions and presentations related to the concept of open access. Also, students search for scholarly information using different methodological strategies.

A mixed questionnaire is given before (pretest) and after (posttest) the implementation of the project. Once the information is gathered, we apply a descriptive analysis, a factor analysis, and a Wilcoxon test to measure significant differences before and after the training program.

Data triangulation can ensure that there is sufficient evidence to support the validity of the results and minimize error variance (Goetz & LeCompte, 1988). The data triangulation (Cohen, Manion, & Morrison, 2000) was implemented using quantitative information collected in the different tests as well as the analysis of the open questions.

[1] (Universidad Complutense. Vicerrectorado de Evaluación de la Calidad, referencia 90. Resolución 7-02-2013 http://www.ucm.es/data/cont/docs/3-2013-02-20-RECTIFICACIÓN%20SOCIALES.pdf).

Table 1

Research Dimensions, Indicators, and Instruments

Dimensions	Indicators	Instruments
Dimension 1: Concepts and opinions regarding open access	Knowledge of the concept of open access	Questionnaire Wilcoxon test Pretest- posttest Factor analysis Open questions
	Attitudes towards open access	
	Training needs related to open access	
	Reviews about journals policy	
	Knowledge regarding tools for finding information	
Dimension 2: Using open access to access to knowledge	Theoretical foundation of work	
	Management of search engines	
	Use of open access databases	
	Management of reliable information	
	Use of open access repositories	

Results

Descriptive Analysis and Wilcoxon Test

The results of the study show a descriptive analysis in which the percentages are measured in two dimensions. The findings provide valuable information to consider. Moreover, it is important to analyze the value of the Wilcoxon test, which is based on the data provided by the pretest-posttest questionnaire. It allows us to ascertain whether there are significant differences before and after the implementation of the innovation project (PIMCD). The significance level is 0.01 ($\alpha = 0.01$).

Table 2

Dimension 1: Concepts and Opinions Regarding Open Access. Post-Test Frequencies and Wilcoxon Test

Dimension 1: Concepts and opinions regarding open access	% Post test				Wilc. test. 0.01
	1	**2**	**3**	**4**	
1.1. - I know the existence of open access journals to support my work	0.9	2.4	**58.7**	**37.9**	**0.00**
1.2. - I believe that access to articles must be free	0	0.6	**19**	**80.4**	0.02
1.3. - I know the Directory of open access Journals (DOAJ)	0.9	6.4	**57.5**	**35.2**	**0.00**
1.4. - I know what academic Google is (Google Scholar)	0	2.4	**55.7**	**41.9**	**0.00**
1.5. - I believe that subscriptions to journals are unfair	0.3	10.7	**58.4**	**30.6**	**0.00**
1.6. - Knowledge should be free and accessible online	0	0	**23.5**	**76.5**	0.35
1.7. - Open access helps to develop society	0	2.1	**33**	**64.8**	**0.00**
1.8. - I know the ranking of journals in SCOPUS	0.6	6.4	**59.6**	**33.3**	**0.00**
/ / 1 = Strongly Disagree / / 2 = Disagree / / 3 = Agree / / 4 = Strongly Agree / /					

Dimension one, which refers to the concepts and opinions about open access, highlights that 100% of students have a clear and positive attitude toward the free access to knowledge (Item 1.6). In addition, 99.4% of students in the sample consider that journal articles should be free (Item 1.2), and 97.9% believe that open access helps to develop society (Item 1.7). In these items, there is no significant increase as shown in the Wilcoxon test data, revealing that students had prior positive attitudes regarding these issues.

However, we can see that subsequent to the applied training program, students indicate they have knowledge of various tools (Items 1.1, 1.3, 1.4, and 1.8) and the ability to find journal articles using open access. Students also indicate their belief that the current situation related to the publication of journal articles is unfair (Item 1.5).

The analysis of the values in the Wilcoxon test shows that the training program has led to a significant increase in students' awareness of the existence of open access journals to support their work (Item 1.1) and their knowledge regarding DOAJ, Google Scholar, and Scopus rankings (Items 1.3, 1.4, and 1.8). In addition, it reveals their critique of the current situation (Item 1.5) and positive attitudes toward the potential of open access to help develop society (Item 1.7).

Moreover, prior to the training program, very few subjects knew about the DOAJ (6.4%) and Scopus rankings (6.1%). Therefore, it has been effective and instrumental in providing this information (Figure 1, Items 1.3 and 1.8).

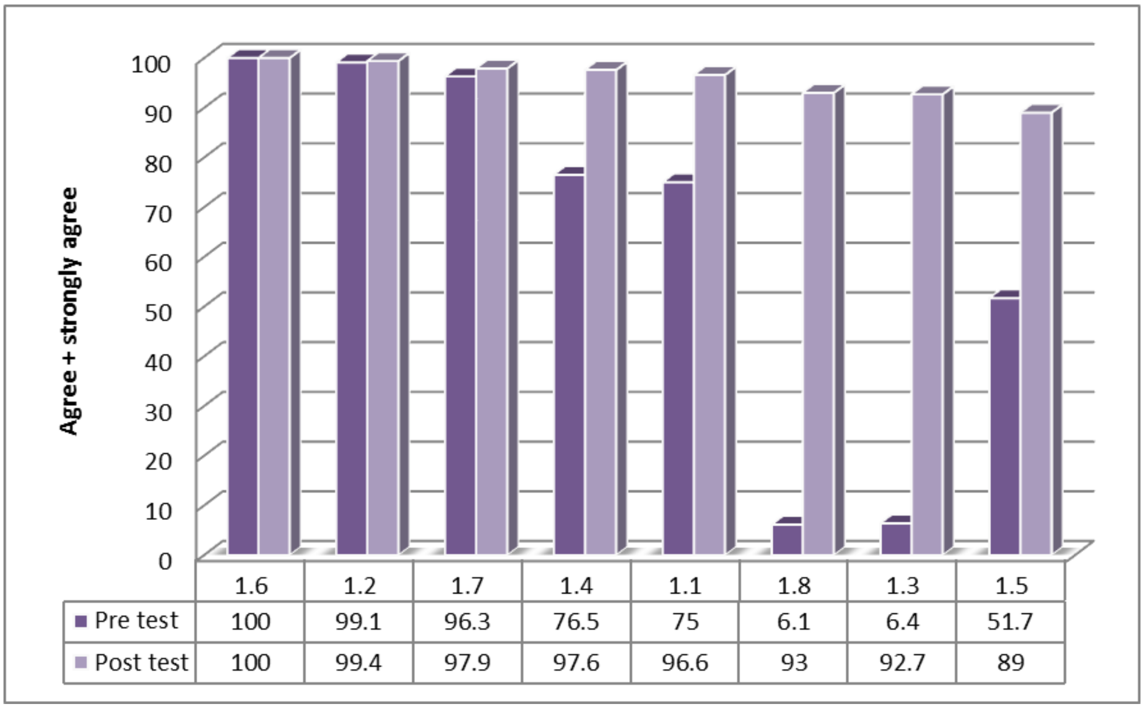

Figure 1. Dimension 1. Concepts and opinions regarding open access.

The data analyzed in Table 3 shows that 98.2% of students usually find free and available journal articles (Item 2.8), 97.9% use Google to find theoretical information (Item 2.2), and 55.4% use Google Scholar (Item 2.4). However, they engaged in these practices prior to the training program, so there is no significant improvement in these items.

The data shows that 85.4% of students have based their work on journal articles on some occasions (Item 2.6) and 80.4% of students often use journal articles to support their work (Item 2.1). In these cases, the training program has contributed to a significant improvement.

Table 3

Dimension 2. Using OA to Access Knowledge. Frequencies in Post-Test and Wilcoxon Test

Dimension 2: Using open access to obtain knowledge	% Post test				Wilc. test. 0.01
	1	**2**	**3**	**4**	
2.1. - I use open access scientific journals to support my work	2.4	17.1	**48.6**	**31.8**	**0.00**
2.2. - I use Google to find theoretical information for my work	0	2.1	**23.5**	**74.3**	0.18
2.3. - I use the Directory of Open Access Journals (DOAJ)	**47.7**	**46.2**	4.6	1.5	0.107
2.4. - I use Google Scholar	13.1	31.5	**35.5**	**19.9**	0.54
2.5. - I tend to use Wikipedia to support work	**39.4**	**35.5**	22.6	2.4	**0.00**
2.6. - On occasion, I based my work on journal articles	0.6	14.1	**55.4**	**30**	**0.00**
2.7. - I use open access repositories (epubs, eprints, DSpace, Fedora, Citebase ...)	**44.3**	**48.3**	6.7	0.6	**0.00**
2.8. - When I find an article it is usually accessible and available.	0	1.8	**23.2**	**74.9**	0.46
/ / 1 = Strongly Disagree / / 2 = Disagree / / 3 = Agree / / 4 = Strongly Agree / /					

Only 6.1% of the students in the sample use the database Directory of Open Access Journals (Item 2.3) and 12.7% of students use open access repositories (Item 2.7). Despite the low percentage, the training program has significantly improved the use of open access repositories (Item 2.7).

The analysis shows that 50.2% of students used Wikipedia to support their work in college (Item 2.5) prior to the training program. After the training program, the detailed posttest shows that only 25% of students continue to use Wikipedia to support their work, a significant reduction of this inadequate practice as detailed by the values of the Wilcoxon test.

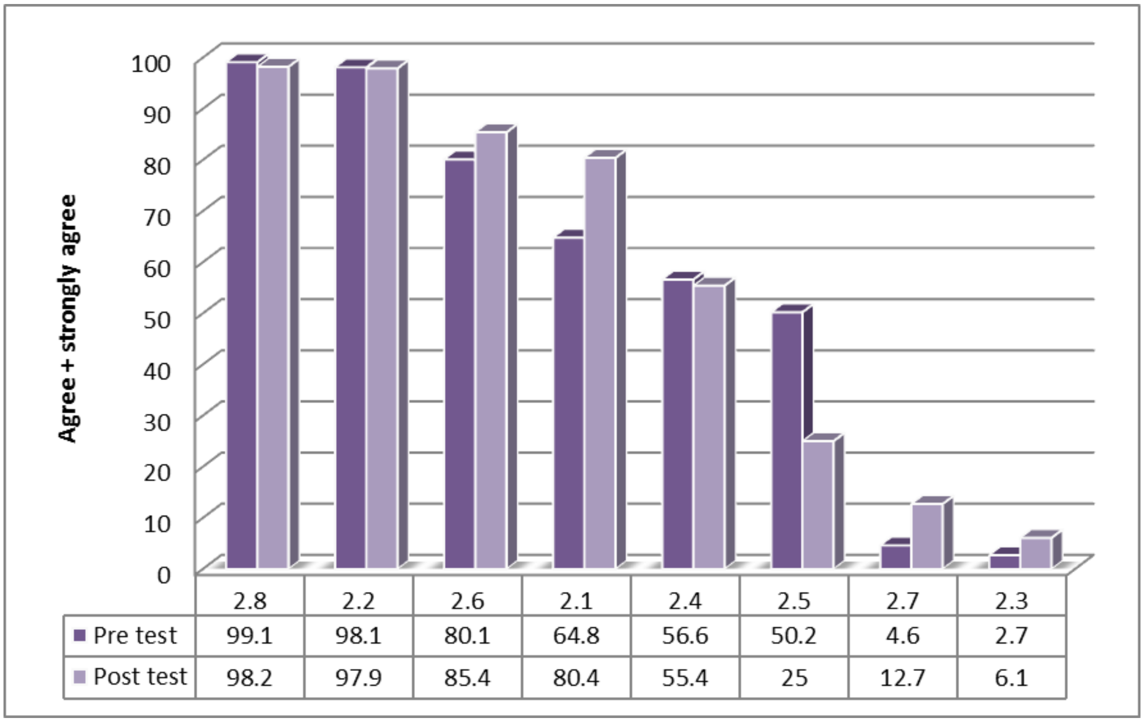

Figure 2. Dimension 2. Using open access to access knowledge.

Open Questions

The open questions are formulated to allow students to answer freely giving details and their particular perspective. This resulted in a number of responses of interest, which are analyzed by the program HyperResearch V 1.25. The students in the sample responded by providing diverse opinions openly as a result of the nature of the following open question: 2.9AB.-What tools do you use when you try to read an article and it is not freely available?

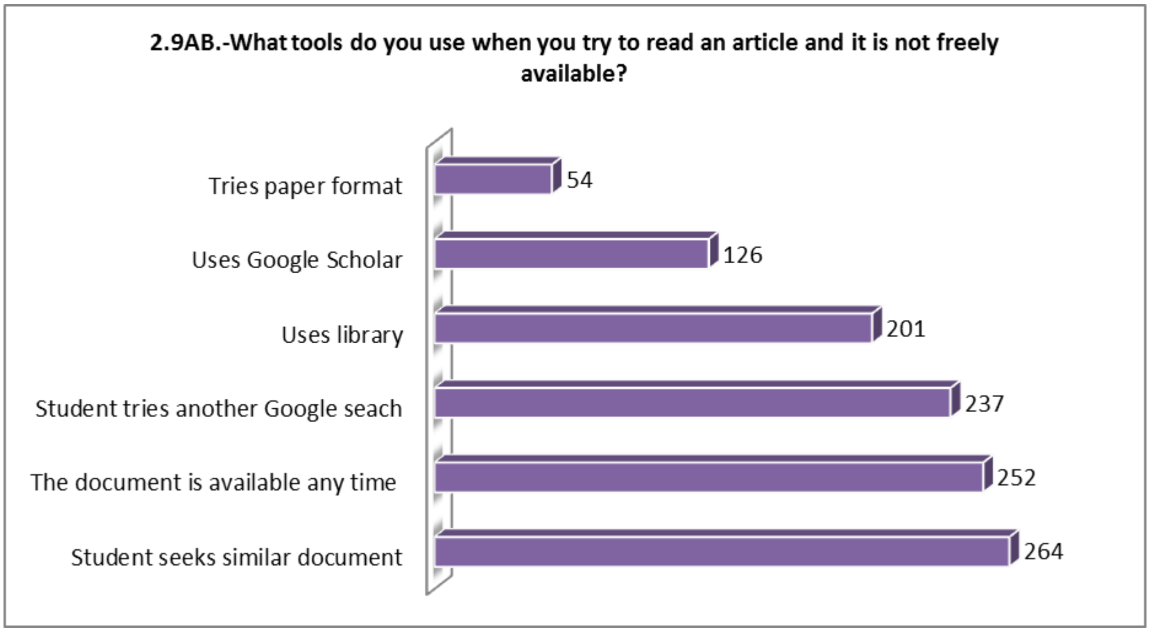

Figure 3. Open Question 2.9AB. Frequencies.

The most frequent responses suggest that students tend to find an available document. When they have access problems, they perform a new search using Google. To a lesser extent, they search in libraries, use Google Scholar, or opt for a paper format.

Factor Analysis

An exploratory factor analysis is proceeding in both of the dimensions studies in order to examine the underlying relationships between the variables. Data in Table 1 verify that it is constructive to proceed with a factorial analysis. The Kaiser-Meyer-Olkin test value is 0.825 and the Bartlett sphericity test shows a correlation that is significant (0001). The extraction method is principal components and the rotation method is Varimax with Kaiser (Table 4). Three factors are nominated:

1. tools to access knowledge,

2. importance of free access to social development,

3. knowledge of the availability of open access.

Table 4

Dimension 1. Rotated Component Matrix. Extraction Method: Principal Components Analysis. Rotation Method: Varimax with Kaiser

	Component		
	1	2	3
1.1. - I know the existence of open access journals to support my work			.732
1.2. - I believe that access to articles must be free		.421	.698
1.3. - I know the Directory of open access Journals (DOAJ)	-.428		
1.4. - I know what academic Google is (Google Scholar)	.690		
1.5. - I believe that subscriptions to journals are unfair	.613		
1.6. - Knowledge should be free and accessible online		.678	
1.7. - Open access helps to develop society		-.648	
1.8. - I know the ranking of journals in SCOPUS	.542		

In Table 3, the data provided by the analysis of Kaiser-Meyer-Olkin have a value of 0.782 and Bartlett's sphericity test is significant (0.000). This information verifies that it is constructive to proceed with a factorial analysis. The extraction method is principal components analysis and rotation method is Varimax with Kaiser (see Table 5). Four factors are nominated:

1. theoretical foundations,

2. tools to access information,

3. ease of finding free content,

4. use of repositories.

Table 5

Dimension 2. Rotated Component Matrix. Extraction Method: Principal Components Analysis. Rotation Method: Varimax with Kaiser.

	Component			
	1	2	3	4
2.1. - I use open access scientific journals to support my work	.662			
2.2. - I use Google to find theoretical information for my work			-.689	
2.3. - I use the Directory of Open Access Journals (DOAJ)		-.682		
2.4. - I use Google Scholar	.491	.401		
2.5. - I tend to use Wikipedia to support work	.414	-.545		
2.6. - On occasion, I based my work with journal articles	.687			
2.7. - I use open access repositories (epubs, eprints, DSpace, Fedora, Citebase ...)				.877
2.8. - When I find an article, it is usually accessible and available			.568	

Conclusions

Consistent with the objectives of the study, utilizing the information obtained in the various tests and with data triangulation, it can be concluded:

1. College students (100%) have very positive attitudes and opinions regarding the free access to knowledge and they consider (97.9%) that this approach contributes to the improvement of society (Table 2, Items 1.2, 1.5, 1.6, 1.7, and Table 4).
2. The training program implemented (PICMD) has statistically significant efficacy regarding students' knowledge of scientific journals and tools, that is DOAJ, Google Scholar, SCOPUS rankings, and repositories. The aforementioned program reduces the use of Wikipedia from 50.2% to 25%. (Table 2, Table 3, Items 1.1, 1.3, 1.4, 1.8, and 2.5, 2.7, 2.9AB, Table 4, and Table 5). Therefore, it is necessary and advisable to implement training related to this information as part of university instruction.
3. The study shows that 97.9% of Spanish university students use Google to search academic content and 55.4% use Google Scholar. Also, 98.2% of the students in the sample find available and accessible articles every time they perform a search (Table 3, Items 2.2, 2.4, 2.8, and 2.9AB).

4. Although 85.4% of students base their work on scientific journals, only 6.1% of students use the DOAJ and 12.7% use repositories (Table 3, Items 2.3, 2.6, and 2.7).

The attitudes of students towards open access are very favorable. Students use Google to find articles. Most consider Google an efficient option as indicated by Norris, Oppenheim, and Rowland (2008), who reported in their research that 86% of articles could be found using either Google or Google Scholar. Approximately half of the students use Google Scholar. However, databases and repositories are very rarely used by students.

The training activity (PICMD) has introduced students to open access and it has reduced the use of unreliable sources. The students have learned about databases, repositories, rankings, and other tools that provide access to reliable sources.

Spanish language journals are accessible and freely available. Accordingly, 98.2% of the students found academic content without problems (Item 2.8). Although limited access is a real problem for many students (Shields, Rangarajan, & Stewart, 2012), the need for open access is not as urgent in the Spanish context.

In short, fostering university training aimed at helping students to find and manage rigorous and reliable sources of information is essential. Although students do not experience limited access to Spanish language articles, it is very important to provide them with the necessary training so they are able to perform a critical analysis when they manage information. It is important for students to utilize academic information in college, and they should be encouraged and motivated to use reliable and valid sources. The positive feedback from students about the concept of open access should be kept in mind. Students have positive attitudes and clear ideas, and, now, they simply need to be implemented.

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IRRODL
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Student and Faculty Outcomes of Undergraduate Science Research Projects by Geographically Dispersed Students


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Abstract

Senior undergraduate research projects are important components of most undergraduate science degrees. The delivery of such projects in a distance education format is challenging. Athabasca University (AU) science project courses allow distance education students to complete research project courses by working with research supervisors in their local area, coordinated at a distance by AU faculty. This paper presents demographics and course performance for 155 students over five years. Pass rates were similar to other distance education courses. Research students were surveyed by questionnaire, and external supervisors and AU faculty were interviewed, to examine the outcomes of these project courses for each group. Students reported high levels of satisfaction with the course, local supervisors, and faculty coordinators. Students also reported that the experience increased their interest in research, and the probability that they would pursue graduate or additional certification. Local supervisors and faculty affirmed that the purposes of project courses are to introduce the student to research, provide opportunity for students to use their cumulative knowledge, develop cognitive abilities, and independent thinking. The advantages and challenges associated with this course model are discussed.

Keywords: Distance education; undergraduate research; senior undergraduate project; science education; research supervisor; research mentor

Introduction

Most educational jurisdictions require post-secondary institutions to have some sort of undergraduate research experience in the sciences[1] to meet their program (and sometimes institutional) accreditation. While research has been present in many bachelor's degrees over the years, it is only relatively recently that it is being explicitly identified as an essential component and made mandatory. Indeed, major government initiated studies like the report from the Boyer Commission (1998) in the US clearly signaled 'integrating research and education' with a move to 'scholar-teachers' and 'research-based learning.' From the academic perspective, the benefits of undergraduate research in science are also well established and there is strong consensus in the literature that it is an effective vehicle for learning (Short, Healey, & Romer, 2010; Seymour, Hunter, Laursen, & DeAntoni, 2004; Bauer & Bennett, 2003; Kardash, 2000). Furthermore, in the sciences the approach to learning is problem solving and scientific inquiry, and this forms the model for navigating and dealing with hypotheses, facts, laws, and theories (Kennepohl, 2013). It is therefore not surprising that the practical components (laboratories, field work, clinics) are at the heart of most science programs, or that more research activities are being introduced at the undergraduate level (Taraban & Blanton, 2008).

The integration of research in an undergraduate program has many facets and is not trivial in its identification let alone its implementation. Healey (2005) presents a four-quadrant matrix (research-based, research-led, research-tutored, and research-oriented) which describes the research-teaching nexus and provides a useful framework and taxonomy for the variety of research activities that may be found within the curriculum. This study will focus on undergraduate research in the form of the senior science project, which—being student focused and emphasizing research processes and problem solving—is clearly research-based within the Healey matrix. Most bachelor degree programs in the sciences will have some sort of senior project (i.e., research project, design project, undergraduate thesis) that is used as a capstone course. By doing the project, students draw on experience and knowledge gained from earlier foundational courses and demonstrate their ability to pull it all together while creating or discovering something new. In addition to the learning benefits alluded to earlier, it also gives students a practical glimpse of what research work is about to make decisions around career direction and allows the institution to assess learning outcomes at the program level.

The delivery of undergraduate research programs (URPs) in the sciences presents additional challenges compared with the on-campus environment, where students typically work in university laboratory facilities, on research projects directed by faculty members. For distance learners, access to university research facilities is generally very inconvenient. Approaches to the distance delivery of URPs include (1) limiting the

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[1] Sciences refers to all science-related disciplines including engineering and allied health disciplines.

research project to a literature search, (2) having the student access and work up raw data already collected from publically available databases, and (3) offering a limited number of pre-canned projects that involve independent field work or coming into a supervised laboratory. One interesting example is the environmental sciences program at the Open University (Netherlands), where the project interface is completely online. Four-student project teams are commissioned by external clients to provide consulting products to gain real working experience and do it entirely at a distance (Ivens, De Kraker, Bitter, & Lansu, 2007). While many of these approaches deal with the distance problem, they do not offer the same degree of freedom or the same research-learning environment for all science disciplines that the on-campus students enjoy.

This paper presents the Athabasca University (AU) model for undergraduate research across a range of science disciplines in the form of senior project courses, which is both unique and addresses many of the challenges in accomplishing this successfully at a distance. It also presents the results of an initial study into the effectiveness of these project courses, in terms of outcomes for students. The study includes analysis of student demographics and performance data, and surveys of students, faculty members, and external supervisors, examining the outcomes of these project courses for each group. This is one of the first research studies to investigate the problem of how distance learners can participate in undergraduate research programs.

Description of the AU Project Courses

The project courses in the Faculty of Science and Technology are open research-based senior undergraduate courses that act primarily as a capstone for the Bachelor of Science degree. They are available in a range of disciplines including astronomy and astrophysics, biology, chemistry, computing and information systems, environmental science, mathematics, nutrition, geography, geology, physics, and science. These courses are student-initiated (project proposal) and are based on a contracted-study arrangement (learning contract) worked out between an individual student, an approved project supervisor, and Athabasca University. Each discipline has two 3-credit (one term) project courses available (e.g., in chemistry there is CHEM 495 and CHEM 496), which can be used by the student as two unrelated projects or used together as continuous research work in one area spanning two terms (one year) for 6 credits.[2]

To obtain approval to enrol in the course the student submits a “project proposal,” which is essentially a two-page form sent out by the course professor. Information required on the form includes student contact details, background and educational goals, relevant courses already completed, topic or specific problem to be solved, methods to be used, materials to be used, possible project supervisor, expertise and credentials of the proposed supervisor, and expected start date of the project. The

[2] A four-year BSc consists of 120 credits.

identification and selection of an appropriate local project supervisor is very important, especially in disciplines where close direction is needed in the laboratory or field. These supervisors can be professors at other universities or experienced researchers in government or industry. In some cases, students will choose a supervisor from work and also incorporate their jobs in their learning activities.

The project may involve any combination of library, field, and laboratory work, as agreed to by the student and the project supervisor in a "learning contract" between the student and Athabasca University. The learning contract states what is to be done in the project, how and when it will be done, how it will be evaluated, and how many credits will be awarded. Not only does this individualize and personalize the project allowing students to learn using their own learning styles, and work at their own rates, it also serves to focus that work by setting clear expectations and mitigates miscommunications.

Methodology and Results

This study consists of two major components meant to complement one another. First, student demographics and performance data (e.g., enrollments, pass/fail rates, average grades, etc.) was retrieved and analyzed. Data came from 155 students who had registered in 495/496 project courses in the previous five years. Statistical tests (student's *T*-test and Pearson correlation) were performed using Microsoft Excel functions.

Second, a selection of students, local supervisors, and professors/coordinators were surveyed or interviewed to provide more in-depth qualitative information and personal perspectives. The methodology and data handling were approved by the AU Research Ethics Board. The surveys were voluntary so respondents were self-selecting. The specific survey and interview questions employed are attached as supplementary material. Sixty-five students, who had completed a 495/496 course and for which valid email addresses were available, were invited by email to complete the anonymous online student survey. Thirty-one students completed the survey, giving a 48% response rate. Eleven local supervisors were recruited randomly and interviewed by phone. The entire group of professors/coordinators for 495/496 courses (n = 9), not including one of the authors (Shaw), were interviewed by phone.

Student Demographics and Performance

The course statistics show that there is no real difference in student performance with respect to gender. The summary shown in Table 1 indicates both average grade and distribution between pass, fail, and nonstart students is very similar between male and female students. There are a considerable number of students (29%) who are completely inactive and do not complete the course. They have been designated as “nonstart” students.

Table 1

Summary of Student Performance by Gender

	Female		Male		Total	
Average grade (%)*	84.4		83.5		84.0	
	N	%	*N*	%	*N*	%
Pass	43	64.2	56	63.6	99	63.9
Fail	5	7.5	6	6.8	11	7.1
Nonstarts†	19	28.4	26	29.5	45	29.0
Total	67	100	88	100	155	100

*Average grades between female and male is statistically insignificant (p = 0.64)

† Nonstarts are defined as registered students who show no activity in the course.

The science project students are about 37 years old on average. There is no correlation between grade achieved and age (R = 0.03). The average student age in various performance categories and by gender was examined (Table 2). Males appear slightly older than females (especially in the pass and fail categories), but are statistically the same age ($p > 0.05$). Among the categories themselves the only significant difference in average age is between the pass (39.1 y) and nonstart (33.5 y) students.

Table 2

Summary of Student Age by Performance

	Age (y)			
	Average*	Female	Male	*p*
Pass	39.1	37.2	40.5	0.08
Fail	35.1	28.2	40.8	0.07
Nonstarts	33.5	33.6	33.5	0.95
Total	37.2	35.5	38.4	0.06

*The only statistical difference is between the average age of students that pass and who are nonstarts (p = 0.0013).

A review of individual disciplines shows the pass rate to vary from 43 to 74% (Figure 1). While there also appears to be a variation in grades (53-87%) between disciplines, they are all statistically the same. The geographic distribution of students is shown in Figure 2. Students were located across Canada, with less than 1% located outside of Canada. The majority of students were located in Alberta, the province in which AU is located.

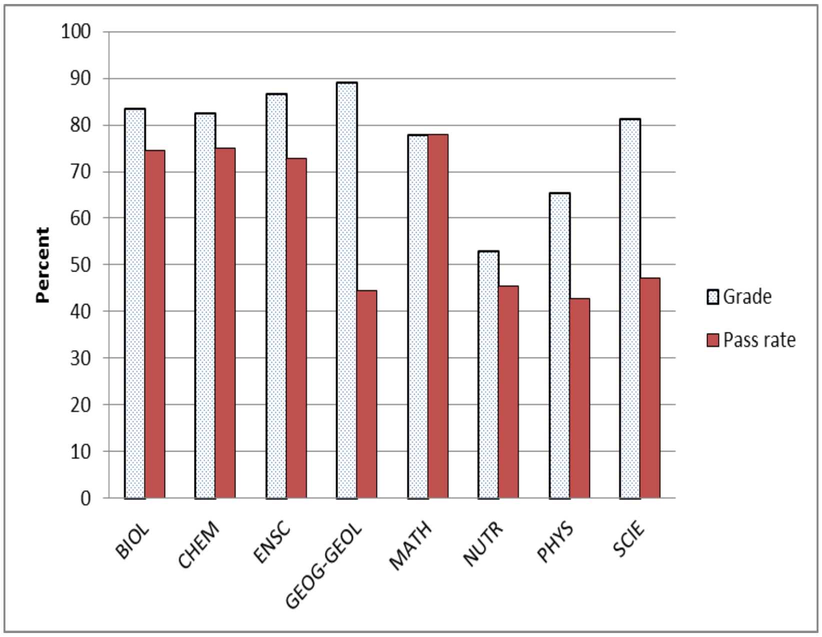

Figure 1. Average grades and pass rates by discipline. There is no statistical difference in average grades between disciplines.

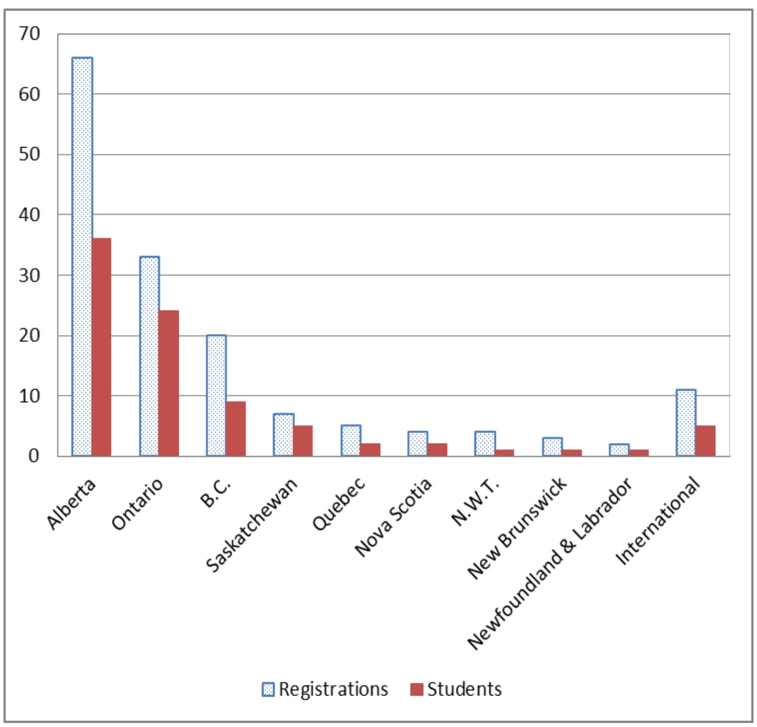

Figure 2. Geographic distribution of registrations and students. The number of students is always lower than the number of registrations because some students undertake multiple projects.

Student Perspective

The student survey indicated that the overall project course experience was positive for students with 90% stating that they valued it. The majority were satisfied or very satisfied with the local supervisor (81%) and the course coordinator (95%). Furthermore, 85% reported the experience increased their interest in research and 79% were more likely to pursue graduate or additional certification. In probing students about what abilities and skills they developed as a result of their project experience they affirmed growth in areas suggested by the survey such as literature searching skills (48%), laboratory skills (23%), learning how research is conducted (42%), communication skills (45%), and some respondents (32%) also suggested other areas of development like data analysis and statistics, writing, field skills, and Research Ethics Board application skills. In addition to earning credit students noted that the project course helped advance their career in several ways including getting a summer job (in one case an internship with the Smithsonian Institute), helping with medical school and graduate school acceptance, obtaining professional certification, and acquiring faster promotion at work. A substantive number of students (35%) reported they needed more than the six-month contract time allotted for the course. The biggest positives noted by students of their experience included being introduced to research, the opportunity to do “real research,” the great flexibility around location, time spent and research topic, and the opportunity to discover future directions for their own education. The students also were critical of several areas including clarity of expectations from the professor and the process, lack of feedback during the project, developing the initial proposal, and lack of face-to-face discussion with the professor.

Local Supervisor Perspective

Of the eleven interviewed, each supervised only one AU student. However, 6 out of 11 had experience with students at this level outside of AU. They noted that AU students are more motivated, more intense, and come with more experience and higher skill sets. In all cases, supervisors were approached by someone they already knew with doing a project. All would supervise another student (given the specific details of the specific project and if they had time) and cited several personal benefits to being a supervisor including following their own professional curiosity, getting academic supervising experience, obtaining insight into a new technique or area of research, helping their unit or department through staff development, and gaining a better relationship with the student. Collectively there was a solid understanding around the purpose of an undergraduate research project.

Not only did everyone agree and affirm suggested aims in the survey (such as introducing the student to research, providing an opportunity for students to use their cumulative knowledge, developing cognitive abilities and independent thinking) they also added several other goals including experience for graduate school, excellent capstone and opportunity to “bring it all together,” improving scientific writing (organizing and structuring reports), developing self-leadership, exposure to research tools, getting real world experience, and moving from passive to active learning. All stated that their student improved as a result of the project course and acquired many of the skills noted above.[3] The biggest positives mentioned by local supervisors were around the flexibility and openness of the course structure, the opportunity to mentor, gaining experience as an academic supervisor, and seeing the student grow. Criticisms of the course experience included concerns around grading and marking, logistical uncertainty around what to do or what was expected, and the low interaction and communication with the university and the course professor.

Professor Perspective

Compared to local supervisors, the professors and coordinators who oversee the project courses reported slightly different views on the purpose of undergraduate research project courses. While 5 out of 9 explicitly agreed with all of the suggested aims in the survey, the other four individuals strongly emphasized that the principal purpose of undergraduate research courses is to introduce students to research. They spoke of the importance of learning the process of research: formulating a research problem, designing the experiment, and responding to expected and unexpected data. For example, one professor described how researchers must adapt and modify their experiments based on results: "The project course allows students to make decisions based on results." Several professors made similar comments about how the undergraduate research experience was meant to give students the ability to deal with uncertainty and unexpected results.

Professors uniformly responded that they benefit from undergraduate projects courses by furthering their own research programs. Two coordinators, who do not have research programs, reported intellectual stimulation and networking as benefits. Professors saw no personal benefit was gained from having students work with external supervisors. Comments revealed that several professors make an effort to design research projects that can be completed at a distance, that are part of their own research programs. These projects usually involved computer analysis of data that can be done on the student's desktop computer at home.

Professors and coordinators noted that, compared to residential universities, research students operating at a distance are disadvantaged by the lack of contact with academics and student peers. One professor stated that at a residential university, "...the student is working in the same environment and they have better contact with students who can share similar experiences. It's easier for students to learn from the other students. The isolation places limitations on the student." On the other hand, two professors noted that AU is well equipped to communicate with students who are at a distance, for example through web video conferencing.

[3] One was supervising a nonstart student.

Discussion

The student survey results in this study are consistent with other literature that shows students reporting improved skills and abilities after participation in undergraduate research programs (URPs). For example, alumni who experienced undergraduate research experienced a number of benefits compared to those who had no undergraduate research experience (Bauer & Bennett, 2003). Benefits included improved skills and abilities, such as analyzing literature, speaking effectively, and acting as a leader. Participation in graduate studies has been shown to be significantly higher for students who have participated in URPs (Bauer & Bennett, 2003; Hathaway, Nagda, & Gregerman, 2002). In a study of undergraduate wildlife students, those students who participated in a URP had a higher GPA, graduated sooner, and obtained employment in their area of study sooner compared to the control group (Kinkel & Henke, 2006). The following quote from a BSc graduate, who took several 495/496 courses, is illustrative of the impact these courses can have on a student's education and career:

> After so many years I have finally achieved one of my most sought after life goals. My favourites were the chemistry and science projects courses... I was able to develop real products at work (oilfield service company chemist) and get course credit for them. This was the best training for a career in the field. (Brian O'Neil BSc, Athabasca University Annual Report 2004-2005)

The benefits of URPs to faculty members have not been studied as much as the benefits to students. One case study reported how undergraduate research could be integrated with the mentorship of junior faculty members (Thomas & Gillespie, 2008). However, there is evidence that faculty are not directly rewarded for supervising or mentoring undergraduate research students. The most important reward for faculty is getting research done, and undergraduate research students can contribute to that (Merkel, 2001). Indeed, in our study, all of the research faculty members stated that they benefit from the project courses by furthering their own research. Interviewed faculty members noted that there is no direct reward for them to coordinate undergraduate research when it is taking place at some other institution or workplace, and not contributing to their own research program. Further rewards and recognition for URP supervision and mentoring would likely improve the quality of the student experience and expand opportunities for students.

At most large research universities, undergraduate research opportunities are limited by student-faculty ratio (Merkel, 2001). That is, there is a limit to the number of students who can be supervised individually by a single faculty member. One suggestion is to look to external institutions for other research supervisors (Merkel, 2001). This approach has been used in a master's level chemistry program, where students complete research that is compatible with laboratories in their workplace (Kellogg, 2011). The 495/496 course model, in which the location of supervisors and research facilities is not restricted, is significantly more scalable than what is possible when the undergraduate research is only possible in on-campus laboratories, and supervised by faculty. The scalability may be hampered by the lack of obvious rewards for faculty, as discussed above.

The course pass rate for project courses is 64%, which is comparable to pass rates for undergraduate independent study courses at open universities of 55-60% (Powell, 2009). Nonstart students represent 29% of the total enrolments in these project courses. This considerable number suggests that administrative systems are not effective in ensuring communication with new students or in connecting them to the faculty members who coordinate the 495/496 project courses. This seems to be confirmed by student comments about the lack of clarity of expectations and the process of starting a project.

The desire for more effective communication with faculty members was expressed by both external supervisors and the project students themselves. This was the most common criticism of the way 495/496 courses were operated. The 495/496 courses are administered almost entirely by the faculty. Each project is unique, and the students start and finish their projects at different times of the year. Over the time period of this study, each external supervisor only supervised one student. Thus, the 495/496 courses can be considered to be completely customized to each student. Due to the lack of any common features among projects, there is an inherent inefficiency in operating an administrative system that ensures each student and external supervisor are contacted at regular intervals. It is also challenging for faculty to keep track of, and this is a faculty workload issue. This is a very different situation from URPs at face-to-face institutions with semesters. In those URPs, students work on their individual projects as a cohort, with identical completion deadlines – usually the end of the academic year. Further, a faculty member or committee is responsible for coordinating and assessing student projects, and this is a major part of their workload. In the 495/496 courses, it is clear that more frequent contact and feedback is desired by students and external supervisors. As this is the most frequently reported opportunity for improvement, it will be important to examine ways to improve the level of contact. These criticisms underline the importance of faculty involvement in URPs, and confirm the findings of other studies (Hunter, Laurson, & Seymour, 2007; Russell, Hancock, & McCullough, 2007) that show that faculty mentors play a major role in facilitating positive outcomes for students.

Social constructivist learning theories can be applied to URPs in science (Hunter, Laurson, & Seymour, 2007). A URP can be seen as an apprenticeship in research, in which the student engages in hands-on research with a mentor (i.e., research supervisor). Students and mentors collaborate together on research, and in the process students learn how research is conducted. The collaboration is inherently studentcentred, and occurs in a 'situated' context. There is an opportunity for further research into the interactions between research students and their mentors, in the unique situation of a distance-delivered URP.

Conclusions

Undergraduate research courses are a vital part of any BSc program, but its appropriate integration can be challenging. This is much more so at universities offering courses online and at a distance. Our surveys revealed some areas for improvement in the AU model including improving communications with students and external supervisors and providing incentives or recognition to faculty to coordinate research projects with those external supervisors.

However, this current model of science project courses is unique in providing accessible, individualized undergraduate research opportunities that

1. can incorporate real research activities (including supervised work) that can be carried out without coming on campus;
2. is very scalable because external supervisors are employed; and
3. allows students to work on a research project that is tailored to their own interests.

The key feature at the heart of the AU model is the three-way learning contract that not only allows for variety and tailoring of the research topic, but also the activities and assessment of the learner. It serves as the primary communication conduit and acts as the vehicle to both project proposal and project management. Student outcomes are largely positive in terms of developing new abilities, and furthering their educational and career ambitions.

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THE INTERNATIONAL REVIEW OF RESEARCH IN OPEN AND DISTANCE LEARNING

Factors Influencing Students' Acceptance of M-Learning: An Investigation in Higher Education


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Abstract

M-learning will play an increasingly significant role in the development of teaching and learning methods for higher education. However, the successful implementation of m-learning in higher education will be based on users' acceptance of this technology. Thus, the purpose of this paper is to study the factors that affect university students' intentions to accept m-learning. Based on the unified theory of acceptance and use of technology (UTAUT) (Venkatesh et al., 2003), this study proposes a model to identify the factors that influence the acceptance of m-learning in higher education and to investigate if prior experience of mobile devices affects the acceptance of m-learning. A structural equation model was used to analyse the data collected from 174 participants. The results indicate that performance expectancy, effort expectancy, influence of lecturers, quality of service, and personal innovativeness were all significant factors that affect behavioural intention to use m-learning. Prior experience of mobile devices was also found to moderate the effect of these constructs on behavioural intention. The results of this research extend the UTAUT in the context of m-learning acceptance by adding quality of service and personal innovativeness to the structure of UTAUT and provide practitioners and educators with useful guidelines for designing a successful m-learning system.

Keywords: Mobile learning; m-learning; unified theory of acceptance and use of technology (UTAUT); behavioral intention; students' acceptance; students' intention

Introduction

M-learning is a new stage in the development of e-learning and distance learning. It refers to any learning which takes place via wireless mobile devices such as smart phones, PDAs, and tablet PCs where these devices are able to move with the learners to allow learning anytime, anywhere (Naismith et al., 2006; Wang, Wu, & Wang, 2009).

The fast spread of mobile devices and wireless networks within university campuses makes higher education a suitable place to integrate student-centered m-learning (Cheon et al., 2012). Mobile learning that utilizes ubiquitous devices will be a successful approach now and in the future because these devices (PDA, tablet PC, smart phone) are more attractive among higher education students for several reasons; one of them is that the mobile devices are cheaper compared with normal PCs; also, they are satisfactory and economical tools (Mohamad et al., 2010). Mobile devices have become more affordable, effective, and easy to use (Nassuora, 2012). These devices can extend the benefits of e-learning systems (Motiwalla, 2007) by offering university students opportunities to access course materials and ICT, learn in a collaborative environment (Nassuora, 2012), and obtain formative evaluation and feedback from instructors (Crawford, 2007).

The connection between e-learning and m-learning is suggested by Peter (2007) in the 'just enough, just in time, just for me' model of flexible learning. Figure 1 explains the model which shows that e-learning and m-learning are both subsets of flexible learning. Although there is an intersecting area between e-learning and m-learning, the latter is not fully a subset of the former as there is an m-learning area located beyond the boundary of e-learning. This means that e-learning does not always include m-learning aspects.

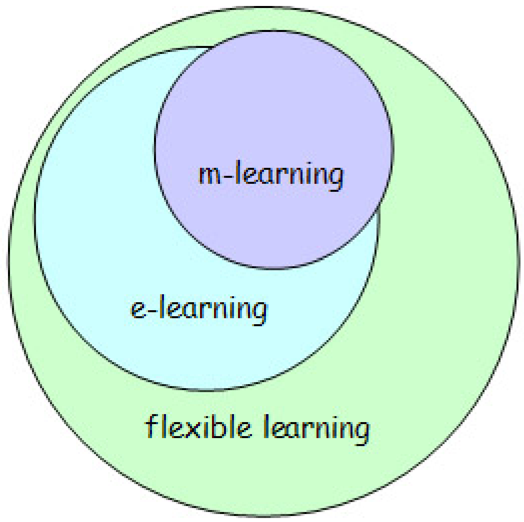

Figure 1. The 'just enough, just in time, just for me' model of flexible learning (Peter, 2007).

M-learning can provide wireless communication between lecturers and students and between students themselves. It can work as additional support to complement and add value to existing learning models (Motiwalla, 2007). In addition, it is expected to become one of the most effective ways of delivering higher education materials in future (El-Hussein & Cronje, 2010).

Mobile learning applications have been utilized in university teaching and learning settings. Cavus and Ibrahim (2009) investigated the ability of learning new English language words using short message service (SMS). Wu et al. (2012) designed a context-aware mobile learning system for nursing training courses. The aim of the learning system is to guide nursing students to practice a physical assessment including gathering patient symptoms, identifying disease, and providing nursing treatment.

There are several issues facing the adoption of m-learning, and there are pedagogical issues regarding the use of mobile devices in classrooms; will it disturb the learning process? (Corbeil & Valdes-Corbeil, 2007; Park, 2011). Also, will users (both students and lecturers) adopt this technology? Users may not be willing to accept m-learning (Wang, Wu, & Wang, 2009). In addition, some university lecturers do not want to apply this technology or might face difficulties in trying to use it effectively as this new technology may require a lot of effort to implement (Abu-Al-Aish, Love, & Hunaiti, 2012).

Students' perceptions of m-learning need to be investigated at the initial step of implementing m-learning in higher education (Cheon et al., 2012). Therefore, it is necessary to conduct research that identifies the factors university students consider important in the acceptance of m-learning. Some studies have investigated the acceptance of m-learning using technology acceptance models (Wang, Wu, & Wang, 2009; Park et al., 2011; Liu, Li, & Carlsson, 2010). However, no study has investigated the influence of university lecturers and the quality of m-learning service on students' behavioral intention to adopt m-learning. Furthermore, students' confidence with mobile device technologies affects their acceptance of m-learning. Therefore, there is a need to clarify the effect of mobile devices experience on the acceptance of m-learning. Students might need training in the basic functions and applications of m-learning technologies (Cheon et al., 2012).

The objective of this study was to investigate the factors influencing university students' acceptance of m-learning and to point out if prior experience of mobile device differences affects university students' acceptance of m-learning.

Review of the UTAUT Model and its Implementation in M-Learning Acceptance

A number of models have been developed to examine individuals' acceptance and intention to adopt new technologies in the world of information systems. Davis (1989) tried to determine what causes people to accept or reject information technology. The most widely used model in the field of technology adoption is the technology acceptance model (TAM) (Davis, 1989). The idea of TAM is to give a theoretical basis to explain the impact of external variables (i.e., objective system design characteristics, training, computer self-efficacy) on internal beliefs, attitude toward use, behavioral intentions, and actual system use (Ibrahim & Jaafar, 2011).

Another popular and recent model in information technology acceptance is the unified theory of acceptance and use of technology (UTAUT). This theory was proposed by Venkatesh et al. (2003) and attempts to integrate and empirically compare elements from different technology acceptance models in technology acceptance.

The UTAUT contains four determinants of IT user behaviour and four moderators that are found to moderate the effect of the four determinants on the behaviour intention and user behaviour. UTAUT theorizes that performance expectancy, effort expectancy, social influence, and facilitating conditions are direct determinants of behaviour intention or user behaviour. This gives appreciable improvement to the explanatory power of the model. Also the moderating variables (gender, age, experience, and voluntariness of use) are very important in understanding the characteristics of different user groups (see Figure 2).

Venkatesh et al. (2003) indicate that UTAUT has the ability to explain about 70% of variance in the intention. It has been shown that UTAUT outperforms the previous models (Venkatesh et al., 2003). In addition, it can provide a useful tool for managers to assess the success of the new technology (Ibrahim & Jaafar, 2011).

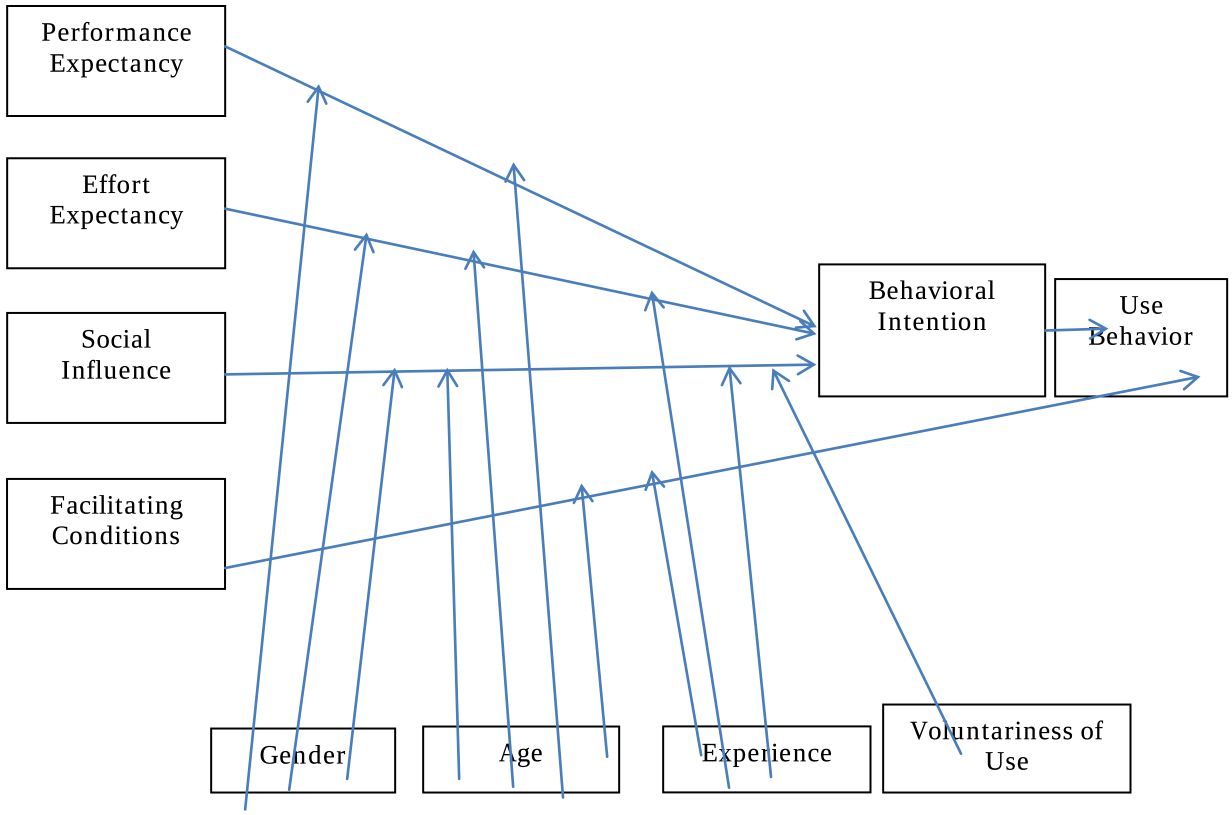

Figure 2. The unified theory of acceptance and use of technology (UTAUT) model (Venkatesh et al., 2003).

Several studies addressed the factors that affect students' acceptance of m-learning. Table 1 provides some studies on m-learning acceptance using UTAUT. The results indicate that student's acceptance of m-learning is key in designing a successful m-learning system. Therefore, there is a need to investigate the factors that affect their acceptance of m-learning and to overtake all challenges that face the success of the factors.

Table 1

Studies on M-Learning Acceptance

Author	IS application	Samples	Results
1. Liu, Y. (2008)	m-learning	A conceptual model	In addition to the basic factors of UTAUT, the model incorporates self-efficacy, mobility, attainment value, perceived enjoyment, and self-management of learning in order to explain learners' behaviour intention.
2. Ju et al. (2007)	m-learning	245 university students	Perceived self-efficacy significantly influences perceived ease of use, which positively impacts perceived usefulness. Perceived usefulness significantly affects users' attitude which further impacts the intention to use m-learning
3. Iqbal & Qureshi (2012)	m-learning	250 universities students in Pakistan	Using UTAUT, all factors, ease of use, perceived usefulness, facilitating conditions, social influence, and perceived playfulness, have significant effects on behavior intention.
4. Lownthal (2010)	m-learning	113 university students	Using UTAUT, the results indicated that performance expectancy, effort expectancy have significant effects on behavioral intention. Self-management of learning is not significant. Age and gender were determined to have no mediating impact.
5. Jairak, Praneetpolgrang, & Mekhabunchij (2009)	m-learning	390 university students	The study was conducted using UTAUT based upon TAM. The results indicated that performance expectancy, effort expectancy, and social influence have a significant positive relationship with attitude towards behavior. Furthermore, effort expectancy, social influence, and facilitating condition have a significant positive relationship with behavioral intention.
6. Wang, Wu, & Wang (2009)	m-learning		Using the UTAUT, Wang, Wu, & Wang (2009) conducted a study to investigate the determinants of m-learning acceptance and to explore if age or gender differences play a significant role in the acceptance of m-learning. The researchers combined two additional constructs into the UTAUT in order to apply this theory for m-learning acceptance; they added perceived playfulness and self-management of learning. The results indicated that performance expectancy, effort expectancy, social influence, perceived playfulness, and self-management of learning were all significant determinants of behavioral intention of m-learning acceptance

Using the UTAUT, Wang, Wu, and Wang (2009) conducted a study to investigate the determinants of m-learning acceptance and to explore if age or gender differences play a significant role in the acceptance of m-learning. The researchers combined two additional constructs into the UTAUT in order to apply this theory for m-learning acceptance; they added perceived playfulness and self-management of learning.

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Research Model

After considering the factors that might affect users' acceptance of m-learning we combined two additional constructs into UTAUT in order to investigate the factors that might affect university student acceptance of m-learning: quality of service and personal innovativeness. In addition, we oriented the social influence construct in UTAUT to explore the lecturers' influence on behavioral intention. There is no implementation of m-learning in Brunel University. The learning management system in Brunel University offers a series of online courses that can be accessed via Blackboard. Therefore, this study attempted to investigate the effect of the above constructs on behaviour intention to use m-learning. (Use behaviour and facilitating conditions were not investigated in the study.) As a majority of students fall within the same age and a high percentage of them are males, we did not test for the effect of age and gender. Also, as we investigated the acceptance of m-learning in a voluntary usage context, voluntariness of use was eliminated. However, we tested if mobile devices experience would moderate the influence of these factors on behavioral intention. The research model to be tested in this study is shown in Figure 3.

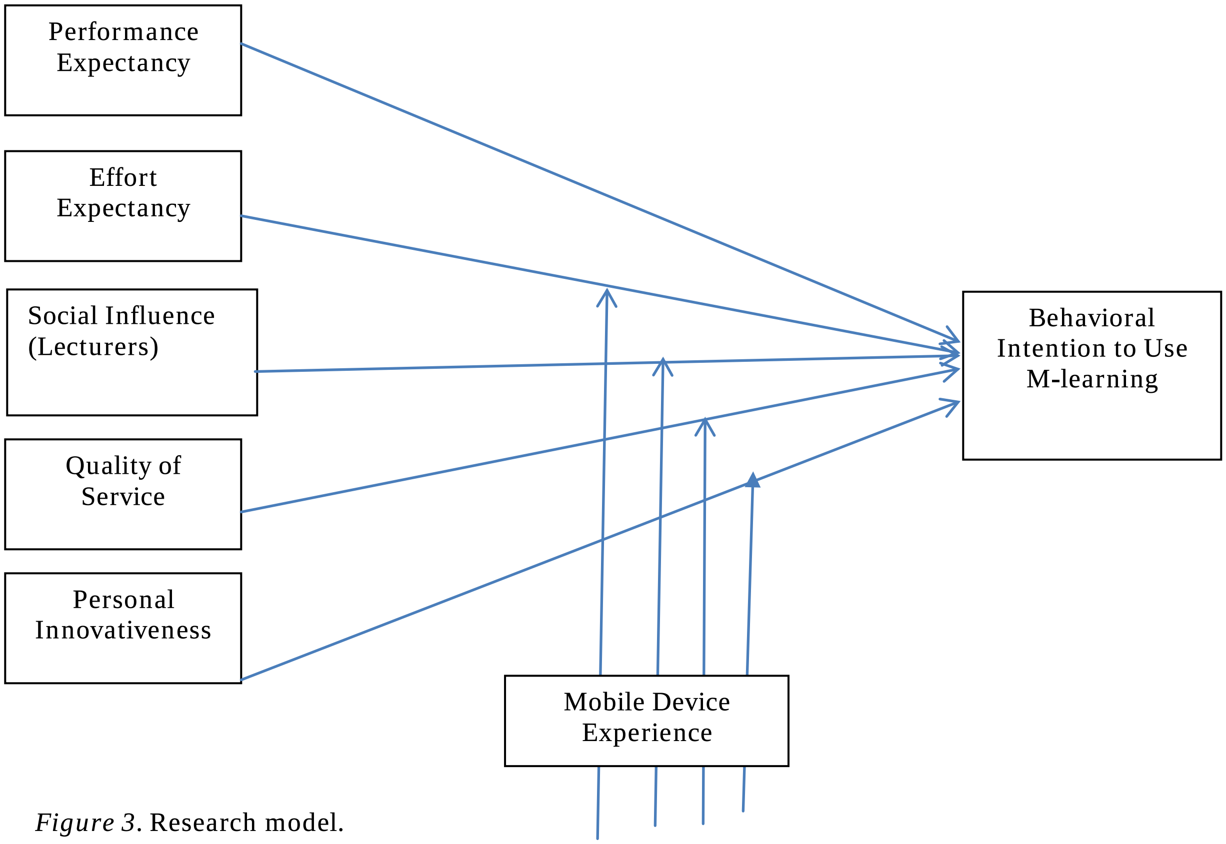

Figure 3. Research model.

Research Dimensions and Hypothesis

In this section we will discuss the constructs of the proposed model.

Performance Expectancy (PE)

Venkatesh et al. (2003) defined performance acceptance as the extent to which a person believes that using an information system would help him or her to benefit in terms of job performance. They also arranged five constructs from the previous models that refer to performance expectancy: perceived usefulness (TAM/TAM2 and C-TAM-TPB), extrinsic motivation (MM), job-fit (MPCU), relative advantage (IDT), and outcome expectations (SCT). In addition, they also indicated that performance expectancy in each previous model is the strongest predictor of behavioural intention to use IT. Davis (1989) demonstrated that perceived usefulness is the most frequent factor used to decide a higher or lower adoption rate. Applying performance expectancy to an m-learning context proposes that students will find m-learning useful because they learn at their convenience and quickly. It will also improve their learning productivity (Wang, Wu, &Wang, 2009). This research attempted to study which performance expectancy of m-learning will influence student behavioural intention to use m-learning. This led to testing the following hypothesis:

H1: Performance expectancy will have a positive effect on behavioural intention to use m-learning.

Effort Expectancy (EE)

Venkatesh et al. (2003) defined effort expectancy as the degree of ease that individuals think they will have when using an information system. The three constructs from the previous models that relate to the concept of effort expectancy are perceived ease of use (TAM/TAM2), complexity (MPCU), and ease of use (IDT). This means that the ease of use of a designed information system is one of the key factors of accepting information technology (Wu, Tao, & Yang, 2008). Prior research suggests that individuals' expectations of system use might be different because of gender, age, and experience. Researchers support the idea that concepts related to effort expectancy will be stronger determinants of individual intention for women (Venkatesh & Morris, 2000; Venkatesh, Morris, & Ackerman, 2000; Vankatesh et al., 2003), particularly those who are older (Morris & Vankatesh, 2000) and who have little experience with the system (Venkatesh et al., 2003). Based on UTAUT, it was expected that students' acceptance of an m-learning system would depend on whether or not it is easy to use. Therefore, it is hypothesized:

H2: Effort expectancy will have a positive effect on behavioural intention to use m-learning.

Lecturers' Influence (LI)

Lecturers' influence is derived from social influence, which is defined as the extent to which a person perceives it is important that others believe he or she should use the new information system (Venkatesh et al., 2003). Prior studies indicate that social influence is a direct determinant of an individual's behavioural intention to use new technology (Mathieson, 1991; Moore & Benbasat, 1991; Thompson, Higgins, & Howell, 1991; Harrison, Mykytyn, & Riemenschneider, 1997; Venkatesh & Davis, 2000). Social influence was divided into two dimensions: superior influence and peer influence (Igbaria, Schiffma, & Wieckowski, 1994). This study incorporates one critical aspect of (superior) social influence and examines its effect on students' acceptance of m-learning. In this study, superior influence refers to the lecturers' influence, which is defined as the extent to which immediate faculty members or instructors directly encourage or motivate their students to use m-learning services. Several studies indicate that supervisors influence a person's acceptance, both in terms of usage (Igbaria, Schiffman, & Wieckowski, 1994; Karahanna & Straub, 1999) and in terms of communication (Leonard-Barton & Deschamps, 1988). Lecturers' influence is an important construct to encourage students to adapt new technologies in their learning setting. This led to testing the following hypothesis:

H3: Lecturers' influence has a positive effect on behavioural intention to use m-learning.

Quality of Service (QoS)

Many research studies in human computer interaction (HCI) (Nielson, 1993; Kuan, Vathanophas, & Bock, 2003) and usability research (Delon & McLean, 1992; Rai, Lang, & Welker, 2002) define quality of service in terms of reliability and response, content quality, and security. The majority of definitions of quality of service have concentrated on customers' perception of and their satisfaction with the services being offered. Parasuraman, Zeithaml, and Berry (1988) defined consumer expectation of quality of service as what they think a service provider *should* offer rather than what they *would* offer. Zeithaml (1988) defined quality of service as users' assessment of the overall superiority of the service. The excellence of services being provided to users can affect the level of acceptance of new technology (Xin, 2004). Lee (2010) indicated that students' perception of online support service quality might be considered as a key factor affecting their behavioural intention towards the acceptance of e-learning. Thus this study tested the following hypothesis:

H4: Quality of service has a positive effect on behavioural intention to use m-learning.

Personal Innovativeness (PI)

Agarwal and Prasad (1998) define it as the individual's willingness to try out any new information technology. IDT suggests that individuals with a high level of innovativeness are more willing to adopt positive ideas and changes in new IT and have more capacity to deal with uncertainty compared with those with a lower level (Lu, Yao, & Yu, 2005). If individuals are more likely to try new IT, then they can act as change agents and opinion leaders for new IT implementation in organizational settings (Agarwal & Prasad, 1998). Several studies investigated the effect personal innovativeness has on a new IT behavioural intention (Hung & Chang, 2005; Lu, Yao, &Yu, 2005; Lian & Lin, 2008; Fang, Shao, & Lan, 2009). For the adoption of mobile technology in a learning context, most students do not have much experience or knowledge to help them form a clear perception belief. It was expected that students with high personal innovativeness would be more risk taking and have a more positive intention to use m-learning in their study. Therefore the following hypothesis was tested:

H5: Personal innovativeness has a positive effect on behavioural intention to use m-learning.

Research Methodology

The questionnaire consisted of 26 items measuring six constructs. The items were derived from different research areas and were adapted to orient them to an m-learning context. This study used a convenience sample technique to collect the data (Creswell, 2012). The questionnaire was distributed to second year students in the School of Information, Computing and Mathematical Science, Brunel University. Students from different classes were invited to participate and complete the questionnaire in their class. A brief description about the research objectives and a definition of m-learning were given by the researcher before students completed the questionnaire.

A total number of 183 responses were obtained. Nine questionnaires were discarded due to being incomplete or containing unreliable answers. We report data from 174 participants. The characteristics of the participants are shown in Table 2.

Table 2

Characteristics of Participants

Characteristics	Frequency	Percent	Cumulative percent
Gender			
Male	125	71.8	71.8
Female	49	28.2	100.0
Course			
CS	91	52.3	54.0
FC	9	5.2	57.5
IS	49	28.2	85.6
MA	25	14.4	100.0
Age			
Less than 20	114	65.5	65.5
20-22	47	27.0	92.5
More than 20	13	7.5	100.0
E-learning knowledge			
Moderate	15	8.6	8.6
Good	98	56.3	64.9
Very good	61	35.1	100.0
Experience of mobile phone			
Less than 1 years	3	1.7	1.7
1-3 years	18	10.3	12.1
3-5 years	153	87.9	100.0
Experience of S phone			
3 years or less	111	63.8	63.8
More than 3 years	63	36.2	100
Using m-learning			
Yes	81	46.6	46.6
No	93	53.4	100.0
Frequency using m-services for learning			
N/A	26	14.9	14.9
1-5(times per day)	111	63.8	78.7
5-10(times per day)	25	14.4	93.1
More than 10	12	6.9	100.0

m-learning knowledge			
Poor	23	13.2	16.7
Moderate	78	44.8	61.5
Good	47	27.0	88.5
Very good	20	11.5	100.0

Data Analysis and Results

The data analysis method consisted of two steps. Step one contained the assessment of the measurement model to examine if the model is a good fit with the data collected, based on the satisfactory results (i.e., after the construct reached the required measurement standard). We then could proceed to step two (structural model) with hypothesis testing.

Measurement Model

An exploratory factor analysis was conducted at the beginning of the analysis using principal components extraction with varimax rotation to extract six factors using SPSS 16. Confirmative factor analysis was then conducted using AMOS 16 to assess the measurement model in terms of factors loading, reliability of measures, convergent validity, and discriminant validity.

Convergent validity can be evaluated using three criteria recommended by Fornell and Larcker (1981): (1) Factor loading greater than 0.50 were considered highly significant; (2) composite reliability should be greater than 0.8; (3) average variance extracted should exceed 0.5.

As shown in Table 3 the results indicate that all items fit their respective factors quite well. All the factor loadings are above the threshold of 0.50. Three items, including items PE4, QoS3, and QoS5, were eliminated due to its standardized factor loadings value, which was less than 0.50. The Cronbach's alpha values range from .718 to .847, which are all over the .7 level. The composite reliability values (CR) were above 0.8 and the average extracted variances (AVE) were all above the recommended .5 level, thereby indicating good internal consistency (Fornell & Larcker, 1981).

Table 3

Results for the Measurement Model

Construct	Factor extracted	Cronbach's alpha	Standardized factor loading	Squared multiple correlations	CR	AVE
Performance expectancy PE1 PE3 PE5 PE2	0.740 0.770 0.750 0.810	0.778	0.721 0.584 0.620 0.875	0.520 0.340 0.380 0.770	0.8428	0.5027
Effort expectancy EE1 EE3 EE4 EE2	0.740 0.850 0.810 0.820	0.820	0.627 0.795 0.745 0.754	0.390 0.630 0.560 0.570	0.9080	0.5371
Lecturers' influence LI1 LI2 LI3	0.880 0.870 0.800	0.812	0.850 0.820 0.640	0.720 0.670 0.410	0.883	0.602
Quality of service QoS2 QoS4 QoS6 QoS1	0.840 0.740 0.710 0.700	0.718	0.790 0.600 0.640 0.710	0.620 0.360 0.410 0.500	0.830	0.500
Personal innovativenes s PInn2 PInn1 PInn3	0.910 0.890 0.820	0.847	0.910 0.840 0.680	0.830 0.710 0.460	0.920	0.670
Behavioural intention BI2 BI1 BI5 BI4 BI3	0.840 0.790 0.780 0.760 0.700	0.834	0.730 0.680 0.750 0.700 0.700	0.530 0.460 0.560 0.490 0.490	0.890	0.507

To examine the discriminant validity this study compared the square root of the average variance extracted for each construct and the correlation between this construct and any other construct (Fornell & Larcker, 1981). If the square root of the AVE of a construct is greater than the off diagonal elements in the corresponding rows and columns, this reveals that each construct is more closely related to its own measurements than to those of other constructs (Fornell & Larcker, 1981). As shown in Table 4, the square roots of the AVE of all constructs are greater than the correlation estimate with the other constructs. In summary, the measurement model exhibits adequate reliability, convergent validity, and discriminant validity.

Table 4

Correlation Matrix and Discriminant Validity

Variables	PE	EE	LI	QoS	PI	BI	Mean	SD
PE	**0.709**						3.67	0.57
EE	0.448	**0.732**					3.88	0.56
LI	0.301	0.489	**0.776**				3.96	0.66
QoS	0.399	0.500	0.461	**0.707**			4.08	0.50
PI	0.316	0.426	0.324	0.454	**0.819**		4.42	0.59
BI	0.553	0.672	0.490	0.493	0.565	**0.712**	3.81	0.59

The bold numbers on the diagonal represent the square root of AVE; off-diagonal elements are the correlation estimates. Correlation is significant at the 0.01 level (2-tailed).

Structural Model and Hypothesis Testing

Before testing the hypothesis, the maximum likelihood method was used to conduct the analysis through obtaining a number of goodness of fitness indices for the model fitness; the early model-fit indices showed that chi square ($\chi 2$) value was 22.65 (df = 10, p = 0.012), comparative fit index (CFI) was 0.38, and the root mean square residual (REMSA) was 0.26, which indicate poor-fit indices, and there is room for refinement. After checking the modified indices positive correlations were created between independent variables to enhance the study model.

The overall goodness-of-fit were examined at another time and achieved the following results. Table 5 shows model-fit indices as well as the recommended thresholds.

Table 5

Model-Fit Indices

Fit indices	Recommended value	Values obtained
$\chi 2$/d.f	≤ 3.00	1.01
GFI	≥ 0.90	0.939
AGFI	≥ 0.80	0.942
NFI	≥ 0.90	0.901
CFI	≥ 0.90	0.998
TLI	≥ 0.90	0.990
RMSEA	≤ 0.08	0.027

($\chi 2$/d.f) the ratio of chi square to degree of freedom, GFI, goodness-of -fit index, AGFI adjusted goodness -of-fit, NFI, normalized fit index, CFI, comparative fit index, RMSR, the root mean square residual.

As shown in Table 5, all model–fit indices exceeded their respective common acceptance level, as suggested by previous research. We proposed to examine the path coefficient of the structure model. Table 6 shows the presentation of the results of the model testing, including the standardized regression coefficient and the critical ratio. The model tested in this study accounted for 55.0% of behavioral intention to use m-learning.

Table 6

Path Coefficients and t-Values of the Hypothesis

The relationship or path	Standardized regression coefficient	Critical ratio or (*t*-value)	P-value	Significance
PE→BI	0.273	2.1(>1.96)	0.02	Yes
EE→BI	0.37	2.20	0.01	Yes
LI→BI	0.23	1.98	0.03	Yes
QoS→BI	0.25	2.05	0.02	Yes
PI→BI	0.30	2.08	0.02	Yes

Influences of Moderator Variable

We continue to find the effect students' prior experience of mobile devices as moderators in the acceptance of m-learning.

To explore the experience differences, we divided the survey respondents into two groups: group one with three years or less experience and group two with more than three years' experience. Having established an acceptable model fit for both groups, the next step was to run the multiple group covariance analysis. The estimates (coefficients) output and critical ratio (t-value) are reported in Table 7.

Table 7

Structural Weights for Two Groups of Mobile Devices Experiences

	3 years or less n = 111			More than 3 years n = 63		
	Estimate	t-value	P	Estimate	t-value	P
PE → BI	0.26	2.81	0.01	0.34	2.82	0.01
EE → BI	0.41	4.69	0.00	0.33	2.73	0.01
LI → BI	0.28	3.04	0.00	0.24	1.97	0.05
QoS → BI	0.22	2.35	0.02	0.30	2.45	0.01
PI → BI	0.26	2.81	0.01	0.25	1.98	0.05

As indicated in Table 7, the structural weights for the first experience group (i.e., three years experience or less) were statistically significant for all links in the model PE-BI. For EE-BI, LI-BI, QoS-BI, and PI-BI (P < 0.05), the structural loading values were 0.26, 0.41, 0.28, 0.22, and 0.26, respectively.

On the other hand, for the second group (i.e., more than three years' experience), the structural weights for the PE-BI, EE-BI, LI-BI, QoS-BI, and PI were all statistically significant (P < 0.05), and the structural loading values were 0.34, 0.33, 0.24, 0.30, and .25, respectively.

Discussion

The results indicate that the proposed model adequately explains and has the ability to predict student behavioral intention to adopt m-learning. Performance expectancy, effort expectancy, lecturers' influence, quality of service, and personal innovativeness were all significant determinants of behavioral intention to adopt m-learning. In addition, the two suggested constructs (quality of service and personal innovativeness) were significant for all students responses (β= 0.25, P < 0.05 and β= .30, P < 0.05, respectively).

Consistent with previous research in the field of technology acceptance, performance expectancy and effort expectancy have a significant, positive influence on behavioral intention to use m-learning (Venkatesh et al., 2003; Jairak, Praneetpolgrang, & Mekhabunchij, 2009; Wang, Wu, & Wang, 2009). The results of this study supports this. Performance expectancy was found to be significant on behavioral intention to use m-learning (Wang, Wu, & Wang, 2009; Chong et al., 2011). It seems that students with high performance expectancy (who believe that using an m-learning system will be beneficial to them in their studies) have a tendency to accept m-learning rather than students with lower performance expectancies.

Effort expectancy was also proven to be a significant influence on student intention to use m-learning (Wang, Wu, & Wang 2009; Chong et al., 2011; Liu, Li, & Carlsson, 2010). The results of the study indicate that effort expectancy was the strongest predictor of behavioral intention to use m-learning ($\beta = 0.37$). This result means that students think that the m-learning system will be easy to use and they will not need a lot of instruction on how to use it. This gives an indicator to m-learning designers to provide higher education with easy to operate and user friendly m-learning applications (Wang, Wu, & Wang, 2009).

Lecturers' influence was found to have a significant effect on behavioral intention to use m-learning. As the study investigates the acceptance of m-learning in universities the researchers explored the effect of social influence from the lecturers' perspective. Lecturers' acceptance, and their attitude toward m-learning, will affect their students' idea about this new technology and will motivate them to adopt it (or not). This is in agreement with previous research results (Igbaria et al., 1996; Karahanna & Straub, 1999).

Quality of service was also found to be a significant influence on behavioral intention to adopt m-learning as students will be willing to adopt an m-learning system when the quality of service provided is seen as being good and beneficial for their studies. This supports the findings of Agarwal et al. (2007), Chong et al. (2011), and Park et al. (2011).

Personal innovativeness, which refers to the individual willingness to adopt new technology, was also found to have a significant influence on behavioral intention to use m-learning. This could suggest an effective strategy to motivate students with high innovativeness at the early stage of the adoption of m-learning, as it has a positive affect on performance expectancy and effort expectancy (Zampou et al., 2012; Liu et al., 2010).

Prior Experience of Mobile Devices Moderator

The results indicate that there exist significant experience differences in terms of the effects of the constructs on behavioral intention. Students' experience of mobile devices moderates the effects of effort expectancy, lecturers' influence, quality of service, and personal innovativeness on behavioral intention. The results also showed that effort expectancy, lecturers' influence, and personal innovativeness are stronger predictors of m-learning acceptance for students with three years or less of mobile devices experience than for students with more than three years of mobile devices experience. This is in agreement with Vankatesh et al. (2003) who found that effort expectancy and social influence will influence the behavioral intention for IT usage more at an early stage of experience. However, quality of service was found to be a stronger determinant for the second group (more than three years of experience) than for the first group (three years or less of mobile devices experience).

Limitations and Future Research

This study has some limitations that create opportunities for future research. First, this study did not include the actual use of m-learning in the proposed model. Therefore, students' responses have been biased towards their thoughts about m-learning, and their perception might change over time as they gain experience of actually using an m-learning system or application. Thus, future research needs to investigate the perception of students who have actually been using m-learning in their studies.

Second, the sampling method (i.e., convenience sample) has a potential bias, as all of the participants were within the same age level and were students on the same course. In addition, more male students than female students were willing to participate in the study. Thus the results may be somewhat over representative of the male group and may not be generalizable. Further research might be conducted to investigate the acceptance of m-learning of users from different ages, culture backgrounds, and subjects.

Finally, university lecturers play a significant role in the adoption of m-learning. They can improve their students' attitude toward m-learning and speed up the implementation of the technology in their departments. Additional research is needed to examine lecturers' perceptions of m-learning and illustrate what challenges they thought might face the adoption of m-learning in the teaching process.

Conclusion

This study investigated the factors influencing university students' intention to use m-learning and indicated how mobile devices experience moderates the influence of these factors on behavioral intention. The results show that 55% of the intention to accept m-learning in a higher education context was explained by the proposed model. The study has also showed the applicability of UTAUT in explaining students' acceptance of m-learning. Furthermore, it extends the UTAUT in the context of m-learning by adding quality of service and personal innovativeness to the structure of UTAUT. The previous conceptual model can be adopted in other educational environments which concentrate on users' (students and lecturers) behavioral intention to use technologies. It can be utilized to investigate the acceptance of interactive whiteboards, mobile knowledge management learning systems, and learning at the workplace.

It is important for practitioners and university management to motivate students about the benefits of m-learning in university study. Some students with less personal innovativeness might need to be motivated at the initial step of implementing m-learning. In addition, mobile learning designers have to design mobile learning applications that are easy to use and improve students' performance. The ease of use and usefulness of a mobile learning system can add value to the existing learning management system through improvement of learning and enhancement of students' acceptance toward m-learning.

Lecturers can promote students' acceptance of m-learning by adding value to their traditional teaching methods using m-learning. However, lecturers need to be familiar with this new technology and be ready to be involved in the implementation plans. There is a need to motivate university lecturers, increase their awareness of m-learning, and provide them with sufficient training. Furthermore, the quality of service offered by m-learning systems needs to include user-friendliness, meeting of all students' needs, and up-to-date service as this will attract more students to use m-learning.

In conclusion, the results indicated that higher education institutes need to develop strategic plans and provide guidelines considering students' acceptance in order to include all critical success factors for the sustainable deployment of m-learning. The results of this study can provide insight into what factors need to be considered for designing an m-learning system in higher education.

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Appendix: Survey Items Used in the Study

Performance Expectancy (PE)

PE1. I find m-learning useful for my studies.

PE2. Using m-learning would enable me to achieve learning tasks more quickly.

PE3. Using m-learning in my studying would not increase my learning productivity.

PE4. Mobile learning could improve my collaboration with classmates.

PE5. Using m-learning would not improve my performance in my studies.

Effort Expectancy (EE)

EE1. I would find an m-learning system flexible and easy to use.

EE2. Learning to operate an m-learning system does not require much effort.

EE3. My interaction with an m-learning system would be clear and understandable

EE4. It would be easy for me to become skillful at using an m-learning system.

Lecturers' Influence (LI)

LI1. I would use m-learning if it was recommended to me by my lecturers.

LI2. I would like to use m-learning if my lecturers' supported the use of it.

LI3. Lecturers in my Department have not been helpful in the use of m-learning systems.

Quality of Services (QoS)

QoS1. It is important for m-learning services to increase the quality of learning.

QoS2. I would prefer m-learning services to be accurate and reliable.

QoS3. It is not important for m-learning services to be secure to use.

QoS4. It is important for m-learning to focus on the speed of browsing the internet and obtaining information quickly.

QoS5. Communication and feedback between lecturers and students would not be easy.

using m-learning systems.

QoS6. It is preferable that m-learning services are easy to navigate and download.

Personal Innovativeness (PInn)

PInn1. I like to experiment with new information technologies.

PInn2. When I hear about a new information technology I look forward to examining it.

PInn3. Among my colleagues, I am usually the first to try out a new innovation in technology.

Behavioural Intention (BI)

BI1. I plan to use m-learning in my studies.

BI2. I predict that I will use m-learning frequently.

BI3. I intend to increase my use of mobile services in the future.

BI4. I will enjoy using m-learning systems.

BI5. I would recommend others to use m-learning systems.

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Security Risks and Protection in Online Learning: A Survey

 

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Abstract

This paper describes a survey of online learning which attempts to determine online learning providers' awareness of potential security risks and the protection measures that will diminish them. The authors use a combination of two methods: blog mining and a traditional literature search. The findings indicate that, while scholars have identified diverse security risks and have proposed solutions to mitigate the security threats in online learning, bloggers have not discussed security in online learning with great frequency. The differences shown in the survey results generated by the two different methods confirm that online learning providers and practitioners have not considered security as a top priority. The paper also discusses the next generation of an online learning system: a safer personal learning environment which requires a one-stop solution for authentication, assures the security of online assessments, and balances security and usability.

Keywords: Online learning; security; risk; threat; protection; e-learning

Introduction

Due to the development of the Internet, more and more people are taking online courses. According to a recent SLOAN-C annual report (2011), a survey conducted in 2011 among 4,523 degree-granting institutions of higher education in the United States reveals that over 6.1 million students were taking at least one online course during the fall 2010 term and 31% of current higher education students have taken at least one course online. Furthermore, 65% of higher education institutions now say that online learning is a critical part of their long-term strategy (SLOAN-C, 2011; Floyd, Schultz, & Fulton, 2012). Meanwhile, in the business world, numerous online courses for job and skill training are offered, to allow professionals to increase their competency and to upgrade their skills (Oncu & Cakir, 2011).

Online learning is “a type of delivery method used in distance education that allows synchronous and asynchronous exchanges of resource over a communication network” (Khan, 1998). It uses content repositories to store content and uses Web-based technologies to help learners interact with instructors and with other learners (Sasikumar, 2013). For example, a number of Web 2.0 tools such as blogs, podcasting, and wikis have been widely used in online learning to facilitate learning, collaboration, and knowledge sharing (Zuev, 2012). Newer web-based technologies such as social media have inspired educators to think differently about the ways in which learning occurs (Neville & Heavin, 2013) because the social media allow learners to create their own content freely and to form learning communities as the media support collaboration among learners and teachers (Redecker, Ala-Mutka, & Punie, 2010). More recently, massive open online courses (MOOCs) have received a lot of attention among institutions of higher education across the world (Meyer & Zhu, 2013); they are expected to change the learning landscape of higher education during the next decade.

As an Internet-based learning method, online learning depends on the Internet for its execution (Alwi & Fan, 2010). However, there are any number of illegal activities and security threats taking place on the Internet. Consequently, the e-learning environment is inevitably exposed to constant security threats, risks, and attacks. Unfortunately, many educational institutions are rushing into adopting online learning management systems without careful planning and without a thorough understanding of the security aspects of online learning (Alwi & Fan, 2010). A recent survey conducted by Campus Computing (campuscomputing.net) and WCET (wcet.info) found that almost 88% of the surveyed institutions have adopted a learning management system (LMS) as their medium for offering online courses.

In online learning, security means that “learning resources are available and unimpaired to all authorized users when they are needed” (Adams & Blandford, 2003). Since online learning takes place via the Internet, every element in an online learning system can be a potential target of hacking or attacks. This may lead to unauthorized modification and/or destruction of educational assets (Zuev, 2012). Online learning must consider the inherent security risks on the Internet, such as identity theft, impersonation, and inadequate authentication (Ayodele, Shoniregun, & Akmayeva, 2011). Online learning systems have attracted the attention of cybercriminals who thrive on their ability to hack into such systems. The risk is great; as the functionalities and features of online learning systems become more complex, online learning is increasingly exposed to security threats (Alwi & Fan, 2010).

In response to increasing threats, researchers have developed a number of countermeasures and solutions to improve security in online learning. The purpose of this paper is to synthesize the related discussions in the literature, to provide an in-depth review of the security aspects of online learning, and to identify the future trends and challenges to security in online learning. Currently, the discussion of security risks of online learning is disparate, fragmented, and distributed among different outlets such as academic articles, white papers, educational reports, and news articles. This paper hopes to coordinate this information and to aid administrators and providers of online learning and online learning systems to understand the state of the art in this fast-moving field. This paper will offer necessary insights and tips so that online learning providers can become proactive and knowledgeable as they mitigate the security risks found in online learning.

Background

Security in online learning refers to protection from malicious or accidental misuse of resources in online learning (Adams & Blandford, 2003; Neumann, 1994). Previous literature indicates that security has three basic requirements: confidentiality, integrity, and availability (Adams & Blandford, 2003; Serb, Defta, Iacob, & Apetrei, 2013; Weippl & Ebner, 2008). Confidentiality refers to the protecting of sensitive information from being accessed by unauthorized persons (Serb, Defta, Iacob, & Apetrei, 2013; Adams & Blandford, 2003) and the absence of unauthorized disclosure of information (Weippl & Ebner, 2008). Since there are a large number of users in any online learning environment (among them students, visitors, instructors, tutors, and administrators), both a login system and a strong delimitation marking registered users and user groups are needed to safeguard the access to the appropriate user (Serb, Defta, Iacob, & Apetrei, 2013). In order to protect personal information, security safeguards such as authentication and encryption are usually implemented. Integrity, a critical element of security, refers to “the protection of data from intentional or accidental unauthorized changes” (Serb, Defta, Iacob, & Apetrei, 2013) and “the absence of improper system alterations” (Weippl & Ebner, 2008). It assures that “information and data have not been accidentally or maliciously modified or destroyed, and are in accurate, correct, and complete original form” (Raitman, Ngo, Augar, & Zhou, 2005). Access control is the key to maintaining integrity in the online learning environment (Serb, Defta, Iacob, & Apetrei, 2013). Availability means the readiness for correct service (Weippl & Ebner, 2008). It connotes that an online learning system can be accessed by authorized users whenever needed (Serb, Defta, Iacob, & Apetrei, 2013). And it assures that “information and communication resources are readily accessible and reliable in a timely manner by authorized persons" (Raitman, Ngo, Augar, & Zhou, 2005). Availability can mainly be damaged by denial of service and/or loss of data processing capabilities (Serb, Defta, Iacob, & Apetrei, 2013).

According to Graf (2002), applications of information communication technology in online learning can cause many security risks, such as loss of confidentiality and availability, the exposure of critical data, and vandalism of public information services. Usually, online learning security issues have been attributed to users' poor knowledge of security measures, improper behaviors, and lack of education, because security protection mechanisms have been adopted in online learning programs. For example, in almost all institutions, the main online learning providers have installed firewalls and anti-virus software to protect their learning resources (Weippl & Ebner, 2008). Furthermore, they continue to enhance the content and technology in their online learning systems to secure online learning (Alwi & Fan, 2010; Srivastava & Sinha, 2013). But in recent years, even though users' security knowledge and skills have grown, security issues such as information manipulation by outsiders and insiders (by students or insiders) and loss of confidentiality still happen from time to time (Dietinger, 2003).

Security is essential as a means to retain users' trust in the online learning environment because any risk can dramatically affect students' perceptions of a system's reliability and trustworthiness (Adams & Blandford, 2003). As a result, it is crucial to identify the underlying factors that can cause security issues in online learning and to identify the limitations of the current security protection methods. Then, counter-measures can be developed to mitigate the security risks inherent in online learning.

Method

This study adopts two approaches to carrying out the review of security risks and protection in online learning.

First, an extensive literature search was conducted, via academic databases including the Web of Knowledge, the ACM Digital Library, the AACE Digital Library, and a web search engine (Google Scholar), using queries regarding security risks, threats, and protection in online learning. Since security has been a hot topic in the domain of online learning for some time, many articles were discovered. However, the discussions of security in online learning are disparate and fragmented.

Second, blog mining, a novel research method, was employed in this study, in order to further identify security risks and threats in online learning and to explore effective security protection strategies available to online learning. Blogs allow self-motivated bloggers to freely and easily post ideas, individual experiences, and opinions (Rubin, Burkel, & Quan-Haase, 2011; Furukawa, Ishizuka, Matsuo, Ohmukai, & Uchiyama, 2007). As blogs have a “high degree of exophoricity, quotation, brevity, and rapid of content update” (Ulicny, Baclawski, & Magnus, 2007, p. 1), running a blog mining analysis can improve the currency and relevance of this study (Chau & Xu, 2012).

However, blog posts can have an inherent bias. For example, the information on blogs is not peer-reviewed; the authorship of some blog pages is either not clear or unknown; and some blog information might be posted for commercial purposes. Therefore, researchers need to be aware of these drawbacks as they carry out blog mining analysis. Overall, this study combines blog mining with an extensive literature search to overcome these shortcomings, in order to engender a comprehensive understanding of the current state of security risks and protection in online learning.

Below is a description of how the blog mining was conducted.

Step one: Keywords, such as “online learning”, “ elearning”, “distance learning”, “security”, and “risk”, were typed in the advanced search option of Google Blog Search (http://www.google.com/blogsearch), a search tool specially designed to retrieve content from blogs that are freely and publicly available on the Internet. To identify the latest blog content discussing security risks and protection in online learning, the query time period was set from January 01, 2010 to June 20, 2013. Next, the query was performed. During this process, Google filtered similar blog posts first and then returned 312 posts that were relevant to the keywords.

To track Internet users’ search interests regarding “online learning security” in recent years, we applied Google Trends, a web-based search tool that provides the frequency of some specific search terms or keywords queried over a specific period of time. The result generated by Google Trends (see Figure 1) indicated that although the search frequency of online learning security has fluctuated in a narrow range since 2010, the overall attention paid to it has not changed much. This was consistent with the result we got via a Google Blog search.

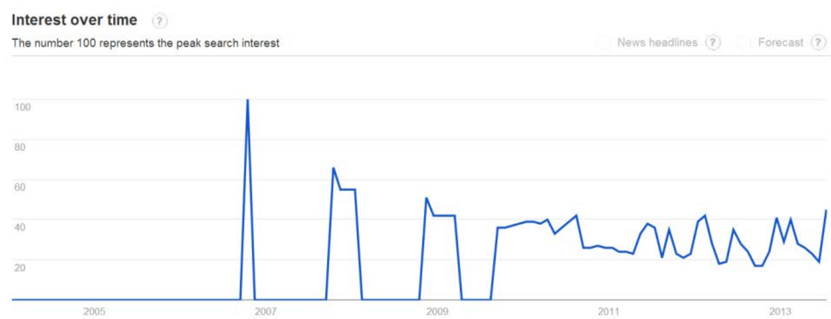

Figure 1. Search frequency of "online learning security" shown by Google Trends.

Step two: The authors read through each page of the 312 blogs generated, removed 62 irrelevant and repetitive posts, and saved the content of the rest of the posts in a single Word document as the sample data set. The sample data set provided a glimpse into the ongoing concerns and discussion regarding security risks and protection in online learning.

Step three: A concept analysis and mapping (CAAM) technique was applied to the data by loading the data file into a special CAAM software tool called Leximancer (http://www.leximancer.com), which extracted and classified the key concepts and themes in the data, and further identified the patterns and the relationships between concepts and themes. Leximancer has been adopted in quite a few studies in recent years (Cretchley, Rooney, & Gallois, 2010; Smith & Humphreys, 2006; Watson, Smith, & Watter, 2005). The Leximancer system is "a method for transforming lexical co-occurrence information from natural language into semantic patterns in an unsupervised manner" (Watson, Smith, & Watter, 2005). It uses word frequency and co-occurrence data to identify which concepts (words that occur very frequently) exist in a set of texts (Cretchley, Rooney, & Gallois, 2010). The technology behind the system is based on Bayesian theory, which argues that fragmented information can be used to predict what happens in a system (Watson, Smith, & Watter, 2005). Cretchley, Rooney, and Gallois (2010) describe in detail the way in which Leximancer works:

> The software includes an interactive concept-mapping facility, which provides an overview of the conceptual structure of the data set that assists the researcher in interpretation. Concepts that co-occur often within the same two-sentence coding block attract one another strongly when the map is clustered, so that similar concepts tend to settle together in close proximity. Clusters of concepts are grouped by theme circles to summarize the main ideas in particular clusters. Each theme is named after the most prominent concept in that

> group, which is also indicated by the largest dot in the theme cluster. (p. 319)

Figure 2 is a screenshot of the interface of Leximancer 4.0. The map in the middle indicates the importance of the concepts. Red is the most important, followed by orange and so on, according to the color wheel.

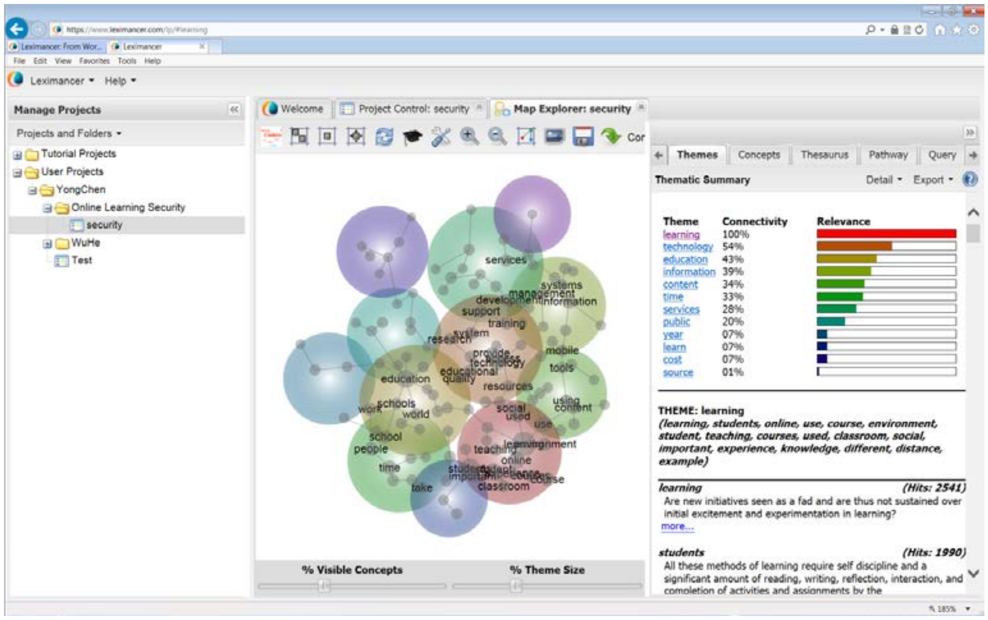

Figure 2. A screenshot of the interface of Leximancer 4.0.

Results

According to an extensive literature search via academic databases and Google Scholar, online learning faces various security risks (shown in Table 1), which mainly come from external intruders.

Table 1

Security Risks and Protection Measures in Online Learning

Security risks	Protection measures
• ARP cache poisoning and MITM attack • Brute force attack • Cross-Site Request Forgery (CSRF) • Cross Site Scripting (XSS) • Denial of Service (Dos) • IP spoofing • Masquerade • Rootkits • SQL Injection • Session Hijacking • Session Prediction • Stack-smashing attacks (Serb, Defta, Iacob, & Apetrei, 2013; Costinela-Luminita & Nicoleta-Magdalena, 2012; Barik & Karforma, 2012; Srivastava & Sinha, 2013)	• Installing firewalls and anti-virus software (Weippl & Ebner, 2008) • Implementing Security Management (ISM) (Adams & Blandford, 2003; Alwi & Fan, 2010) • Improving authentication, authorization, confidentiality, and accountability (Cardenas & Sanchez, 2005; Agulla, Rifon, Castro, & Mateo, 2008) • Using digital right management and cryptography (Barik & Karforma, 2012) • Training security professionals (Srivastava & Sinha, 2013)

To mitigate these risks, scholars have offered quite a few protection proposals (shown in Table 1). In contrast, in the concept map generated by Leximancer, neither the risks nor the protection measures can be easily identified. Figure 3 shows the concept map that Leximancer generated after the blog data was loaded. The large circles represent the clusters of concepts and the dots represent the main concepts. Leximancer can generate many concept terms using its text analytics algorithms. For our study, those clusters and concepts that appear with the highest frequency are listed in Table 2. It should be noted that compared with Table 1, Table 2 shows quite different content.

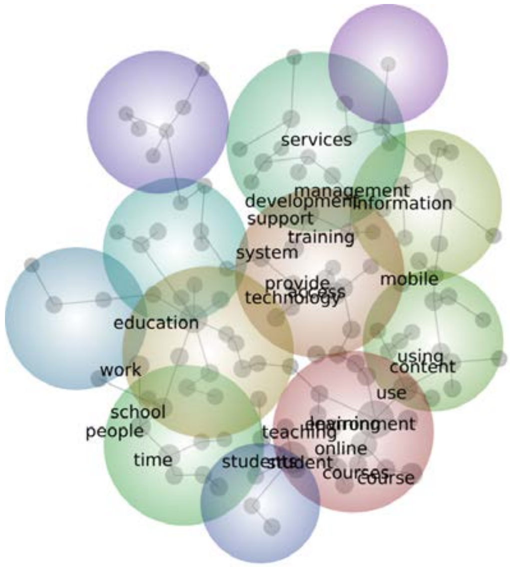

Figure 3. An example of the concept map generated by Leximancer with the sample data.

Table 2

Cluster of Concepts Associated with Security in Online Learning in Blog Posts

Cluster of concepts	Concept
Learning	learning, students, online, use, course, environment, teaching, courses, used, classroom, social, important, experience, knowledge, different, distance, example, virtual
Technology	technology, support, system, development, access, training, provide, research, resources, educational, quality, skills, institutions, developed
Education	education, work, world, schools, community, higher, better, program, become, life, group, programs, making
Information	information, management, mobile, systems, software, data, design, based, web, include, applications, performance, network, provides
Content	content, using, tools, available, process, technologies, e-learning, digital, level, computer, communication, offer, assessment

Discussion

Based on our extensive literature search and blog mining, we would like to provide a more detailed discussion on the causes of security threats, security protection measures, and the status of existing security protection for online learning.

Causes of Security Threats

Security threats in online learning can be examined from two aspects: the user side and the management side. As far as the user side is concerned, emerging ICT applications and imprudent human behavior are the main causes that lead to security issues in online learning. Besides, of the security risks inherent in the Internet, the development of new learning technologies such as Web 2.0 and social media have allowed for many new security breaches and a much larger security impact (Adams & Blandford, 2003; He, 2012). The amount of malicious content and the number of cyber-attacks on these new Web applications is rapidly increasing in both frequency and sophistication. Nowadays, many instructors are using social media sites such as Tumblr, Facebook, Wikis, online forums, and Twitter to support collaborative learning in their online courses (He, 2011; Camarero, Rodríguez, & José, 2012; Patel et al., 2012). However, for unwary instructors and students, these social media sites pose a variety of serious security risks and threats. For example, as a collaborative learning environment, a wiki also becomes a ripe environment for hacking, deception, abuse, and misuse (Patel et al., 2012). Personal data posted on social media sites can be misused in many ways (e.g., for virtual insult or, worse, for financial gain). Furthermore, recent studies show that social media sites are more likely to be used for delivering malware than were previously popular methods of email delivery (Kaspersky, 2009; He, 2013).

Other scholars analyze security issues from the standpoint of the user. For example, Adams and Blandford (2003) argue that threats to online learning security are caused by two main reasons: 1) The security mechanisms used in online learning programs lack usability; and/or 2) security discipline is not user-centered and therefore can lead the user to overlook serious security risks. They point out that the need-to-know principle (restricting information only to those who need to know) coupled with the unwillingness of security departments to know their users can cause a low usability of security mechanisms. Due to the lack of usability, many online learning systems do not provide users with adequate feedback or with the control rights that would allow them to protect their data (Adams & Blandford, 2003). Furthermore, poor user-centered design of security mechanisms and policy can contribute to insecurity and to users' low motivation to seek security (Adams & Sasse, 1999).

From the perspective of management, online learning providers have made some mistakes. In the domain of online learning, threats not only come from outsiders, but also from insiders (Alwi & Fan, 2010). Many scholars argue that security risks are caused by online learning providers' underdeveloped security policies and immature security measures. For instance, Serb, Defta, Iacob, and Apetrei (2013) note that although more people are currently taking online courses, the security risks inherent in online learning have not been seriously taken into account in the actual educational context. Alwi and Fan (2010) point out that many online learning providers rush into adopting information communication technology without fully understanding the related security concerns. Yao and Ji (2011) note that online learning system designers consider the quality of online course content a considerably bigger issue than the security of their online systems. Furthermore, Weippl and Ebner (2008) indicate that even though almost all institutions have firewalls and anti-virus software to protect their campus resources, they often fail to perform adequate information system security management. Unfortunately, content and technology are still the focuses of online learning (Srivastava & Sinha, 2013). We feel that more attention should be put on the security aspect of online learning. In fact, security is very important for online learning because lacking security in online learning will cause a number of serious problems. For example, as Adams and Blandford (2003) point out, any security risk in online learning can dramatically affect students' perception of reliability and trustworthiness about learning via the Internet. As such, online learning will be less attractive and the development of online learning will be hindered. In addition, ICT applications make user authentication a big challenge for student assessment in online learning. When assessing students' asignments, as Alwi and Fan (2010) argue, it is very hard to verify whether an assignment is completed and/or submited by a valid student. If student assessment is not conducted correctly, the quality of online learning will be harmed greatly.

Security Protection Measures

Scholars have discussed security protection from the user side and management side as well. From the user side, protection motivation theory (PMT), a theory originally from social psychology, is introduced into the field of information system security. Based on this theory, information is perceived and evaluated, and then provides supports for users to take actions (Crossler, 2010). This theory explains the cognitive mediating process and coping modes when users encounter information sources. The PMT theory is helpful for understanding security protection measures adopted by online learning users.

From the management side, general deterrence theory (GDT), a theory from criminal justice, is adopted by information system security scholars to explain how security countermeasures can increase the perceptions of members in an organization regarding the severity and certainty of punishment for any misuse of information (Straub, 1990).

Security policies and mechanisms in online learning must support authentication, authorization, confidentiality, and accountability (Cardenas & Sanchez, 2005; Agulla, Rifon, Castro, & Mateo, 2008). Authentication refers to the validation of a person's identity before the access is assigned. Authorization defines what rights and services a person can access after the authentication process is passed. Confidentiality means that some specific information or data cannot be disclosed to anyone who is not authorized.

Accountability refers to the methodology by which users' resource consumption information is collected for billing, auditing, and capacity-planning purposes (Song, Lee, & Nam, 2013).

To mitigate security threats and risks in online learning, researchers have proposed many remedies from a variety of points of view. For example, Alwi and Fan (2010) propose information security management (ISM) for online learning providers, in order to build an effective security architecture that can fight existing and emerging information security threats. They argue that ISM should include policies, process, procedures, organizational structures, and software and hardware functions, in order to enhance the execution of security measures. Furnell and Karweni (2001) depict a framework that includes five aspects: 1) authentication and accountability; 2) access control; 3) protection of communications; 4) non-repudiation issues; 5) learning resource provider server protection. Srivastava and Sinha (2013) highly recommend that information security professionals improve their security knowledge and skills by using the Virtual Training Environment (VTE), a web-based knowledge library launched by the Carnegie Mellon Software Engineering Institute.

Security Protection Status

By comparing the results from the two research methods (Table 1 and Table 2), it is obvious that security is not a prime focus of blog posts discussing online learning, even though the topic has attracted much attention in the academic domain. Given the analysis of the causes of security risks in online learning, security is not at the top of the priority list in distance learning providers' hands. As long as a decade ago, Furnell and Karweni (2001) noted, "Security represents an aspect that may not suggest itself as a high priority in an education environment." The differences between the results generated by the two research methods confirm the scholars' conclusions, as mentioned above: The security risks inherent in online learning have not been seriously taken into account in an educational context. It may be that security issues have not caused as much damage in the realm of distance learning as they have in the business world. Since nothing serious about security has yet happened in the realm of online learning, not much attention has been paid to it in blog posts so far.

Research Trends

During the past decade, online learning has quickly grown. It has grown, perhaps, too quickly – too little attention has been paid to its security. Online learning will become more user-centered and more secure with the help of new technologies.

1. Personal Learning Environment and Biometric Authentication

Authentication has been widely adopted in online learning as a tool to improve confidentiality. Generally speaking, there are three ways to authenticate a user: 1) knowledge-based authentication that requires that users provide something that only they know (e.g., type in a password, answer a secret question, or submit a personal identification number); 2) token-based authentication that requires that users show something that only they own (e.g., a key card, a mobile device, or a security token); 3) biometrics that require that users provide something for measurement (e.g., a fingerprint, a palm print, a retinal image, or a face gesture) (Garfinkel & Spfford, 1996; Alotaibi & Argles, 2011). Among these authentication methods, passwords and personal identification numbers (PINs) are most widely used (Adams & Blandford, 2003). As Raitman, Ngo, Augar, and Zhou (2005) note, user logins are the simplest means for providing identity and access services.

The next generation of online learning system is a personal learning environment (PLE), "a learning environment where the student is able to customize his/her learning environment based on pedagogical and personal choices" (Kolas & Staupe, 2007). As a new way of using the web or Web 2.0 for learning, the PLE focuses on the individual and "presents learners with learning resources based on individual interests, education level, attitude and cultural, social and other factors" (Li & Gu, 2009). It is a framework that integrates Web 2.0 and social tools, such as blogs, wikis, Facebook, podcasting, and videocasting, according to the choice of learners (Alotaibi & Argles, 2011; Kompen, Edirisingha, & Mobbs, 2008). As Alotaibi and Argles (2011) point out, the widespread authentication mechanism of username and password is out of date for use in the PLE, because learners have to sign on to multiple systems, each of which may involve a different username and password. As intruders and hackers become smarter and more technologically savvy (Science News, 2002), easy passwords make intrusion very achievable for malicious users, even as long and complex passwords are impractical for learners to remember (Gligor, 1993). According to a survey carried out in Alotaibi and Argles (2011), the average internet user has to remember 15 access control passwords.

Thus, a one-stop solution that is not dependent on a series of characters but on a technology, which is unique and can only be possessed by a specific individual, is needed for PLE. As such, Alotaibi and Argles (2011) have proposed a biometric authentication system, FingerID, which requires a fingerprint scan and human interaction to utilize a service. Meanwhile, Song, Lee, and Nam (2013) have proposed another method that uses brain wave and eye movement to authenticate users of online learning systems. Biometrics refers to the use of identification mechanisms, such as a fingerprint and retina scan, to certify that a person in front of a computer is indeed the intended person (Sasikumar, 2013). Biometric authentication seems to be the option for the next generation of authentication (Wang, Ge, Zhang, Chen, Xin, & Li, 2013).

2. Security for Online Assessments

As a major component in online learning, online assessments are important, both to ascertain students' progress and because they can be carried out flexibly in different locations and at different times (Reeves, 2000; Meyer & Zhu, 2013). According to a study carried out by King, Guyette, and Piotrowski (2009), 73.6% of students think that it is easier to cheat in an online environment than in a conventional one. Methods of cheating on online assessments include online communication, telecommunication, internet surfing (Rogers, 2006), copying and pasting from online sources (Underwood & Szabo, 2003), obtaining answer keys in an illegitimate way, taking the same assessment several times, and getting unauthorized help (Rowe, 2004).

Other means of cheating on online tests include someone other than the actual student taking the online test and the copying of answers from elsewhere (Sasikumar, 2013). Ndume, Tilya, and Twaakyondo (2008) argue that preventing cheating in online course assessments is much harder than in traditional classrooms and that secure assessment of online courses requires the improvement of system security, the registration of learners with unique identification, and the overall administration of the online assessment. Therefore, improving the security of online learning will improve the security of online assessments, and this should not be neglected. The one-stop security solution for the next generation of online learning needs to assure the security of online assessment, as well.

3. The Goal of Security for Online Learning

Online learning is built on trust, information exchange, and discussion. However, a secure environment can rely on distrust, restricted information flow, and autocratic rules (Adams & Blandford, 2003). These attributes can make online learning and security mutually exclusive concepts. In addition, Weippl and Ebner (2008) indicate that no system can ever be totally secure while still remaining usable. What level of security does online learning need? Needless to say, the goal of security in online learning is definitely not to limit its usability. However, currently, online learning providers are facing a difficult balance, as they try to provide sufficient security to protect online learning resources while not inhibiting the appropriate use of these resources. Maintaining such a balance is challenging due to diversity – the diversity of computers and devices as well as a large number of diverse users (Pendegraft, Rounds, & Stone, 2010). Although this study shows that security is not a top priority for many online learning providers right now, serious efforts are needed to improve the security in online learning. The goal of security for online learning is to maintain the confidentiality, integrity, and availability of the resources in online learning at a certain level while keeping their usability acceptable for learners.

Conclusion

The growing availability of the Internet and the number of diverse end user devices facilitate the demands of online learning. The application of Web 2.0 and MOOCs are heralding a new era in education. Online learning brings with it all of the security risks inherent to the use of the Internet. However, although more people are taking online courses, online learning providers have not been seriously taking security risks into account. Many of them rush into adopting information communication technologies without fully understanding the related security concerns. Scholars have identified diverse security risks and have proposed solutions to mitigate the security threats in online learning. To our surprise, our study found that security is not a hot topic among blog posts which discuss online learning. So far, online learning providers and practitioners have not considered security as a top priority, possibly because few serious security incidents have happened in the realm of online learning. As more and more people are studying online, more attention and efforts are needed from online learning providers and practitioners to prevent possible security breaches in online learning before it is too late.

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Institutional Level Identity Control Strategies in the Distance Education Environment: A Survey of Administrative Staff

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Abstract

Physical separation of students and instructors creates the gap of anonymity and limited control over the remote learning environment. The ability of academic institutions to authenticate students and validate authorship of academic work at various points during a course is necessary for preserving not only perceived credibility but also public safety. With the growing scope of distance education programs that permeate critical areas such as healthcare, airspace, water management, and food solutions, universities have a moral obligation to employ secure measures to verify learning outcomes. This study examines the measures universities with large distance education programs employ to align identity of learners with the academic work they do, as well as the effectiveness of and challenges and barriers to their implementation. The research was undertaken using a multiple case approach and examined survey responses from five academic administrators at five officially accredited post secondary institutions in three countries. The cases examined in the study include: Athabasca University, Open University UK, Penn State University World Campus, University of Maryland University College, and eConcordia,Concordia University's distance learning facility. This study is not an exhaustive attempt to examine all aspects of academic integrity, but rather to create awareness about various learner authentication strategies. This study confirms that secure learner authentication in the distance education environment is possible. However, with greater pressure to enhance security of learner authentication, the openness of open learning is challenged and may change as we know it.

Keywords: Academic integrity; plagiarism detection; accessibility; identity assurance

Introduction

Technology improves learning and teaching by making it more effective and efficient, by increasing accessibility to a wider range of learning resources, and by creating authentic learner environments that address individual learning styles (Bates & Poole, 2003). And as technology becomes more embedded into the academic structure, it may generate new ethical challenges (Mitchell, 2009). One crucial ethical concern strongly influenced by the advancement of technology, coupled with the growth of popularity of online learning, is academic integrity (Chiesl, 2007; Faculty Senate Committee on Technology, 2005; Grijalva, Nowell, & Kerkvliet, 2006; Mott, 2010).

Some scholars note that assessment of remote learners and the identity validation aspect of it in particular has historically been a challenging issue often cited by critics of distance education (Bailie & Jortberg, 2008; Moore & Kearsley, 1996). There are many benefits of using online assessments not only in distance courses but in traditional courses as well. These may include cost savings and greater accessibility. But the very same technology that makes education more accessible presents a cornucopia of cheating methods (Mott, 2010). For example, mobile devices play a pivotal role in enabling mobile learning. However, electronic communication and computing devices capable of transmitting, capturing, storing, retrieving, and processing information also pose a challenge for the exam integrity (Faculty Senate Committee on Technology, 2005). These devices may not only simplify finding solutions to a variety of test problems, but also streamline capture and distribution of digitized exam documentation. They are compact and easy to conceal, and they provide high processing power. Another important concern is the increasing availability of over-the-counter essays (Sheridan, Alany, & Brake, 2005).

In a traditional school setting, many of the examinations are taken in a proctored environment. Identity documents are verified by proctors, thus to spoof an identity, a proxy test taker must forge the identity documents or work in collusion with proctors. In distance environments, proctored examinations through examination invigilation networks remain a popular choice of secure assessment. However, institutions of distance education tend to shift away from secure testing towards project-based or authentic assessment strategies such as written assignments, projects, and portfolios (Bailie & Jortberg, 2008, p. 65). Instructional design strategies that minimize pressure to engage in unethical behavior have also been adopted as an alternative to traditional testing and examination (Chiesl, 2007).

As a result, courses that do not follow a proctored exam route may require students to submit a number of written assignments. In an online environment where username and password are often the only credentials used for identity verification, there is no need to forge documents. Changing identity is as easy as typing two strings of text on a login screen. Thus, without a secure process that aligns student virtual identities with the academic work they do, the identify validation by legitimate universities offering distance courses and programs may not be perceived as credible as that provided by traditional institutions.

Much literature on academic misconduct in distance education is concerned with prevention of plagiarism, with wrongful appropriation of intellectual property, and with the technological means of prevention. There is little research done on the institutional level identity control measures or their effectiveness. Data on the incidence rates of student academic dishonesty show a wide variance. One of the challenges with academic integrity research is that it often relies on self-reporting (Scanlon & Neumann, 2002). A study conducted by McCabe and Trevino (1996) examines the magnitude of academic dishonesty and historical trends of student behavior in traditional universities by comparing data from two research projects conducted almost 30 years apart involving multiple campuses and large samples. The patterns observed in these two studies are relatively consistent and at the same time raise serious concerns about academic integrity. The findings suggest that over 80% of students cheated at least once on a major written assignment. Although, this research was aimed at analyzing data from traditional college settings where testing and examinations are proctored, one may argue that the trends identified in the study are transferable to the distance education environment, where project based assessment may replace secure examination and where proctoring is not always an option. Some scholars argue that students who admit engaging in cheating behavior may not limit its scope to only one medium, but rather employ both conventional and internet plagiarism (Scanlon & Neumann, 2002). The internet may simplify access to a wider source of information, but whether or not it influences one's preference for cheating is still unknown. Data from studies on academic integrity in a distance environment suggest that student and faculty perceptions of cheating in distance courses are similar and that it is easier to cheat in the distance environment (Kennedy, Nowak, Raghuraman, Thomas, & Davis, 2000).

Some scholars consider academic integrity a policy issue (Isa, Samah, & Jusoff, 2008; Sheridan et al., 2005) while others argue for a technology-based solution (Mott, 2010; Kennedy et al., 2000). There is a variety of technology available to institutions ranging from plagiarism detection tools (Sheridan et al., 2005) and remote proctoring services to biometric authentication systems designed to secure the process of remote learner authentication. These technologies have been pilot tested at several universities (Case & Cabalka, 2009; McNabb & Maynard, 2010). The pilot project results suggest that biometric and remote monitoring technologies hold great promise in providing learner identity assurance.

Method

This study was designed to examine measures universities with large distance education programs employ to align identity of learners with the academic work they do, as well as examine the effectiveness of and challenges and barriers to their implementation. The research was undertaken using a multiple case approach and examines survey responses from five academic administrators at five officially accredited post secondary institutions in three countries. The data collection was carried out from June to October, 2012.

The five leading universities, in three countries, were selected for this study. This multiple case study examines the cases of Athabasca University, Open University UK, Penn State University World Campus, University of Maryland University College, and eConcordia,Concordia University's distance learning facility. These institutions fit the criterion of officially accredited universities that offer distance education courses and programs. Each institution has already implemented or evaluated an identity control strategy. A strategic convenience sample of university administrative staff involved in development, administration, or enforcement of an academic integrity policy was selected.

Publicly available information from university websites was used to generate a preliminary participant list of V.P. Academic and Registrar office staff involved in academic integrity matters. Introductory emails were then sent out to the preliminary list of participants in order to introduce the study and identify the key experts on the academic integrity and in particular identity control issues at each institution. Additional referrals were received, and the final participant list was created. The data from one participant from each university to the total of five participants for the entire study was collected and analyzed. Participants were selected on the basis of involvement in development, administration, or enforcement of an academic integrity policy and expressed interest in participating in this research project.

The rationale for choosing to survey administrative staff as opposed to faculty or academic leaders was that the administrators tend to have broader knowledge of academic integrity issues and are responsible for overseeing the entire academic integrity process from policy making to financing to enforcement, whereas other groups tend to have limited involvement and are delegated specialized tasks within the process. Although faculty and staff share a common understanding of the academic integrity process, the survey results should be interpreted as the opinions of the stakeholder group that is likely to be most informed on the subject of academic integrity. However, a note of caution on this interpretation is appropriate since administrators' opinions may not be widely, and are certainly not unanimously, endorsed by all university faculty and staff.

Data Collection Strategies

The data collection process was divided into four phases. First, each university's website was examined for general academic integrity guidelines as well as admission requirements and examination instructions for students. In the second phase of the data collection, strategic convenience sampling was used to select an administrative office staff member from each university and these were invited to answer a brief questionnaire and participate in a follow up interview. A personal introductory email was sent to prospective participants by the researcher to introduce the study and identify the key experts responsible for the development, administration, or enforcement of the academic integrity policy. During the third phase of the data collection process and once a final list of participants had been established, an introductory letter containing a brief description of the study and the questionnaire was distributed via email. In the final phase of the data collection process, follow up questions were asked through email and via telephone to clarify the questionnaire responses. As well, the participants were provided an opportunity to review, validate, and provide additional comments on the summary of the research findings.

Survey Instruments

A survey instrument was developed for this study and consisted of seven Likert-like scale questions (with a 5 point range from *strongly agree* to *strongly disagree*) and one multiple choice question. The questionnaire also allowed for qualitative information and extra details to be recorded if the participant wished to provide them. A follow up to clarify the answers was conducted by email or telephone. The data collection was performed using LimeSurvey, web-based survey software hosted by Athabasca University and via email. Some participants considered it easier to complete the survey via email. Each participant was assigned a unique participant identification number.

Questionnaire

1. Identity fraud has emerged as an issue at my institution. (SA/A/N/D/SD)

2. My institution tracks and trends academic misconduct data. (SA/A/N/D/SD)

3. My institution has an adequate system of identifying online students before each project or paper submission. (SA/A/N/D/SD)

4. My institution has an adequate system of identifying online students before each final and/or midterm exam. (SA/A/N/D/SD)

5. My institution has encountered barriers to implementation of identity control measures. (SA/A/N/D/SD)

6. The identity control measures my institution employs to authenticate the identities of online students are effective. (SA/A/N/D/SD)

7. The system my institution employs to conduct remote identification of test takers has challenges. (SA/A/N/D/SD)

8. The best practice for authenticating the work of remote learners is:

    a. Remote Proctoring using web cams

    b. Biometric Authentication asserting the identity of the student by fingerprints, keyboard activities etc.

    c. Traditional Proctoring

    d. Policy Enforcement

    e. Other

Data Analysis Procedures

Upon collecting the necessary data from documents, surveys, and follow up emails or phone interviews, the collected information was organized into categories and cross-compared. Data analysis was concluded using the analytic comparison framework (Neuman, 2006).

Results

The survey results are summarized from questions as depicted in Table 1 and 2.

Table 1

Likert-Like Scale Survey Responses

Case 1	**Case 2**	**Case 3**	**Case 4**	**Case 5**
1. Identity fraud has emerged as an issue at my institution.				
Strongly agree	Strongly agree	Strongly agree	Neither agree nor disagree	Agree
2. My institution tracks and trends academic misconduct data.				
Strongly agree	Agree	Strongly agree	Agree	Strongly agree
3. My institution has an adequate system of identifying online students before each project or paper submission.				
Agree	Agree	Strongly disagree	Neither agree nor disagree	Disagree

Case 1	Case 2	Case 3	Case 4	Case 5
4. My institution has an adequate system of identifying online students before each final and/or midterm exams.				
Strongly agree	Agree	Agree	Agree	Disagree
5. My institution has encountered barriers to implementation of identity control measures.				
Agree	Disagree	Strongly agree	Agree	Neither agree nor disagree
6. The identity control measures my institution employs to authenticate the identities of online students are effective.				
Neither agree nor disagree	Neither agree nor disagree	Strongly disagree	Neither agree nor disagree	Neither agree nor disagree
7. The system my institution employs to conduct remote identification of test takers has challenges.				
Disagree	Disagree	Agree	Agree	Agree
8. The best practice for authenticating the work of remote learners is:				
Traditional proctoring / Invigilator network	Traditional proctoring / Invigilator network	Traditional proctoring / Invigilator network	Each system has advantages and disadvantages. What is best depends on circumstance, cost and context	Remote proctoring / Biometric/ policy enforcement

Table 2

Authentication Summary

Case #	Case 1	Case 2	Case 3	Case 4	Case 5
Authentication methods	Password, traditional proctoring	Password, traditional proctoring	Password, traditional proctoring	Password, traditional proctoring	Password, remote proctoring, traditional proctoring
Plagiarism detection tools	Turnitin, Google	Turnitin, Google	Turnitin	Turnitin, Copycatch	Turnitin
Challenges	Provision of examination facilities	No challenges cited	Provision of examination facilities	Technical issues, provision of examination facilities	Technical issues
Barriers	No barriers reported	No barriers reported	Cost	Cost, complexity	No barriers reported

Discussion

Academic Integrity

Identity fraud is an issue that affects all academic institutions and is particularly a concern for those who provide service to remote learners. One administrator indicated reported cases of students sharing login credentials and hiring others to complete online assignments. Since physical separation creates the gap of anonymity, authentication protocols need to be implemented to close the gap and align virtual identities with the work that students do. Access to academic resources and learning management systems is often protected by a username and password authentication. This method is not designed to validate one's identity or authorship of submitted materials, but rather act as a gatekeeper granting access to anyone with the correct user name and password combination. Like a door lock, it prevents unauthorized access, but does very little to examine the identities of people inserting the key. The problem is serious enough to have drawn the attention of the United States Department of Education. In 2008, U.S. Congress enacted the Higher Education Opportunity Act. Section 602.17 of the act requires institutions to develop and employ measures that validate identities of distance learners (Higher Education Opportunity Act, 2008).

Policy and Enforcement

All of the surveyed institutions have designated staff to deal with reported incidents of academic misconduct. This process often involves multiple stakeholders. While some cases are handled by instructors, other cases may be escalated and reviewed by designated committees. The reported data are tracked and trended by all five institutions; however, the criteria for tracking incidents and methodology of data collection may vary. A disciplinary action is generally the last resort. Education and communication are the preferred methods of managing academic misconduct cases. Students are provided with academic integrity tutorials and resources, and they may be required to sign a statement of academic integrity or complete a quiz. In serious cases, penalties are assigned by designated committees on a case by case basis as the magnitude of an offence may hinge on a number of factors. It often takes a retributive justice approach. Since copying and pasting of a website article is different from uploading a digital image of a final exam taken with a smart phone to a file sharing website, the penalty needs to be proportional to the damages caused. Tracking incident data is a vital part of risk management and is a process that is worth examining in itself.

Authentication Strategies

There are several authentication strategies available to universities, aimed at enhancing authentication of student work. These are depicted in Table 3. They also provide different levels of assurance. A course or program may employ any combination of these strategies to manage academic integrity and maximize identity assurance. Some strategies provide a greater degree of confidence in the identification of students than others; therefore, they are classified into two categories. Courses that do not follow the exam route often employ low level authentication measures for validation of student identity before submission of projects, assignments, and papers as well as participation in online discussion groups or completion of an online quiz. They often rely on the username and password authentication for access to learning management systems. In order to compensate for limitations of the traditional authentication methods, additional validation measures such as login pattern analysis, instructor validation, and plagiarism detection tools are often employed. Although the latter is not an identity control strategy, but rather a method of disproving authorship of any written work, assignments that are submitted electronically are often screened by instructors for plagiarism, using plagiarism detection tools. Turnitin was cited in all five cases, and Copycatch was used by one institution. Google search engine was also occasionally used by some instructors as a first line of defense against plagiarism.

Table 3

Authentication Strategies

Low level authentication	High level authentication
Password authentication	Biometric authentication
Instructor validation (large groups)	Instructor validation (supervised study)
IP monitoring/login pattern analysis	Proctoring (traditional)
Plagiarism detection (similar content)	Proctoring (remote)

Instructors play an important role in student work authentication and contribute to identity assurance. Learners demonstrate academic skills throughout the course allowing an instructor to track student progress and flag any suspicious activities or question the source of the submitted content. It may serve as an effective identity authentication and authorship validation mechanism when students' activities are closely supervised and continuously evaluated; such may be the case with supervised research projects where intermediate snapshots of work in-progress are examined and discussed through telecommunication technologies that replicate face to face communication. Furthermore, a login data analysis may not be effective in aligning student identities with the academic work they do. It is not safe to assume that the variance in login patterns is indicative of a problem, whereas a correctly entered username and password is not.

However, the second list of strategies shares much of the same validation protocols as that employed by the traditional institutions. This usually involves interaction with instructors or support staff, validation of officially issued identification documents, and participation in proctored exams at designated examination facilities. Technologies that enable synchronous communication such as video conferencing substitute for physical meetings. Even in project route courses, instructors may include interactive participation components through the web or telephone conference systems, allowing students to present and discuss their ideas, research, and assignments and to conduct thesis defense and oral examination.

Unlike electronic paper and project submissions, exams emphasize higher security measures. Facilitation of exams requires traditional methods of authentication such as verification of officially issued identification. The remote proctoring process follows a similar pattern. When remote proctoring is used outside of the designated test centers, students are required to create an identity profile often comprised of a keystroke signature and a photograph before access to the exam is allowed.

The survey results show that perceived adequacy of identifying students before final and/or midterm exams was reported to be higher than that of a project or paper submission. Furthermore, four out of five administrators consider proctoring as the best practice for remote learner authentication. Three administrators selected traditional proctoring, and one selected remote proctoring. Although proctoring is perceived favourably and offered by all universities examined in this study, it is not the primary learner authentication strategy that is consistently applied across all courses, likely due to costs and management challenges. Only one institution reported proctoring all of the final exams.

Challenges

In the distance education environment, academic integrity and technology are interconnected and continuously evolving. New methods of student authentication emerge, as do technologies that facilitate cheating. For some institutions, technology was not able to provide the desired level of performance. For others, the high cost of technology created a barrier to implementation. In addition to the cost of technology selection and initial deployment, maintenance, support, and administration may exert a significant impact on the budget. This in turn may affect student tuition rates and consequently accessibility.

High level authentication strategies add logistical burden on instructors and administrators. Provision of examination facilities, time zone differences, and technical issues are some of the challenges that administrators reported when dealing with exam invigilation both traditional and remote. Examination facilities are managed differently based on location and, therefore, there is a variance in level of service and support quality. Facilitation of standardized exams in examination centers dispersed over multiple time zones is also a challenge, as it creates a potential for sharing exam information between learners in different time zones.

Technical issues were also reported emerging outside of examination facilities. Remote monitoring of students' computers that use different operating systems may be affected by compatibility issues. Technical glitches resulting from software or hardware failure or loss of connectivity during examination may undermine reliability and efficient operation of the remote proctoring. Nevertheless, the future outlook for secure and reliable remotely managed examination is optimistic.

Effectiveness

An effective authentication system enables aligning student work with their identities with a reasonable degree of certainty at various stages in a course. The survey results show that the effectiveness of the identity control measures employed by the surveyed institutions is not well known. Many courses are designed for authentic assessments and project-based learning and do not always provide an opportunity for identity validation. While administrators were satisfied with select components of their existing system of authentication, pilot projects or various initiatives to further strengthen authentication measures were underway. Institutions are striving for continuous improvement and examining methods that promote academic integrity and higher identity assurance.

Organizational Issues

Logistical and administrative issues were reported among the challenges facing administrators for the provision of examination facilities. Technical issues were also reported when technology based authentication was employed. As new technologies emerge, institutions should not only examine the benefits, but also implications for the organizational structure (Bates, 2005). Implementation of new technology is often a challenging task in itself, especially when it requires organizational changes and involves a large number of stakeholders who depend on reliable and secure technology systems.

Accessibility

An open learning approach accommodates students who are unable to attend traditional universities. It is imperative that technologies that mediate open learning are accessible and available to all learners (Bates, 2005). With greater pressure to enhance security of learner authentication, the openness of distance learning is challenged and may change. One may argue that the very process that promises secure authentication of distance learners is also a barrier to accessibility. Regardless of technology employed, an identity profile needs to be accurately created prior to the authentication stage. The quality of authentication depends not only on the type of technology used, but also on the quality of initial identity enrollment. In order for a student to enroll and create a student profile, the university must provide a designated facility to do just that, either internally or through external service providers. It may work well for local institutions, but in the case of international students enrolling in a single distance course in another country or in a city that is not within driving distance, the logistics of student registration and identity validation pose a serious challenge.

Future Research

As previously noted, institutions put onus on instructors to conduct authentication tasks such as monitoring students' progress and flagging irregularities in their work. A future study may examine the process of validation of students' identities from instructors' perspectives and analyze the effectiveness of both the non technical means and technology tools instructors employ. Furthermore, studies on academic misconduct usually report data collected from student surveys. Since institutions track and trend academic misconduct data, future research may focus on an institutional level academic integrity incident reporting and not only compare institutional data collection and analysis procedures, but also examine the magnitude of academic dishonesty and identity fraud in particular.

The impact of secure authentication measures on accessibility is another question that has arisen as a result of discussion about various levels of authentication. Future research may examine accessibility levels of several authentication technologies and evaluate their influence on instructional design considerations and distance education in general. There is a discrepancy between what administrators consider effective measures of authentication and what measures they employ. Future research may examine this gap. And to conclude with a more fundamental question, a future study may examine different perspectives on what is a reasonable degree of certainty for authentication of student work. Should distance education schools follow the footsteps of traditional institutions and conduct at least one proctored exam in every course or continue relying on username and password authentication? Finally, the use of high stakes examinations as a corner stone for academic integrity is itself under challenge. Is performance on a time stressed, high stakes examination a valid assessment of a students' knowledge, skills, or potential to perform effectively in any but this very peculiar and foreign environment?

Recommendations

This study was undertaken using a pragmatic paradigm with an aim to implement findings and conclusions into policies and practices that may help university administrators deal with academic integrity issues. A complete avoidance of secure testing is not reasonable. Identity and authorship validation can and should be conducted at various points during a distance course. Administrators and instructional designers need to start taking academic integrity issues into consideration at the course/program design stage and consistently embed high level authentication strategies into the course activities.

Conclusion

This research was conducted with the intention to examine learner authentication measures and find examples that refute the "not possible" claim made by Moore and Kearsley almost twenty years ago. When the literature review was conducted to explore the relevant research regarding the issue of remote authentication of learners, several promising developments that indeed challenge the claim Moore and Kearsley made in 1996 stood out as a potential solution to this issue. These include biometric technologies and remote proctoring systems. This study confirms that secure learner authentication in the distance education environment is possible not only through the use of technology, but also through application of policy that requires adequate identity assurance measures to be embedded into course design.

The findings from this study tend to reinforce the idea that the values and standards of academic integrity remain the same regardless of the medium of instruction. One may argue that a project paper or assignment collected by a teaching assistant in a large auditorium of a traditional school provides the same level of identity assurance as the one submitted electronically. Neither identity of students nor authorship of manuscripts is validated at the time of collection. Students are expected to be honest across all academic activities they participate in whether in class or online. The issue of trust is key, however one may not merely rely on an assumption that the virtue of integrity is maintained by all students. Authentication measures are important not only for preserving the perceived credibility of the institution, but also for public safety as may be the case with critical areas such as aviation training or health care studies. Therefore, secure authentication is justified and ought to provide a system of checks and balances that ensures that the relationship of trust is intact.

The underlying issue when dealing with remote learner authentication is finding not only the right technology, but also a healthy compromise between the credibility and accessibility of distance learning. Low level authentication methods make academic resources more accessible, as access is open to anyone with a computer and internet access. In contrast, high level authentication methods often require additional technical or administrative resources and add logistical challenges. A system of checks and balances is what defines credibility, and credibility of distance education entails greater responsibilities for all the stakeholders. Therefore, putting greater emphasis on high level authentication strategies may require greater involvement of students, administrative, and teaching staff in the evaluation process. By minimizing over-reliance on measures that do not provide authorship and identity validation, the convenience and accessibility levels of distance courses may be affected. This may consequently change the face of distance education once again.

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Improved Fuzzy Modelling to Predict the Academic Performance of Distance Education Students



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Abstract

It is essential to predict distance education students' year-end academic performance early during the course of the semester and to take precautions using such prediction-based information. This will, in particular, help enhance their academic performance and, therefore, improve the overall educational quality. The present study was on the development of a mathematical model intended to predict distance education students' year-end academic performance using the first eight-week data on the learning management system. First, two fuzzy models were constructed, namely the classical fuzzy model and the expert fuzzy model, the latter being based on expert opinion. Afterwards, a gene-fuzzy model was developed optimizing membership functions through genetic algorithm. The data on distance education were collected through Moodle, an open source learning management system. The data were on a total of 218 students who enrolled in Basic Computer Sciences in 2012. The input data consisted of the following variables: When a student logged on to the system for the last time after the content of a lesson was uploaded, how often he/she logged on to the system, how long he/she stayed online in the last login, what score he/she got in the quiz taken in Week 4, and what score he/she got in the midterm exam taken in Week 8. A comparison was made among the predictions of the three models concerning the students' year-end academic performance.

Keywords: Distance education; academic performance; fuzzy logic; genetic algorithm; online learning

Introduction

Two out of every three people use the Internet, according to a report published by the International Telecommunication Union in 2012. Similarly, the National Center for Education Statistics (NCES) reported that the number of students who took at least one course via distance education significantly increased from 1.1 million in 2002 to 12.2 million in 2006 (Brain Track, 2013). These two reports suggest that an increase in Internet use leads to a corresponding demand for distance education. Considering the advantages distance education offers, it is easy to project a further increase in the demand. Even so, distance education has its own drawbacks such as lack of motivation on the part of the individuals and limited dialogues with instructors. These disadvantages cause students to quit distance education. The number of students leaving distance education is higher than those quitting formal education (Kotsiantis, Pierrakeas, & Pintelas, 2003).

In traditional education, instructors enjoy the opportunity to observe student behaviors, which is a key contribution to testing and evaluation. On the other hand, observation is impossible in distance education. The purpose of this study is to offer a solution to the problem. In distance education, student performance can be tracked thanks to logs in the learning management system. These logs enable one to record how long a student studies teaching materials, how long he/she is active in the system, how successful he/she is in the quizzes taken, how active he/she is in the forums on the subjects, and how many messages he/she posts or reads. An analysis of these logs allows student performance to be predicted in the middle of the semester.

The objective of assessment activities for an evaluation of student performance is not to grade students or to provide them with a certificate or other similar documents if they prove to be successful; instead, the objective is to have the opportunity to revise and improve the education and assessment instruments so that educational activities can be enhanced as a whole (Simonson, Smaldino, Albright, & Zvacek, 2003). Therefore, predicting student performance offers a number of benefits both to the organization and to instructors. Predicting student performance early at the beginning of the academic year enables one to take precautions so that high-risk students will not face adverse consequences later on.

The present study was based on predicting distance education students' year-end academic performances using a fuzzy-based model. The input data were comprised of particular variables in the learning management system as well as the results of the quiz in Week 4 and the midterm exam in Week 8.

Literature Review

A review of literature suggests that there are similar studies on the issue. A number of international publications have attempted to predict student performance using machine learning techniques. International publications share one characteristic: They are involved in predictions based on the categories “pass” or “fail” as a standard for performance (Zafra & Ventura, 2009). Such studies only predict whether a student can pass or fail. They have recommended that further studies could focus on predicting student grades and attempt to find the minimum length of time sufficient for prediction before the final exam.

Lykourentzou et al. (2009) used multiple genetic algorithms on the basis of an evaluation of results derived from three different methods to predict whether a student would quit a course or school. The study employed test results, project evaluations, and demographics (Lykourentzou, Giannoukos, Nikolopulos, Mpardis, & Loumos, 2009).

In another study, Vandamme et al. (2007) attempted to predict who would fail in a course or quit the school. To do so, they used artificial neural networks by classifying students under low, medium, or high-risk groups depending on such data as demographics, socio-economic background, and academic background (Vandamme, Meskens, & Superby, 2007).

Dimitris and Christos (2006) predicted distance education students’ academic performance using genetic algorithm and decision trees. In another study, Zafra and Ventura (2009) predicted whether students would pass or fail a course using multiple instance genetic algorithms. The study was based on student activities in the form of quizzes, assignments, and forums.

The research by Kalles and Pierrakeas (2004) analyzed students’ academic performance through the academic years measuring students’ homework assignments, and implemented short rules that explain success and predict success or failure in the final exams. Ibrahim and Rusli (2007) used neural network, decision tree, and linear regression to estimate students’ academic performance. In this work, they used demographic profiles and students’ first semester cumulative grade point averages (CGPA) to predict final CGPA.

Purpose and Research Questions

It is essential in distance education to predict students’ year-end academic performance in the middle of the academic year. Such prediction can enable one to take precautions for improving not only student performance but also the efficiency of distance education. Therefore, the present study attempted to find an answer to the following questions:

1. Do the results derived from the fuzzy-based model constructed have a satisfactory accuracy rate?
2. Would it bring about a significant difference in the accuracy rate if membership functions for the fuzzy-based model were reconstructed in accordance with expert opinion?
3. Would it bring about a significant difference in the accuracy rate if the intervals of the membership functions for the fuzzy-based model were optimized through genetic algorithm?

Method

Sample

The data for the study were initially on a total of 242 students who enrolled in Basic Computer Sciences at Yildiz Technical University during the 2011-2012 academic year. Since 24 of them had not participated in any of the activities in distance education throughout one semester, they were excluded, which meant that the study was conducted on 218 students. Demographics were not incorporated into the analysis. The data consisted of five inputs and one output. Out of the inputs, three were collected through Moodle, the distance education program on which the classes were based. These inputs were recency, which stood for the last time a student logged on to the section of the system related to the course; frequency, which represented the frequency at which a student logged on to the system; and monetary, which showed the amount of time (minutes) a student spent on the section of the system related to the course. Firstly, the data on the first six weeks starting from the beginning of the semester were collected through Moodle in the form of logs. The log file was comprised of approximately 55,000 lines. The software written in the Matlab environment ensured that recency, frequency, and monetary values could be calculated in these crowded data for each student. The fourth input was the results of the quiz administered online through Moodle in Week 4. The fifth input was the results of the midterm exam administered formally in Week 8. Within the scope of the course, students were required to take three online quizzes, two midterm exams, and one final exam. All these exams had their own influence on the year-end academic performance. To put it in a more clear way, three online quizzes, two midterm exams, and one final exam represented 20%, 40%, and 40% of the year-end academic performance respectively.

A fuzzy inference system was modeled so as to predict distance education students' year-end academic performance. First, a classical fuzzy was modeled. Then, it was remodeled in accordance with expert opinion. Finally, the model was optimized via genetic algorithm.

Fuzzy

In classical sets, an element is a member of a set or not. In mathematical terms, when an element belongs to a set, its degree of membership in that set is “1”. However, when it is not a member of a set, its degree of membership in that set is “0”. In fuzzy logic, nevertheless, each member has a value of membership that ranges between 0 and 1. Moreover, one element can be a member of more than one set. Take the statement that “those who are above 1.85 m. in length are tall”. According to classical logic, those who are above 1.85 m in length are tall, but those who are 1.85 m in length are not tall. In contrast, fuzzy logic asserts that a person who is 1.85 m in length is tall with a 0.9 degree of membership and of medium height with a 0.1 degree of membership.

Not everything in our lives is comprised of 1s and 0s as in classical sets. Rather, they have a number of uncertainties. In today’s world, fuzzy logic is commonly used for modeling and solving a problem dominated by uncertainties.

Fuzzy logic generally contains three stages. Fuzzification is the process where actual values as inputs in the system are blurred. Each input value is assigned a value of membership and turned into linguistic forms. The second stage is where rules are processed. Here, rules are derived in the form of “if then”. Inputs are handled in accordance with the rule table. The third stage, defuzzification, involves transforming fuzzy values into actual values. Figure 1 presents the structure of a common fuzzy system.

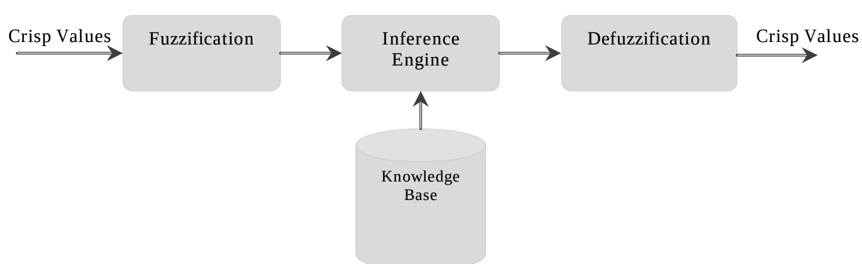


Figure 1. Structure of a fuzzy logic model (Osofisan, 2013).

The reason for using a fuzzy logic in the present study is its advantages. These are the facts that models can be established in an easy way through linguistic variables, imprecise/contradictory inputs are allowed, rules can be established in an easy way to design the model, and linguistic terms between input variables and output variables can be understood easily (Valluru, 1995).

Apart from these advantages of a fuzzy logic, its main disadvantage has been argued to be the necessity of establishing rules and membership function intervals in accordance with learned opinion (Taylan & Karagozoglu, 2009).

Genetic Algorithm

Genetic algorithm (GA) is a method of optimization that employs techniques associated with genetic process in living creatures in nature. Based on “the survival of the fittest”, it intends to find the best solution (Haupt & Haupt, 2004). GA works with a population of randomly generated individuals represented by chromosomes. Here, chromosomes are generally binary-encoded. The population has evolved toward better solutions using such genetic operators as crossover and mutation. In each new generation, the individual with the best solution generates new offspring, replacing those with poor solutions. Crossover hybridizes the genes of two parent chromosomes and generates child chromosomes. In this way, an increase is experienced in the number of individuals that will yield the best solution. The main component here is fitness function, which plays a role in deciding on good or bad solutions (Cordon, Herrera, Hoffmann, & Magdalena, 2001). Mutation is the process of altering, at a randomly determined rate, the genes of the chromosomes of the individuals in the population. The reason for the process is to ensure that the next generation will not be the same as the preceding generation. Figure 2 shows the flow chart of genetic algorithm.

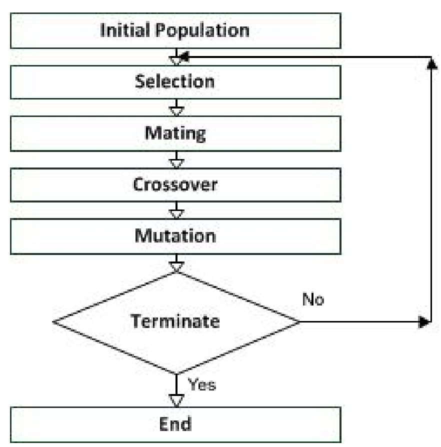


Figure 2. Simplified flow chart of a genetic algorithm (Keet, 2013).

Gene-Fuzzy

Fuzzy model has two significant steps following the determination of input and output variables. These are establishing fuzzy rules and determining membership function intervals.

Fuzzy rules can be created depending on data or by consulting experts. In this study, rules are generated by consulting experts. Some rules of the model are as follows.

1. If (recency is very poor) and (frequency is poor) and (monetary is very poor) and (quiz is medium) and (midterm is poor) then (academic performance is poor)

2. If (recency is poor) and (frequency is medium) and (monetary is very good) and (quiz is poor) and (midterm is poor) then (academic performance is poor)

3. If (recency is poor) and (frequency is poor) and (monetary is poor) and (quiz is very poor) and (midterm is poor) then (academic performance is poor)

...

12. If (recency is very good) and (frequency is very poor) and (monetary is very good) and (quiz is very good) and (midterm is medium) then (academic performance is medium)

13. If (recency is very good) and (frequency is very poor) and (monetary is very good) and (quiz is very poor) and (midterm is poor) then (academic performance is medium)

14. If (recency is very good) and (frequency is very poor) and (monetary is very good) and (quiz is very poor) and (midterm is very good) then (academic performance is medium)

...

49. If (recency is medium) and (frequency is good) and (monetary is very good) and (quiz is very good) and (midterm is very good) then (academic performance is good)

50. If (recency is medium) and (frequency is medium) and (monetary is very poor) and (quiz is very poor) and (midterm is very poor) then (academic performance is good)

51. If (recency is medium) and (frequency is medium) and (monetary is good) and (quiz is very good) and (midterm is very good) then (academic performance is good)

The other most significant components of fuzzy logic systems is membership functions. Figure 3 shows a triangular membership function.

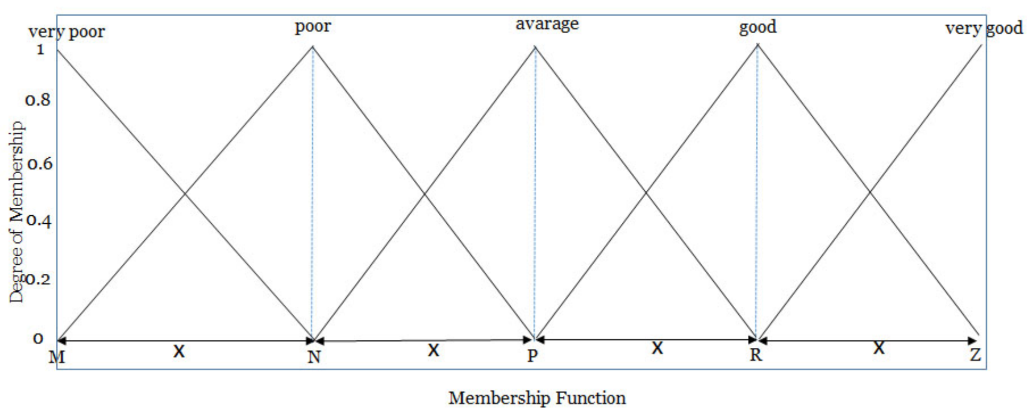


Figure 3. Fuzzy logic system membership function.

A membership function consists of shapes comprised of its own linguistic terms. The most commonly used ones are triangular, trapezoidal, or parabolic in shape. The present study is based on triangular membership functions. Each linguistic term has a particular interval value. In classical fuzzy, these intervals are determined through a number of operations. However, experiences are emphasized in the system based on expert opinion. In gene-fuzzy, starting and ending values of these intervals are determined for each membership function following the stages of genetic algorithm. Algorithm is inserted into the cycle until the optimum result is found. Determined intervals are transferred to the fuzzy logic system. This method is assumed to yield a better result than classical fuzzy, which is based on simple mathematical calculations, and expert fuzzy, which is dominated by experiences.

Findings

Classical Fuzzy

The fuzzy logic system constructed in this study had five inputs and one output. The former included recency, frequency, monetary, results of quiz, and midterm 1. The latter was year-end academic performance. One particular triangular membership function was determined for each input and output. Maximum and minimum points were identified on the data via normal distribution. The intervals for membership functions were revealed using these points (M, N, P, R, Z).

X = 95% in Normal Distribution

Y = 5% in Normal Distribution

Z = Highest value in each data set

T = Lowest value in each data set

Max = Greatest (X,Z)

Min = Smallest (Y,T)

a = (Max-Min)/4

M = Min

N = Min+a or Max-3a

P = Min+2x or Max-2x

R = Min+3x or Max-x

Z = Max

All these calculations yielded the following membership function:

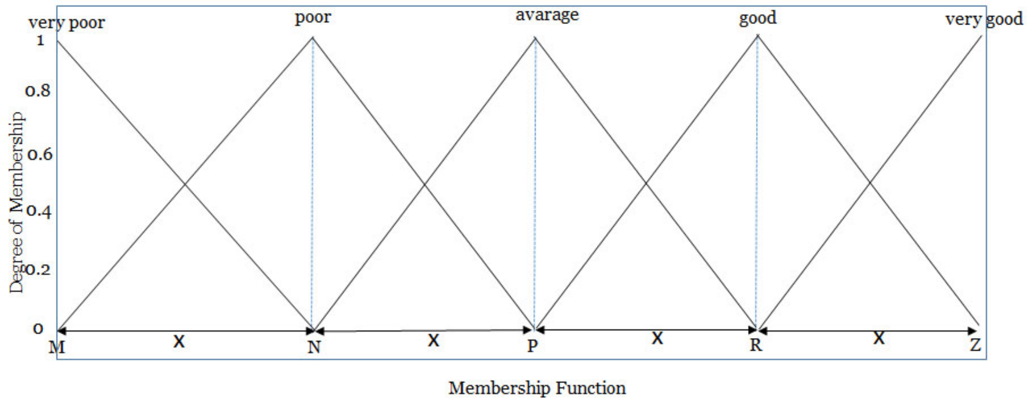


Figure 4. Classical fuzzy membership function.

The data for the study were on a total of 218 students. While 70% of the data were randomly chosen as educational data, the remaining 30% were identified as test data. The intervals of the membership functions for each input and output were determined through the process specified above. The following is an example of how the intervals of monetary membership function were determined.

Table 1

Mean and Standard Deviation for Monetary

Mean	22.16
Standard deviation	15.79

Figure 5. Normal distribution z values.

First, the values that corresponded to the top 5% and bottom 5% according to normal distribution were identified via the formula $Z = \frac{x-\mu}{\sigma}$.

Whereas z^* value for the top 5% was -1.65, the one for the bottom 5% was +1.65 (Moore, McCabe, & Craig, 2009). The formula yielded the values x = -3.90 and x = 48.23. Since the minimum value was negative, it was accepted as limit value. Maximum value in monetary was 71.7 and thus higher than 48.23. Therefore, maximum value was taken as 71.7. In order to generate a fuzzy logic membership function, it was necessary to identify the limits for the categories "poor", "average" and "good". For that reason, the lower limit was subtracted from the upper limit and it was divided by 4 in order to obtain interval values: x = (71.7-0) / 4 = 17.92

Interval for the category "poor" (N) = 0+17.92 = 17.92

Interval for the category "average" (P) = 17.92 + 17.92 = 35.85

Interval for the category "good" (R)= 35.85 + 17.92 = 53.77

Figure 6 presents the monetary membership function determined with the data above.

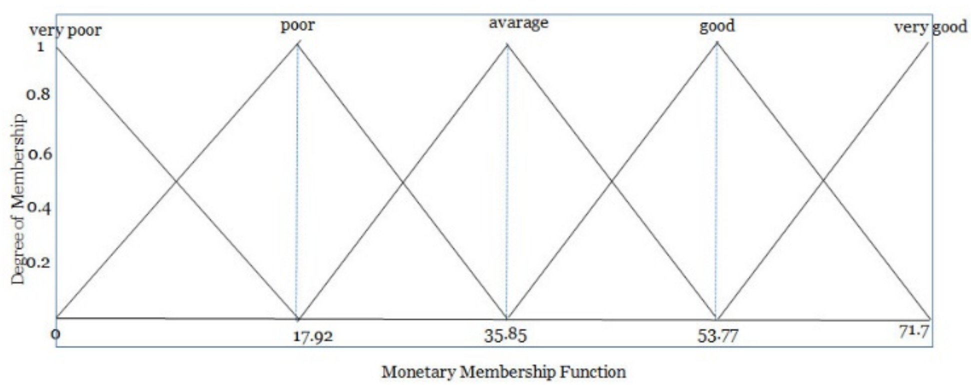


Figure 6. Interval values for monetary membership function.

The same process was followed for the other data as well, which yielded the membership functions presented in Figure 7.

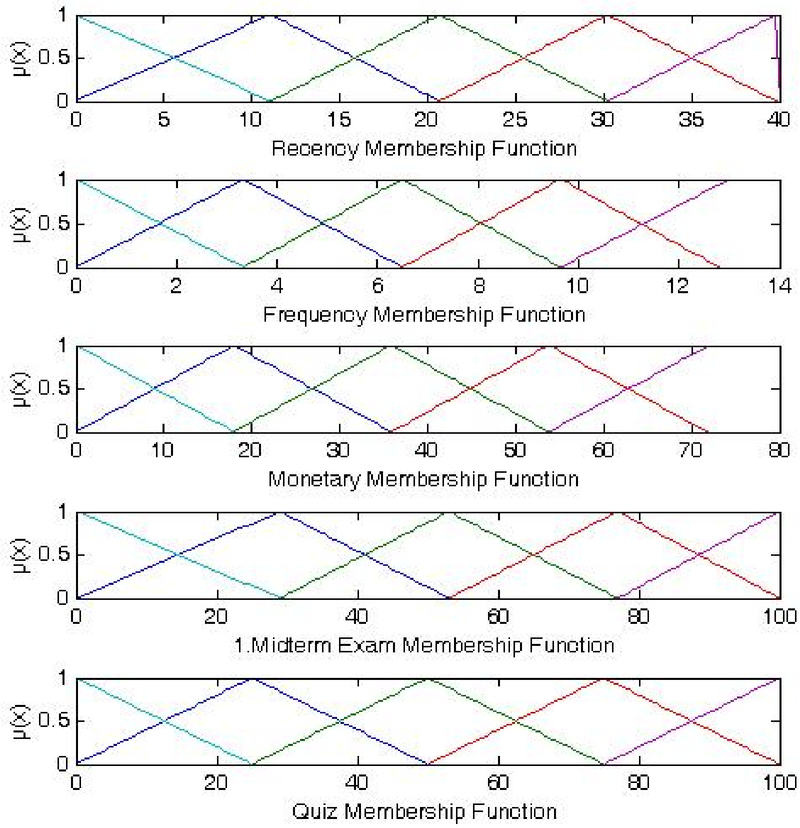


Figure 7. Membership functions for input variables.

The membership function for the output variable is presented in Figure 8.

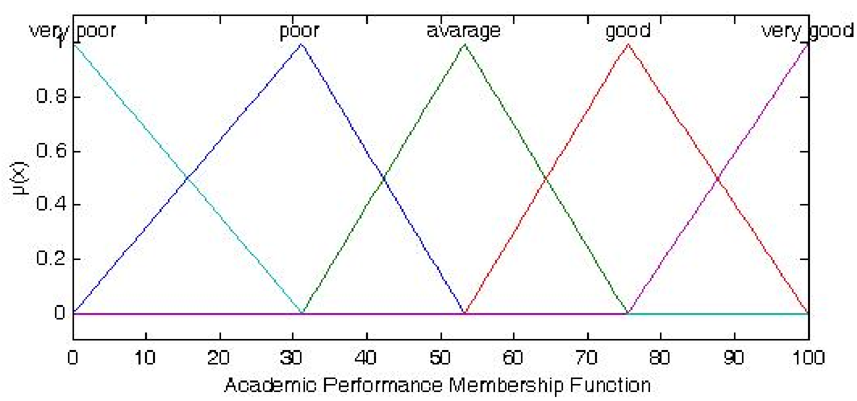
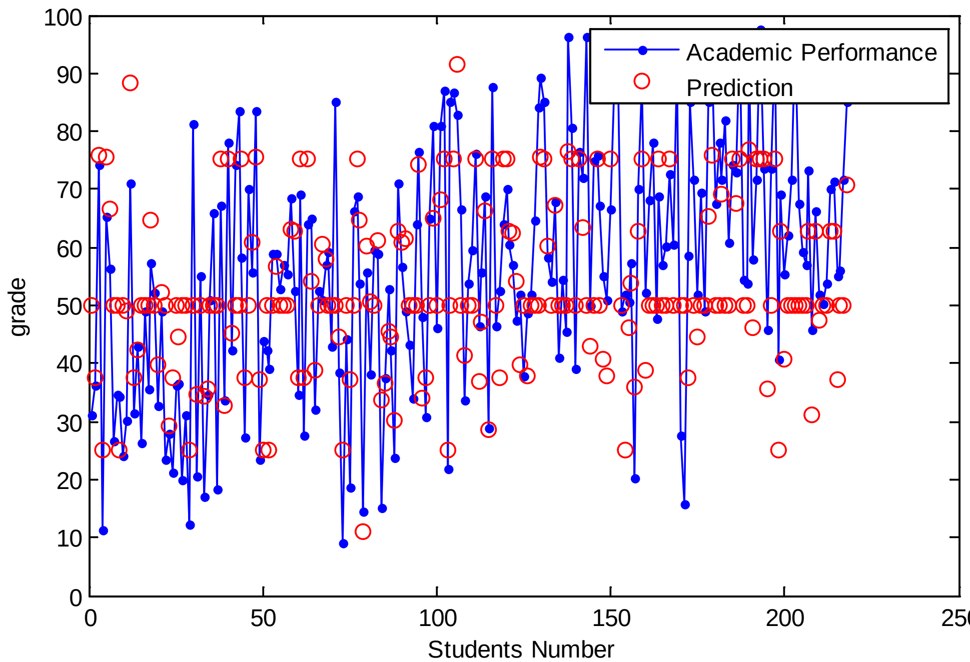


Figure 7. Membership function for the output variable.

When inputs were entered into the system to make predictions, the accuracy rate was nearly 72%.

The following is a comparison graph for the results.



Graph 1. A comparison for academic performance and prediction.

Expert Fuzzy

The most important criteria for a fuzzy logic model are membership functions and forming rules. Membership functions are chosen by trial and error, which might take a long time. It is another significant step to determine intervals for inputs. Experiences are essential at this point. One can predict results more accurately in a fuzzy logic model based on expert opinion. In addition to the fuzzy logic model constructed in the classical way, the present study also included another model based on experiences. To exemplify, the limit for recency, which recorded how many days passed before a student logged on to the system after a particular class was uploaded to it, was [0,42]. This meant that students logged on to the system and studied the class 0 to 42 days after it had been uploaded to the system. In the classical fuzzy logic, intervals for categories “good”, “average” and “poor” were determined by subtracting the minimum from the maximum and dividing it by 4. In this case, the limit for “good” should be [0 11 20]. This meant that a student would be a member of the category “good” with a degree ranging from 0 and 1 if he/she logged on to the system 0 to 20 days after the class had been uploaded to the system. Considering the fact that revising within seven days would ensure better understanding, the interval for the category “good” was changed to [0 7 14] in the model based on experiences. In addition to recency membership function, frequency and monetary membership functions were also changed to generate an expert fuzzy model. The results reported that the model had a mean accuracy rate of 78.62%.

Figure 9 presents the membership functions for the expert fuzzy model.

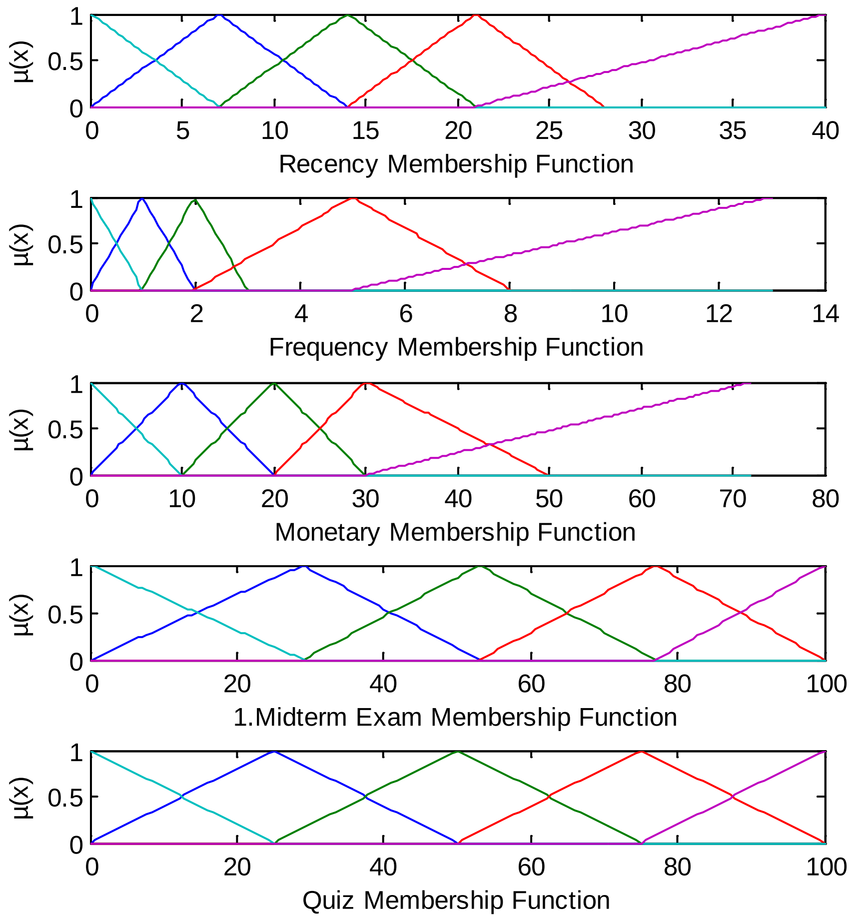
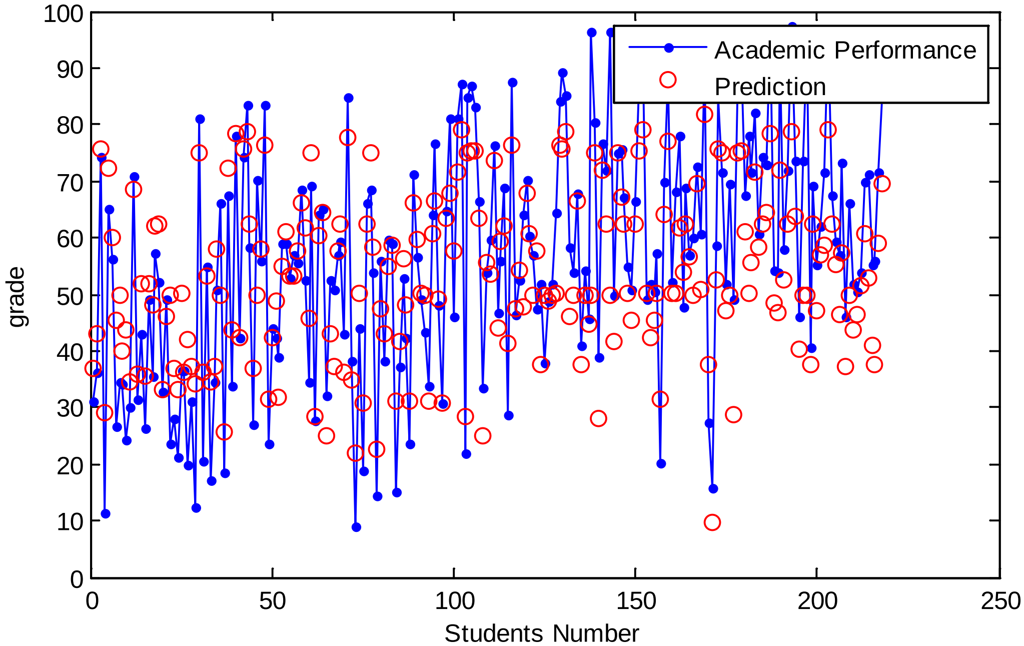


Figure 8. Membership functions for input variables.

The following is a comparison graph for the results obtained from the expert fuzzy model.



Graph 2. Comparison graph for academic performance and prediction.

Gene-Fuzzy Model

It is rather difficult to enhance the accuracy of results that are obtained from the method based on trial and error and expert opinion for determining the intervals of membership functions. Therefore, the intervals were optimized through genetic algorithm, a method of optimization based on natural selection and evolution. The objective was to maintain those intervals that could yield the best result in a population of randomly generated numbers, to generate better intervals, and to reach the interval that could yield the best result. The stages of genetic algorithm are briefly presented below:

1. Eight numbers were generated, three numbers for each of the inputs recency, frequency, and monetary between 0 and 128. At this point, quiz and first midterm exam membership functions were incorporated into optimization at fixed intervals.
2. Previous input interval values for classical fuzzy and expert fuzzy models were added to population. Each line of the matrix of the initial population, which consisted of a total of 10 x 45 matrixes, represented the intervals of the membership functions for fie inputs.
3. Values in the matrix of the initial population were applied to the fuzzy model and operated. Those values with the lowest error value according to the fitness function were listed. In the present study, the fitness function was error ratio function.

4. Five members of the population that could yield the best result by 50% selection survived (Haupt & Haupt, 2004).
5. Roulette wheel weighting was based on selecting individual performances by weighted average. The error ratios of the five members were found.

    a. Error ratio = $\frac{1}{n}\sum_{k=1}^{n}|(x_k^* - x_k)|/\, x_k$

x_k^*: Estimated value

x_k: Actual value

Error ratios for five intervals were calculated out of 100. The results are presented in the following table.

Table 2

Mating Error Ratios

Population number	Error ratio	Number of population members
1	0,177622	19,85411
2	0,177116	19,91076
3	0,17663	19,96559
4	0,175561	20,0871
5	0,174732	20,18244
Sum	28,35658	100

The results suggest that the first population with an error ratio of 17.76% would have 20 places in a set comprised of 100 populations. Similarly, the member of the population with an error ratio of 17.47% that could yield the best result would have 20 places. In this way, a new population pool was built.

1. Nine new members were selected from the population pool. The member of the population that could yield the best value was duplicated in the same way and, therefore, the best interval was maintained.
2. Binary encoding: Numbers in the decimal system were turned into the binary system to generate chromosomes.
3. Mating: A set was created with numbers ranging between 1 and 5. It was mated with a new set created by randomly ranking numbers from 6 to 10.
4. Crossover: Assume that two individuals mated were 0110010 and 0111001. At this point, a random number was created between 1 and 7. It was necessary to decide at which digit of the binary string the crossover would be operated. Assume that it was 5. New individuals were created by combining the first five

digits of the first individual with the last two digits of the second individual, and the first five digits of the second individual with the last two digits of the first individual. The process concluded that the first individual was 0110001 whereas the second one was 0111010.

5. Mutation: The objective of mutation is to prevent all individuals in the population from starting to yield the same result. Mutation is random selection and transformation of genes from the new individual created by crossover.
6. Iteration: Iteration was applied starting from the fourth step until the best result was obtained.

Figure 10 presents the ultimate status of the intervals following iteration.

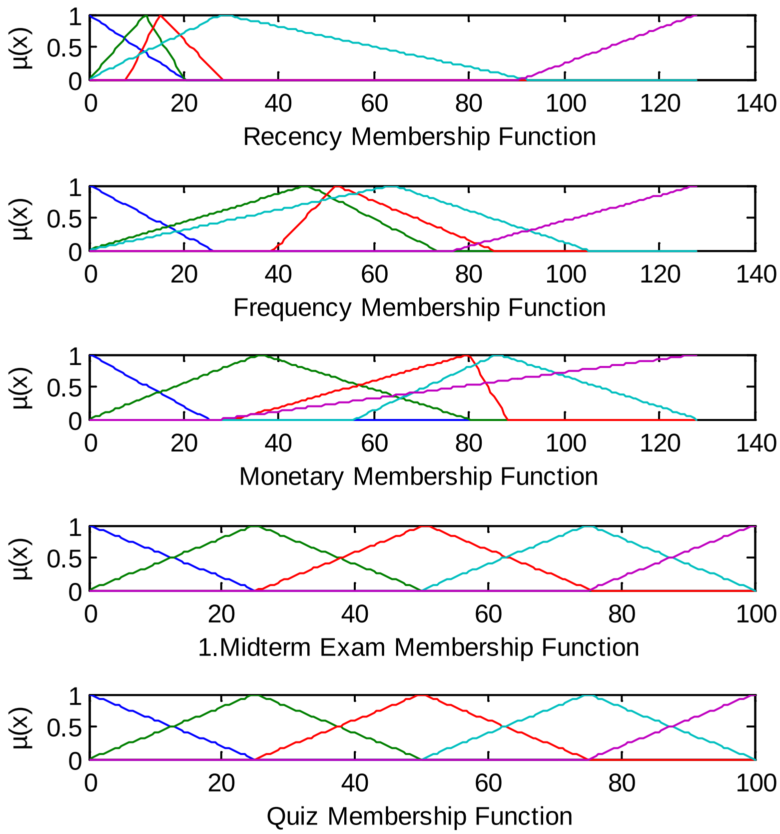


Figure 10. Membership functions by gene-fuzzy.

Figure 11 presents the membership function for the output.

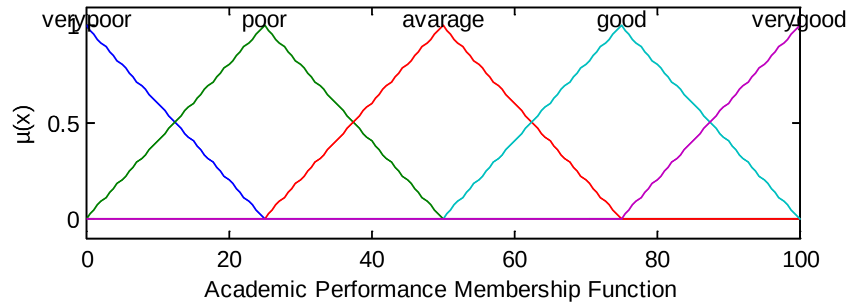
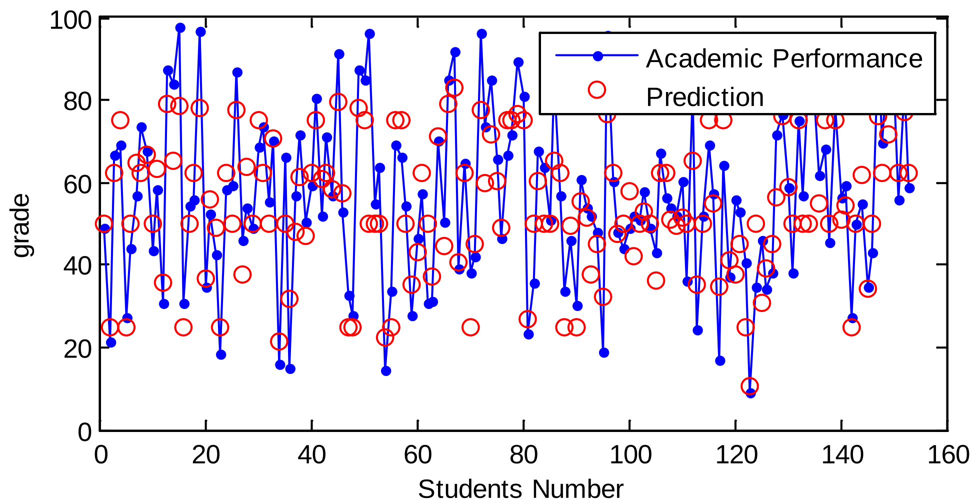


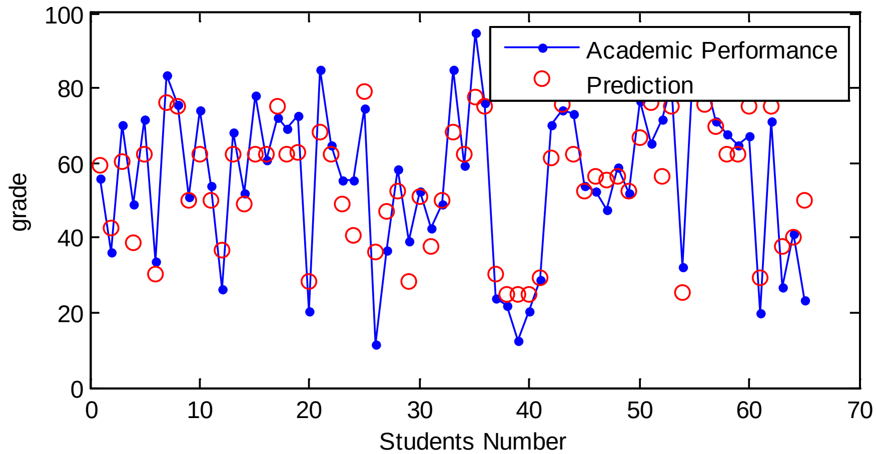
Figure 9. Academic performance membership function.

The following is a comparison graph for the results obtained by 70% random optimization. Iteration was operated 1000 times. In the end, 70% of the data, which were chosen randomly, had an accuracy rate of 82.5%.



Graph 3. Comparison graph for educational data.

The following is a comparison graph for the results obtained with the remaining 30% of the data. The accuracy rate for the 30% of the data was 81.11%.



Graph 4. Comparison graph for test data.

Table 3 presents the accuracy values for the three methods used in the study.

Table 3

Accuracy Values for the Methods

Model	Accuracy
Classic Fuzzy	72%
Expert Fuzzy	78%
Gene-Fuzzy	82,50%

The accuracy values for the predictions with the remaining 30% of the data are presented in Table 4.

Table 4

Accuracy Value for Gene-Fuzzy Test Data

Model	Accuracy
Gene-Fuzzy	81%

Discussion

Some of the significant results of a survey on 2500 universities in the United States are as follows:

- 63% of the universities assert that distance education will have a prominent place in the years to come. This is a 3% increase compared to the previous year.
- The number of students who took at least one online course in the spring semester in 2009 is 5.6 million. This is an increase of approximately 1 million compared to the previous year (Allen & Seaman, 2013).

These results suggest that supply and demand for distance education is increasing at a breakneck pace. The characteristics of distance education compared to formal education, coupled with rapid advances in technical infrastructure, mean that the increase will be more and more significant. However, it is inevitable that the disadvantages of distance education will increase as well unless necessary precautions are taken. The present study reports results that are likely to prevent these disadvantages from increasing. Thanks to the study, both students and instructors will have a clear idea about the general situation and take necessary precautions in the middle of the semester.

Limitations and Future Suggestions

The present study was conducted on distance students enrolled in Basic Computer Sciences. Further studies could focus on different courses and provide comparative results. The present study did not take the demographics of the participants into account. Further studies could build other models that also include demographics and present results in comparison with those of the present study. In addition, further studies could find intervals for fuzzy logic membership functions through clustering methods.

The model used in the present study can be adapted to the learning management system. In this way, it will be possible to predict distance education students' academic performance early during the semester on the basis of real-time data.

Conclusion

The present study concludes that fuzzy logic systems enable one to validly predict a distance student's year-end academic performance on the basis of the first eight-week data. His/her year-end academic performance can be predicted in accordance with the data on how many days pass before he/she logs on to a class after it has been uploaded to the system, how often he/she logs on to the class, how long he/she stays online in the class, how well he/she scores in the online quiz taken in Week 4, and how well he/she scores in the midterm exam taken in the classroom in Week 8. In this respect, the lowest result is provided by the classic fuzzy model. More accurate results are obtained from the fuzzy model that is based on expert opinion as well as the gene-fuzzy model, which is based on the optimization of the intervals for membership functions using genetic algorithm.

The best result is provided by the gene-fuzzy model, which is based on the optimization of the intervals for membership functions using genetic algorithm.

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Online Social Media Applications for Constructivism and Observational Learning

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Abstract

Web 2.0 technologies have a range of possibilities for fostering constructivist learning and observational learning. This is due to the available applications which allow for synchronous and asynchronous interaction and the sharing of knowledge between users. Web 2.0 tools include online social media applications which have potential pedagogical benefits. Despite these potential benefits, there is inadequate utilization of online social media applications in learning management systems for pedagogical purposes. Reasons cited for the limited uptake of online social media applications in learning management systems include the lack of consideration regarding the pedagogical benefits of these applications (Christie & Garrote-Jurado, 2009, pp. 273-279). There is limited information regarding experiences of the use of online social media that foster constructivist and observational learning. Using a qualitative meta-ethnographic approach, this article explores the experiences of students and instructors regarding online social media applications for constructivism and observational learning. Constructivist criteria (Baviskar, Hartle, & Whitney, 2009, pp. 543-544) and observational learning, based on Bandura's (2001, pp. 265-299) social cognitive theory, formed the theoretical grounding for this research. The findings suggest that discussion forums are ideal for the stimulation of constructivism and observational learning in online learning programmes.

Keywords: Learning management systems; online social media; constructivism; observational learning

Introductory Background

Online social media usage has grown exponentially over the last decade. This growth has been driven by the Web 2.0 concept, which allows for the creation and sharing of user generated content (Hershey, 2010, p. 196). Online social media includes collaborative platforms such as wikis, blogs, and discussion boards that can be used to form virtual communities. Online social media are communication and collaboration tools found in varied arenas including educational arenas.

With the introduction of Web 2.0 technology in the field of education, the possibilities for fostering constructivist and observational learning have increased. These possibilities are driven by the nature of emerging online applications (Siemens & Tittenburger, 2009, p. 35). In order to fully exploit the available possibilities, online instructional designers and instructors ought to align instructional design and facilitation of online teaching and learning along established learning paradigms. With the large number of applications available in learning management systems (LMS), it is sound for instructional designers, instructors, and institutional information technology (IT) departments to invest in those tools and applications that foster constructivist learning and observational learning. In spite of the potential pedagogical benefits offered by online social media applications, there is a general lack of uptake of learning management systems for pedagogical use by online instructors.

In this regard, a meta-ethnographic study was conducted to explore the experiences of lecturers and students regarding online applications found in learning management systems. The aim of the study was to identify applications that foster constructivism and observational learning among students. It is against this backdrop that the research reported on in this article took place. In the following sections, an overview of institutional learning management systems and online applications is presented. This area addresses available literature regarding the use of learning management systems for pedagogical purposes. A review of literature related to media for constructivism and observational learning is presented, followed by explanations of constructivism and observational learning which served as theoretical grounding for this study. The methodology employed and findings revealed are addressed with conclusions drawn based on the findings obtained. This article concludes by presenting recommendations, based on the findings, regarding online applications that foster constructivism and observational learning. These recommendations may assist institutional IT departments and online instructors as they make choices regarding the selection, management, and use of online social media in institutional LMS.

The Use of Online Media Applications in Learning Management Systems

LMS are internet based systems now found in higher education institutions. LMS are created for course administration as well as for pedagogical use. These widely used systems vary from one to another in terms of sophistication and adaptation. They also allow for customisation to meet various needs. However, they have certain characteristics that define them as LMS. The first is the possibility for both synchronous and asynchronous communication using the LMS. This is made possible by the applications available such as email, discussion boards, and chat platforms. Secondly, these systems allow for the development and delivery of learning resources and links to internet resources. In terms of assessment, LMS allow for the submission of assignments, feedback, and multiple choice testing. Lastly, LMS enable management of learning such as registration information, the display of time-tables, and the management of student activities (Coates, James, & Baldwin, 2005, pp. 20-21). LMS are essential in both campus based institutions and open and distance learning institutions. When effectively used they have the potential to improve and support learning within both modes of education facilitation (Dalsgaard, 2006).

Despite the potential benefits to learning offered by LMS, the use of these platforms by instructors and students is limited. Literature has addressed the problem of lack of uptake of LMS for pedagogical purposes. The lack of sufficient knowledge regarding the pedagogical benefits of LMS is one factor limiting its use and adaptation (Chen, 2011, pp. 42; Christie & Garrote-Jurado, 2009, pp. 273-279). Another factor that contributes to the limited adoption of LMS for pedagogical purposes is the management and selection of LMS, which lies in institutional IT departments. In this regard, academics have limited input in the choices made by IT departments (Bell & Shank, 2004, in Black & Blankenship, 2010, pp. 459). Another reason for the limited adoption of LMS for pedagogical purposes is the lack of competence development and support in how to use the LMS for pedagogical purposes, on the part of instructors and students (Christie & Garrote-Jurado, 2009 pp. 277).

While the studies cited have addressed pedagogical affordances of various applications, there is a need for aligning these affordances to learning theories and typologies. It is against this backdrop that a meta-ethnographic study was conducted to explore the experiences of online students and instructors regarding online social media and learning. The purpose of carrying out the study was to explore the pedagogical benefits of online social media found in LMS. The pedagogical benefits the study sought to explore were aligned to the criteria for constructivist and observational learning.

Media for Constructivism and Observational Learning

Research from a positivist paradigm has revealed that online media applications foster improved learning outcomes (Liang & Tsai, 2008, pp. 226-237; Sultan, Woods, & Koo, 2011, pp. 149-163). While research in online learning environments has added to the understanding of the role media plays in fostering learning, the media in question was not based on Web 2.0 technology (Sultan, Woods, & Koo, 2011, pp. 149-163). Additionally, the pedagogical affordances of various online media applications are known (Clark & Mayer, 2011 pp. 284-285; Siemens & Tittenberger, 2009, pp. 42). Discussion forums have proven useful as reflective tools (Juwah, 2010, pp. 24-25). Similarly, the pedagogical benefits of interaction in virtual environments have been empirically established (Yang, Yeh, & Wong, 2010, pp. 287-306). While podcasts have been proven to stimulate constructivist learning (Ng'ambi & Lombe, 2012, pp. 181-192), knowledge regarding the pedagogical potential of other online media applications in institutional learning management systems is lacking leading to a lack of uptake by lecturers and students.

The use of collaboratively observed videos as a means of achieving observational learning has been established in literature (Craig, Chi, & VanLehn, 2009, pp. 179-189). In addition, videos have also been proven as a means through which individuals with special needs can be effectively taught socially expressive behaviours (Charlop, Dennis, Carpenter, & Greenberg, 2010, pp. 371-393; Charlop-Christy, Le, & Freeman, 2000, pp. 537-552; Geiger, LeBlanc, Dillon, & Bates, 2010, pp. 279-383; Nikopoulos & Keenan, 2003, pp. 87-108; Sherer, Pierce, Paredes, Kisacky, Ingersoll. & Schreibman, 2001, pp. 140-148) and vocational skills and life skills (Keen, Brannigan, & Cuskelly, 2007, pp. 291-303; LeBlanc, 2010, pp. 333-337). These studies have contributed to an understanding of the role video based media plays in fostering learning amongst learners with special needs.

Constructivism

Constructivism in education is based on the works of Lev Vygotsky (1978) in Pritchard (2005, pp. 254), a Russian psychologist and Jean Piaget (1961 in Pritchard, 2005, pp. 254). The common thread that links constructivist thought is that learning occurs when the students create new knowledge based on existing knowledge which they inherently possess. Constructivism, as a learning paradigm, formed part of the theoretical and conceptual framework for the research. Baviskar, Hartle, andWhitney (2009, pp. 543-544) identify four constructivist criteria and emphasize the need to adhere to the four criteria for any teaching and learning to be considered constructivist.

The first critical element is the eliciting of prior knowledge. The premise of this element is that all new knowledge is acquired in relation to prior knowledge which the student possesses (Baviskar, Hartle, & Whitney, 2009, pp. 543). This is achieved by either the lecturer's use of mechanisms to elicit prior knowledge or the drawing of the student's attention to his prior knowledge. This criterion is referred to as elaboration (Loyens, Rikers, & Schmidt, 2007, pp. 582) who state that elaboration leads to significant learning gains. The creation of cognitive dissonance is the second criterion for the stimulation of constructivist learning, according to Baviskar, Hartle, andWhitney (2009, pp. 544). In this second criterion, the student is made aware of the difference between his prior knowledge and new knowledge. The third criterion for constructivist learning is the application of the knowledge with feedback. At this stage the student is required to interpret and modify prior knowledge in the context of new knowledge. This particular criterion is consistent with the defining characteristic of constructivism as a social and collaborative activity as noted by Al-Fadhli and Khalfan (2009, pp. 531) and others such as Loyens et al. (2007, pp. 582). This serves as a means to integrate the new knowledge permanently (Baviskar, Hartle, & Whitney, 2009, pp. 544). Reflection on learning is the fourth criterion for constructivist learning. On integrating the new knowledge permanently, the student ought to become aware that learning has taken place (Windschitl, 2002; Yager, 1991 in Baviskar, Hartle, & Whitney, 2009, pp. 544).

Observational Learning

Observational learning based on Bandura's (2001, pp. 265-299) social cognitive theory was further grounding for the research. Bandura (2001, pp. 266) explains that human nature is a vast potentiality that can be fashioned from direct and observational experience. In observational learning, a single model can transmit new ways of thinking and behaving simultaneously to countless people in dispersed locales. Social cognitive theory also posits that humans operate within socio-structural networks which they are products of and producers of. As a result human nature is shaped by direct observable experience through various processes which are intrinsically human, symbolizing capabilities, self-regulatory capabilities, self-reflective capabilities, and vicarious capabilities.

As asserted by social cognitive theorists, human beings have evolved an advanced capacity for observational learning that enables them to advance their knowledge and skills beyond their fields of experience. Human beings similarly have the unique ability to use information conveyed by the rich variety of models for all behavioural, cognitive, and affective learning. This is achieved through both direct experience and vicariously by observing people's actions and its consequences for them (Bandura, 1986; Rosenthal & Zimmermann, 1978 in Bandura, 2001, pp. 271). Much social learning occurs from modelling based on one's direct realm of existence; however, a vast amount of social learning is gained from modelling in the symbolic environment of mass media (Bandura, 2001, pp. 271).

Stefanone, Lackaff, andRosen (2010, pp. 512) explain that modelling refers to the process through which individuals observe others, interpret the behaviour, and adjust their own in response. The development of television is viewed by Bandura (1986 in Stefanone, Lackaff, & Rosen,2010, pp. 512) as an especially important source of behaviour models, enabling people to "transcend the bonds of their immediate social life" (Bandura, 1986, pp. 55). In comparison to the quantity of information about the world available in daily life, the amount of environment rich information provided via media is vast. To the extent to which one's images of reality, mediated and vicarious, rather than directly experiential and experimental, is greater is a result of the impact of media (Bandura, 1986). Whereas previously modelling influences were largely confined to the behaviour patterns exhibited in one's immediate environment, the accelerated growth of video delivery technologies has vastly expanded the range of models to which members of society are exposed. Because the symbolic environment occupies a major part of people's everyday lives, much of the social construction of reality and shaping of public consciousness occurs through electronic acculturation (Bandura, 2001, pp. 271). Modelling has proven to yield better results in the area of training (Yi & Davis, 2003, pp. 147). Modelling is thus a more complex process than mimicry or imitation, and Bandura (2001, pp. 273) identifies four specific functions of the process.

Attentional Processes

Attentional processes during modelling for observational learning determine what is selectively observed in the profusion of modelling influences and what information is extracted from ongoing modelling events. This is achieved by the person exercising attentiveness when observing modelling. According to Bandura (2001, pp. 272) a number of factors influence what is modelled. He classifies these factors as the observer factors, which include cognitive skills, preconceptions, and value preferences. Similarly, the factors may be classified as the modelled activity factors: salience, attractiveness, and functional value. Separate factors include the structural arrangements of human interactions and association networks, which largely determine the types of models to which people have ready access (Bandura, 2001, pp. 272).

Retention

Bandura (2001, pp. 272) identifies the second major sub-function of modelling for observational learning as retention. Retention involves the active process of transforming and restructuring information conveyed by modelled events into rules and conceptions for memory representation. Retention is greatly aided by symbolic representations of modelled information into memory codes and cognitive rehearsal of the coded information (Bandura 2001, pp. 272). Actions thus must be cognitively registered as symbolic representations in one's memory in order to regulate behaviour (Yi & Davis, 2003, pp. 147). Bandura (2001, pp. 272) emphasizes that preconceptions and affective states exert biasing influences on these representational activities. He further asserts that recall involves a process of reconstruction rather than simply retrieval of registered events.

Production Processes

The third sub-function of modelling for observational learning is the behavioural process. Bandura (2001, pp. 272) explains that this process involves the translation of symbolic conceptions into appropriate courses of action. This is achieved through a conception-matching process in which conceptions guide the construction and execution of behaviour patterns that are then compared against the conceptual model of adequateness. The behaviour is modified on the basis of the comparative information to achieve close correspondence between conception and action. The mechanism for translating cognition into action involves both transformational and generative operations. Execution of a skill must be constantly varied to suit changing circumstances. Adaptive performance, therefore, requires a generative conception rather than one to one mapping between cognitive representation and action. By applying an abstract specification of the activity, people can produce many variations on the skill (Bandura 2001, pp. 272). Yi and Davis (2003, pp. 147) elaborate that the retained symbolic memory of actions must be reconverted into overt actions to generate desired responses.

Motivational Processes

The fourth sub-function in modelling for observational learning as identified by Bandura (2001, pp. 274) is the motivational process. Social cognitive theory distinguishes between acquisition and performance because people do not always perform everything that they learn. Bandura (2001, pp. 274) identifies the three major types of incentive motivators which influence performance as direct, vicarious, and self-produced. People are more likely to exhibit modelled behaviour if it results in valued outcomes rather than in punishment or unrewarding outcomes. People are motivated by the successes of others who are similar to themselves. Personal standards of conduct provide a further source of incentive motivation. The self-approving and self-censoring reaction people generate on their own behaviour regulate which observationally learned activities they are most likely to pursue. They pursue activities that they find satisfying and that give them a sense of worth but reject those they personally disapprove of (Bandura, 2001, pp. 274). The symbolic memory of actions weakens unless perceived consequences of performing the actions are favourable to cause repeated performance (Yi & Davis, 2003, pp. 147)

Methodology

This research is based on a meta-ethnographic approach. Meta-ethnography is a qualitative method that is used to synthesize understanding from ethnographic accounts. It allows interpretivists to derive understanding from multiple cases, accounts, narratives, or studies. Meta-ethnography is described as the synthesis of interpretive research (Noblit & Hare, 1988, pp. 10-12), The procedures that were therefore followed when conducting the meta-ethnography used the guidelines as prescribed by Noblit and Hare (1988, pp. 26-29).

The initial step of the meta-ethnographical method entailed the identification of the interest of the research (Noblit & Hare, 1988, pp. 26-29). In this case the interest of the research was the exploration of online social media applications that lead to constructivist learning and observational learning in online learning environments. The objective of this research was to synthesize previous research theses produced internationally, in order to gain understanding into the experiences of lecturers and students regarding online social media applications, constructivism, and observational learning. This part of the meta-ethnographic approach involved the conducting of a library search in order to access the data. The keywords of constructivism, observational learning, and online media were used to conduct the search. The search yielded 346 theses and dissertations.

The relevant theses and dissertations were identified using four guidelines. The first was what was credible and of interest to the focus of the research. Inclusion and exclusion criteria were drawn in order to allow for sifting through the total number of research reports and extricating what was relevant to the research objective. In this case, the first criterion for selecting sources for the meta-ethnography was the inclusion of only completed primary research in the form of a research dissertation or research thesis in English. The selected sources addressed the experiences of students regarding online media and learning. The second criterion was the inclusion of theses and dissertations based on research conducted between 2001 and 2011. Data based on research prior to 2001 and after 2011 were not included. The third inclusion criterion was theses and dissertations that were fully accessible. At this stage the theses and dissertations that could not be fully accessed were excluded from the study. The abstracts of the remaining articles were read to determine which of the research designs departed from a qualitative research approach which constituted the fourth inclusion criterion. The remaining four articles which are based on qualitative designs appear in Table 1. The selected articles were subjected to the subsequent meta-ethnographic procedures as indicated by Noblit and Hare (1988, pp. 28-29).

Table 1

Theses and Dissertations Focusing on Online Media Applications and Learning

Title of the research	Author	Year
Elementary lecturers' perceptions of technology as a catalyst for constructivist practices in the classroom: a case study	Lynne Brown Menard	2010
Social implications facing online students: a case study of undergraduate multimedia students	Mia Boster	2009
The lived experiences of university faculty who teach using a hybrid instructional model	Udeme Taylor Ndon	2006

Instructional uses of computer-mediated text-based messaging tools: a case of faculty and student experiences and perceptions	Carol DeArment	2002

The available qualitative theses were read through in order to note the interpretive themes in each thesis. The reading of each thesis was conducted more than once and the themes as they relate to the focus of the study were noted. For this purpose Atlas.ti qualitative data analysis software was utilized.

Noblit and Hare (1988, pp. 62) indicate that lines-of-argument synthesis allows for inferences to be made about the whole based on selective studies of the parts, and is amenable to the meta-ethnographic approach. In line with a lines-of-argument synthesis, similarities and differences amongst the studies to be synthesized were discovered and constructed in a holistic synthesizing scheme.

Findings

In this section links were made between the findings and the criteria of the theoretical framework for the research. The findings as they relate to constructivism followed by the findings in relation to observational learning are presented.

Research Findings in Relation to Constructivism

As is consistent with the first criterion for constructivism (Baviskar, Hartle, & Whitney, 2009, pp. 543), the students have to be able to elicit their prior knowledge regarding learning content and link this prior knowledge with new knowledge. In the case of this research, the experiences of students using technology were explored and linked to the various criteria for constructivism. The link between the student experiences and the constructivist criterion of eliciting prior knowledge emerged in the use of discussion boards for online teaching and learning. Some quotations associated with this particular criterion are as follows:

> The Discussion Board could help us to develop our own thoughts. A student has to have (his or her) ducks in a row before posting. The Discussion Board forces students to support their thinking, and if they can't, they should keep their mouths shut. (DeArment, 2002, p. 105)

> I can think of several times on the Discussion Board where I have read articles (assigned for class), and

> someone else has read the same article, and (his or her) comments kind of articulated something that resonated with my response, an idea that I hadn't really fully formed yet. It helped me to kind of put it together. (DeArment, 2002, pp. 104)

> This teacher recognized how her students were independently pulling from their life experiences and connecting them to the district strategic objectives. (Menard, 2010, pp. 95)

The second criterion for constructivist learning was that of achievement of cognitive dissonance. As was the case with the first criterion, the experiences of students using technology were explored and linked to cognitive dissonance and the media that stimulated cognitive dissonance. The medium that stimulated cognitive dissonance was the discussion board, as shown in the following quotation:

> Scrutinizing a message she had posted for Unit 4, Meg recalled,

> I had browsed sites as part of my work, and (my thoughts) sort of clicked when I read the discussion; that's when I posted. I think I got something out of trying to gather my thoughts together. (DeArment, 2002, pp. 142)

The criterion of application of knowledge was absent from the data with no themes emerging that inferred the application of knowledge with feedback.

The final criterion for constructivist learning was that of reflection. This criterion was inferred from the data and the media that encouraged reflection were those that allowed for text messaging and included blogs and discussion boards. Examples of the quotations are as follows:

> Another example of how the participants encouraged active and independent learning was through self-reflection. Madison indicated that he used the critical incident questionnaires which appear in the Brookfield book "How to be a Critical Reflective Teacher" to ask students to "report on their experiences each week on what they learned, and what frustrated them. (Livonia) (Ndon, 2006, pp. 115)

> ...online text-messaging tools provided varied ways they could access and engage with course information. She pointed out to the researcher examples of Discussion

> Board exchanges in which students reflected on awareness of their own learning. (DeArment, 2002, pp. 84)

Research Findings in Relation to the Functions of Observational Learning

In this section the findings were linked to the criteria for observational learning which, in addition to constructivism, formed the theoretical framework for the research.

Attentional processes.

With regard to observational learning one of the factors that allow for modelling of observed behaviour is that of attentional processes. On the part of the modelled activity factors salience, attractiveness, and functional value are the key attributes (Bandura, 2001, p. 272). In this regard, the theme of attentional processes came up during data analysis, with attractiveness appearing once:

> Thus, to Meg, effective messages were those that were carefully crafted, and her scrutiny of discussion threads in preparation for her own reflective messages helped her to gain insight into her own thinking and learning processes. (DeArment, 2002, pp. 143)

Attentional processes include affective valence which includes salience on the part of the modelled activities. This means the modelled activity is viewed as striking and conspicuous. In this regard, this theme appeared in the data analysed, and discussion boards, videos, and learning objects were the media that facilitated this process:

> When we can ask questions on the discussion board and see other student work it is helpful. Multimedia classes are more visual and fun online. I think the discussion boards are vital to the class. It’s vital to help students succeed and the support from other students is important. (Boster, 2009, pp. 81)

> Thomas indicated that the online environment was good for information seeking; retrieval and storage of reading materials, syllabus, or reporting on on-going progress. Barb believes that videos and learning objects are best for the online environment and added, “I think what happens is that if you can make the online environment as visual as possible that really helps the students, that is, if you can move beyond the text. (Ndon, 2006, pp. 108)

The internet served as a source of modelling events once students realized the functional value of the resources:

> The teachers reasoned these gains could be attributed to students accessing research materials on the Internet that were intended for higher grade levels. (Menard, 2010, pp. 56)

Retention processes.

The retention processes include the active process of transforming and restructuring information conveyed by the modelled events (Bandura,2001, p. 272). One of the ways in which this occurs is through cognitively organising the modelled events. In the data for this research, retention through cognitive modelling occurred and was facilitated by discussion boards:

> Repetition of above quoteThe teacher participants discussed how students consistently exceed expectations when using technology. Students are fully engaged by multimedia content that accelerates learning and improves comprehension. The students seem to assimilate digital information easily. (Menard, 2010, pp. 60)

> Meg gained insights about her perceptions of effective messages when the researcher asked her to reflect on several of her posts. Meg recognized the value of messages that reflected careful thought and realized that other students' messages could serve as catalysts for her own thought processes. (DeArment, 2002, pp. 142)

In addition, retention processes may occur by symbolic coding in which case the discussion board proved useful in this regard:

> Others' posts gave me stuff to kick around and see what came out [when I wrote my thoughts down]. Their posts have helped me to crystallize my ideas, to rethink what I thought I was learning, or to realize that maybe I need to step back and look at this again, or to go to my friends and hash it out with them. (DeArment, 2002, pp. 105)

> Bob thought that it was "a different kind of teacher's time" because it is/was not as fixed as it is in the face-to-face class and the discussion forum produced "interesting thought provoking activities." He further stated, "[I] think that the students learn more because

> they are more engaged. I think that they have more opportunities to develop their own approach to logical ideas and to contribute to the work of the class as a whole. (Ndon, 2006, pp. 137)

Production processes.

The third sub-function of modelling for observational learning is the production process. Bandura (2001, pp. 272) explains that this process involves the translation of symbolic conceptions into appropriate courses of action. Constituent processes associated with the production process include the use of feedback for conception matching. In this regard, quotations related to this theme included:

> When the student took Barb's hybrid class, in the face-to-face part, the student again, was noticed to be very quiet. But Barb and other students noticed that in the online environment of the hybrid course, this student was able to express herself very well. She was extremely articulate to a point that some of the students had to wonder who the student was because they were so impressed with her contributions. This example reinforces the notion that going at teaching in two different, but integrated ways improves student's involvement, engagement, and learning. (Ndon, 2006, pp. 140)

> A student's individual strengths are recognized and valued. As students present their work to other students, they analyze and evaluate their contribution to the final product. The student "audience" evaluates how individual contributions impact their work as they listen to the presentation. (Menard, 2010, pp. 70)

Motivational process.

The fourth sub-function in modelling for observational learning as identified by Bandura (2001, pp. 274) is the motivational process which emerged as the most prominent theme in the analysed data. A constituent of this theme includes social incentives. Two quotations associated with social incentives appear below:

> In my experience classes were a lot more fun online when you can share views on class work and have discussions as assignments rather then just turning in a weekly assignment. So even if the student is forced to participate and socialize (because it is a required

> assignment) with other online students it was more enjoyable. (Boster, 2009, pp. 69)
>
> The discussion board was a social place to exhibit and discuss multimedia projects and this interaction motivated students to participate and learn online. (Boster, 2009, pp. 102).

A second constituent of motivational processes includes vicarious incentives. Vicarious incentives was inferred once in the data:

> EDGE classroom teachers regularly use big concept activities. Incorporating smaller lessons into a large scope project encourages students to work through the fundamentals to get to the "fun part", and steadily expands their research on the project. The finished project is the amalgamation of many different thoughts and ideas created by the student. Student creativity is further enhanced through collaboration and sharing. Technology provides many ways for students to showcase their work. This also helps students who prefer digital solutions to "paper and pencil". (Menard, 2010, pp. 70)

Self-incentives is another constituent of motivational processes and was inferred once:

> The imagination that emerges (from online research) is amazing." The teacher continued, "When the story is over in the reading series it's really not over in a technology-based classroom. The students take it so much further than we possibly would have taken it without technology." (Menard, 2010, pp. 64)

External incentives was the constituent of motivational processes in observational learning and was inferred 11 times. The online social medium that served as an external incentive in motivational processes was the discussion board. Some of the quotations related to external incentives are:

> Students gained a sense of gratification and motivation when others responded to their posts, and the valued messages that fostered awareness of their peers of individuals and a sense of community. (DeArment, 2002, pp. 134)
>
> [The requirement of submitting to the Discussion Board] motivated me to do some reading before I could respond.

> I feel I have to look at other sources and do active research before it becomes a part of me. I went to the Internet to see some good sites that Ruth had posted on XML. They helped me. (DeArment, 2002, pp. 108)

> I'm posting mainly because it's required, but I like to post because it motivates me to read people's posts and I think about how I can apply my knowledge to what they've said. Then I post my own personal applications and examples. For the most part that's how I interact with the Discussion Board. I usually can't learn much from reading; I have to hear everything. I listen in class, and then, if I can, I teach it to someone else. If I can explain it to someone who doesn't understand, I know I will learn it. The Discussion Board lets me do this. (DeArment, 2002, pp. 108)

Discussion of Findings

The purpose of this meta-ethnographic study was to synthesize previous research theses in order to gain understanding into the experiences of students regarding online media applications, constructivism, and observational learning. This section discusses the emergent themes related to constructivism, observational learning, and the online media that facilitated the learning processes.

In terms of the online media for facilitating constructivist learning, the discussion boards featured as aiding in the elicitation of prior knowledge, which was the first criterion for constructivist learning. Similarly, the discussion boards served as a means of stimulating cognitive dissonance on the part of the students. The discussion boards were used for reflection which is the fourth criterion for constructivist learning. While the discussion board as a reflective tool is consistent with Juwah (2010, pp. 25), the findings of this study suggest the discussion board may serve as a social media online application for stimulating other criteria of constructivist learning. The additional constructivist criteria that the discussion board may facilitate are the elicitation of prior learning and the attainment of cognitive dissonance. The online blog emerged as an additional online social media application that served as a reflective tool on the part of the students. In this regard, the finding is consistent with Juwah (2010, pp. 25). The findings suggest that online blogs stimulate the reflection criterion for constructivist learning. With regard to online social media that stimulate constructivism, the meta-ethnographic study revealed the discussion board was the most appropriate application. The online blog was useful for facilitating reflection in online learning.

The meta-ethnographic study was also grounded in observational learning as the theoretical point of departure. The discussion board featured as a means of facilitating attentional processes and retention. In addition, discussion boards were a means through which motivational processes were achieved. The findings suggest in addition to promoting constructivist learning, discussion boards may be used to facilitate attentional, retentional, and motivational processes which are constituents of observational learning amongst students. This is in addition to promoting collaboration, discussion, analysis, synthesis, and evaluation (Clark & Mayer, 2011, pp. 284-285; Juwah, 2010, pp. 25). Research has shown the benefits of using video in fostering observational learning (Charlop, et al., 2010, pp. 371-393; Charlop-Christy, Le, & Freeman, 2000, pp. 537-552; Craig, Chi, & VanLehn, 2009, pp. 779-189; Geiger et al., 2010, pp. 279-383; Keen, Brannigan, & Cuskelly, 2007, pp. 291-303; LeBlanc, 2010, pp. 333-337; Nikopoulos & Keenan, 2003, pp. 87-108; Sherer et al., 2001, pp. 140-148;). The findings of this study suggest the use of discussion boards in LMS may be an additional online social media application for facilitating observational learning amongst students.

Conclusion

This research indicated that discussion boards and online blogs have the potential to contribute to aspects of constructivist and observational learning. Online social media applications are not evident in the area of application of knowledge. As is consistent with application of theory and practical work, students are expected to expand their knowledge beyond the classroom by carrying out experiments and independent investigation (Siemens & Tittenberger, 2009, pp. 18-19). In this regard, online applications other than social media applications may be utilised. The benefits of online social media applications in LMS are particularly evident as motivational activators.

With the range of applications available to instructors in LMS, choices made for the incorporation of these applications into teaching and learning ought to be made based on the pedagogical possibilities they offer. In this regard, the findings of this study suggest discussion boards form a basis for the facilitation of constructivist and observational learning. As the study only investigated online social media found in LMS, further studies into media that facilitate application of theory and independent investigation ought to be carried out.

As this research used unpublished research theses and dissertations, and the data were sourced from the library repository of the University of South Africa, additional research using published data from alternative repositories may contribute to furthering this research.

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Using a Design-Based Research Study to Identify Principles for Training Instructors to Teach Online


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Abstract

Within the overall framework of design-based research, this paper reports on a study that focused on evaluating an online training course for online instructors. This intervention was designed as a possible solution to the problem facing many higher education institutions of how to provide quality, accessible training for mostly part-time instructors who are making the transition to teaching online. The research project explored whether the training course had any impact on the participants' later teaching practice. The major outcome of this research study is the identification of design principles that can be used by other researchers and practitioners designing online instructor training.

Keywords: Online teaching; adjunct faculty; design-based research; faculty training; online teaching professional development

Introduction

Within the overall framework of design-based research (Barab & Squire, 2004; Design-Based Research Collective, 2003; Sandoval & Bell, 2004), this paper reports on a research project that focused on evaluating a training course for online instructors: MarylandOnline's Certificate for Online Adjunct Teaching (COAT) course. COAT was designed as a possible solution to the problem facing some higher education institutions of how to provide quality, accessible training for part-time instructors who are making the transition to teaching online. COAT is a nine-week, online, instructor-led course that was designed to prepare adjunct faculty to teach their first online course. Although designed specifically for adjunct faculty with no online teaching experience, COAT participants were found to be more diverse than originally planned for with full-time faculty, administrators, and instructors with extensive prior online teaching experience enrolling in the course (Shattuck, 2013). This article reports the findings from a study that explored the impact of the COAT course on the participants' later teaching practice.

Design-Based Research

Design-based research (DBR), also called *design experiments* (Brown, 1992), *design research* (Collins, Joseph, & Bielaczyc, 2004), and *educational design research* (McKenney & Reeves, 2012), has generated increasing interest among educational researchers in the last decade (Anderson & Shattuck, 2012). Wang and Hannafin (2005) defined DBR as "A systematic but flexible methodology aimed to improve educational practices through iterative analysis, design, development, and implementation, based on collaboration among researchers and practitioners in real-world settings and leading to contextually-sensitive design principles and theories" (pp. 6-7). DBR positions researchers with practitioners as part of a team that works together, usually over an extended period of time, to provide a solution(s) to a practical problem that faces a specific educational context. DBR studies use the term *intervention* to denote the object, activity, or process that is designed as a possible solution to address the identified problem. McKenney and Reeves (2012) identified intervention as a broad term used "to encompass the different kinds of solutions that are designed" (p. 14); these solutions include educational products, processes, programs, and policies. This study identified the COAT course as the intervention that was developed as a potential solution to the perceived need for better high quality training for online adjunct faculty.

DBR projects can span many years with multiple research cycles that focus on the iterative stages of the project analysis, design, development, implementation, and evaluation phases. In order to clearly explain how the research reported in this paper was positioned within a collaborative, ongoing DBR project, it is helpful to use McKenney and Reeves' (2012) *generic model for design research* (GMDR) to provide an outline of the COAT project phases. The GMDR consists of three main phases, analysis and exploration, design and construction, and evaluation and reflection, that lead to the two eventual outputs of increased theoretical understanding and effective intervention maturation. The three phases of analysis/exploration, design/construction, and evaluation/reflection interact with ongoing practice as the intervention is adopted, enacted, and sustained (implementation) in a particular educational setting while information about the intervention is disseminated and diffused to a wider audience.

Using the GMDR to frame the COAT project, this study is situated in phase three: evaluation/reflection. Table 1 briefly outlines how the COAT project aligned with the initial iteration of the three phases of the GMDR with *implementation* added to the second phase in order to include how the COAT project implemented the first iteration of the training course after a successful pilot.

Table 1

COAT Project and Generic Model for Design Research Phases

	Analysis/Exploration	Design/Construction (& Implementation)	Evaluation/Reflection
When?	Fall 2008-spring 2009	Fall 2009-spring 2012	Summer 2012-spring 2013
What research/ activities?	1. Literature review on online teaching roles and competencies. 2. Survey of 37 Maryland higher education institutions. 3. Interviews with key personnel from 17 US higher education online teaching training programs.	1. Developed, designed, & evaluated pilot course. 2. Ran 11 sections of COAT course. 3. Used results from module & end-of-course surveys, course assignments, & reflection journals to make minor ongoing changes to design.	1. Questionnaire to COAT alumni to find out who took the COAT course and why. 2. Focus groups of alumni who taught online after taking COAT to identify key characteristics that impacted later practice. 3. Observations/interviews focused on COAT's impact on later practice.

In DBR, the content, structure, and instructional approaches of an intervention are first identified in the analysis and exploration phase of a design project through a literature review and the input of experts and practitioners. This information is then used to design the first iteration of the intervention. A preliminary literature review is conducted with the purpose of identifying draft design principles that have the potential to address the problem the intervention is being designed to solve. In the COAT project, the draft design guidelines included what content, structure, and instructional approaches might best be used to address the training and experiential needs of adjunct faculty who are making the transition to teaching online.

A preliminary literature review was conducted in fall 2008 to spring 2009 and the results were disseminated (Dubins & Graham, 2009). Findings from that literature review, combined with interviews with key personnel from 17 US training courses for online instructors and a survey of distance learning administrators and faculty trainers at Maryland higher education institutions that offer online courses, informed the development of the first iteration of the COAT course. This course placed instructors as students within a paced, asynchronous online course that was structured to be similar to the type of online courses they may teach in higher education institutions. The results and discussion of the design/construction phase which included a pilot run of the course are published elsewhere (Shattuck, Dubins, & Zilberman, 2011). This paper focuses on the initial evaluation/reflection phase of the COAT project.

DBR has proved to be an effective approach for other research projects focused on the design and evaluation processes of instructor training programs and initiatives (Dede, Ketelhut, Whitehouse, Breit, & McCloskey, 2009). Ketelhut, McCloskey, Dede, Breit, and Whitehouse (2006) highlighted the importance of, and tension between, the dual goals of asking program evaluation questions about the *effectiveness* of online teacher professional development (oTPD) programs and asking empirical research questions about the *impact* of oTPD programs, and they identified DBR as a promising approach to address both of these goals. A comparison of DBR to other methodological approaches reinforces the choice of DBR as the appropriate approach for this study.

Collins, Joseph, and Bielaczyc (2004) compared DBR to three types of educational research approaches: laboratory and training studies; ethnographic research; and large-scale studies. They argued that laboratory and training settings do not account for multiple variables, multiple participants' expertise, and "the messy situations that characterize real life learning" (Collins et al., 2004, p. 20); ethnographic research describes in detail what and why relationships and events occur, but it does not try to change practice; and large-scale studies "do not provide the kind of detailed picture needed to guide the refinement of a design" (p. 21).

Action research has similarities with DBR in terms of collaboration, researchers having multiple roles, and reflection on practice. Typical action research, as opposed to critical action research, positions the teacher-as-researcher conducting "a form of disciplined inquiry, in which a personal attempt is made to understand, improve, and reform practice" (Cohen, Manion, & Morrison, 2007, p. 297). Action research can be collaborative, but the emphasis is on reflective research to inform individual practice at the local level. DBR, in contrast, is always collaborative with a focus on the generation of design principles in an evaluation/reflection phase where reflection "involves active and thoughtful consideration of what has come together in both research and development (including theoretical inputs, empirical findings, and subjective reactions) with the aim of producing new (theoretical) understanding" (McKenney & Reeves, 2012, p. 151). Developing design principles is part of an ongoing DBR process that may eventually lead to theoretical understanding:

> The outcomes of design-based research are a set of design principles or guidelines derived empirically and richly described, which can be implemented by others interested in studying similar settings and concerns. While the ultimate objective is the development of

> theory, this might only occur after long-term engagement and multiple design investigations. (Amiel & Reeves, 2008, p. 35)

One of the goals of the study reported in this paper was to use the detailed data that were collected and analyzed from the evaluation of the first iteration of the COAT course to articulate design principles that are relevant to other distance learning professionals and that are transferable to similar contexts.

Purpose and Research Questions

The purpose of this research study was to evaluate whether the content, structure, and instructional approaches of the COAT course effectively helped prepare higher education instructors to teach online, and, through reflection, to extract design principles that could prove useful for other researchers and practitioners working in the field of online instructor training. The research model used to evaluate the COAT course was Guskey's (2000) model of five critical levels of professional development evaluation. This study collected and analyzed data focused on evaluating Level 4: participants' use of new knowledge and skills.

Guskey (2000) argued that most evaluations of professional development occur at Level 1 (initial participant reactions) as it is the easiest level to assess. However, data gathered from the lower levels are not informative for measuring the impact of training on subsequent practice. Guskey highlighted that it is challenging to make a connection between teaching practice and earlier training experiences:

> Educators work in complex environments where multiple factors affect their behaviors. Changes in leadership, occurrences in one's personal life, other learning opportunities, or changes in professional assignment could alter participants' behaviors and activities quite apart from the influence of professional development. Isolating the professional development experience as the true cause of change in practice is a challenging aspect in any evaluation effort. (2000, p. 187)

This study aimed to meet this challenge through utilizing mixed research methods that included most of the ways Guskey identified for gathering information at Level 4. His methods included: questionnaires; interviews with participants and their supervisors; participant reflections; participant portfolios; direct observations; and video or audio tapes. The research methods used in the doctoral thesis (Shattuck, 2013) in which this study was conducted included a questionnaire, participant reflections in focus groups, analysis of archived online courses, and interviews. This paper reports on the second phase of the doctoral study: online, asynchronous focus groups in which the following research questions were explored:

1. Can a sample of alumni who taught online after completing the COAT course identify any elements (content, structure, instructional approaches, etc.) of the COAT course as being notably important in helping them teach their subsequent online course(s)? If yes, which elements?

2. Do they identify any elements as being unimportant or even misleading in informing their subsequent online teaching practice? If yes, which elements?

Research Paradigm

This study was framed within an interpretivist paradigm which considers that "a primary aim of social science is to understand what people mean and intend by what they say and do and to locate those understandings within the historical, cultural, institutional, and immediate situational contexts that shape them" (Moss et al., 2009, p. 501). Denzin and Lincoln (2011) state that an interpretivist paradigm "assumes a relativist ontology (there are multiple realities), a subjectivist epistemology (knower and respondent co-create understandings), and a naturalistic (in the natural world) set of methodological procedures" (p. 13). Crotty (1998) differentiated between *creating* understandings, a subjectivist epistemology that sees meaning as being created by individuals, and *constructing* understandings, a constructionist epistemology that considers that people construct meaning together in relation to their engagement with their human world. This DBR study, with its focus on generating knowledge about a training course from the subsequent activities and reflections of COAT participants, operated within a social constructionist epistemology. According to Koro-Ljungberg, Yendol-Hoppey, Smith, and Hayes (2009), educational researchers working within a social constructionist perspective have multifaceted, participatory roles; research goals to "negotiate and transform the practice" (p. 690); and a view of knowledge as being generated from groups of participants. In addition, this study falls within what Bell (2004) described as a "folk (emic) research orientation that investigates the manifested meaning of an intervention from the point of view of the participants of the research as interpreted through their activity and their accounts" (p. 248). This aligns with DBR's characteristics of offering practical solutions to real world problems from both the perspectives of the participants and the researchers involved in the design team.

Research Method

This study collected data using online, asynchronous, threaded discussion groups as focus groups to explore the research questions using online discussion boards within a learning management system (LMS). Turney and Pocknee (2005) researched the use of

LMS discussion boards for virtual focus groups, and concluded that asynchronous focus groups were theoretically sound because they have the potential to meet Krueger's (1988) six criteria for making a group a focus group: involving people, being conducted in a series, having relatively homogenous participants who do not know each other, being a method of data collection, collecting qualitative data, and constituting a focused discussion.

Nicholas et al. (2010) summarized the advantages to conducting asynchronous focus groups: convenient access; no time constraints allows participants to reflect which leads to "data depth and richness" (p. 110); participants cannot interrupt each other; emotions can be expressed through emoticons and textual clues; no travel or transcription costs; and face validity is fostered "due to member checking, as participants have continuous access to the data transcript and have ongoing opportunity to reflect on their statements to ensure that meaning is sufficiently captured within the data" (p. 110). Disadvantages include a lack of visual clues, time commitments required of participants, possible technical barriers to participate, and questions about security of data.

An online, asynchronous format was appropriate for the participants of this study for the following reasons. All COAT alumni were accustomed to interacting asynchronously using a discussion board as this was an integral part of the COAT course, and, as such, technical barriers were not expected to be problematic due to the participants' familiarity with these tools. In addition, the lack of visual clues is something that COAT alumni are used to dealing with in their roles as online learners and instructors. The LMS used to host the focus group discussion boards is a secure site that is password-protected, and participants were given pseudonyms to protect their anonymity. The convenience of interacting asynchronously meant that geographic and time constraints were less likely to impact the feasibility of setting up the groups. Krueger and Casey (2009) suggested inviting asynchronous focus group participants "to spend 15-30 minutes each day for several days as they review the questions and make their responses" (p. 178). By considering the time commitment of about 15-30 minutes a day over a period of several days, participants were able to gauge whether they had the time needed to participate.

Focus Group Participants and Logistics

The purposive sample for the focus groups was derived from the respondents to a questionnaire sent to all participants who had completed one of 11 COAT course sections that ran fall 2010 to spring 2012. All 126 (out of a possible 179) respondents to the online questionnaire were sent an invitation to participate in the focus groups if they had taught online after completing COAT which led to 24 COAT alumni participating in the focus groups.

Participants were offered a choice of five dates for the focus groups. Two dates were not popular which resulted in three separate groups that ran in July, August, and

September, 2012: focus group one (FG1), focus group two (FG2), and focus group three (FG3). After signing the informed consent agreement, participants were enrolled in the LMS focus group site using a numeric identifier to maintain anonymity. The researcher's role in each focus group was to welcome people to the group, facilitate the conversations, and provide summaries of the discussions for member-checking. Each group was held asynchronously using the discussion board feature of the LMS that had hosted all of the COAT courses. Each focus group was held over three days with a separate discussion prompt for each day. FG1 and FG2 had identical prompts, and FG3's *Day One* prompt was also identical. However, changes were made to the prompts for the second and third days of FG3 based on the ongoing data analysis results from FG1-2.

Each focus group was opened a few days early for participants to preview. The focus groups were left open for a week after day three finished, so that participants could make any changes or additions to their postings before the data collection period closed and data analysis began. No changes were made, but three participants (one in each focus group) did add a post the day after the third day. The researcher provided summaries for each day's discussion and a final summary of the whole focus group. Participants were invited to make changes and corrections to these summaries. Only one clarification was suggested, and three participants verified that the summaries had captured what was important from their perspectives.

Focus group participants were not asked to give detailed demographic information about themselves, as this may have compromised their anonymity. However, some participants did disclose personal details in their introductions which included the information that participants held a number of professional roles within education with ten people saying they had worked or were currently working as adjunct faculty, five as administrators, three as full-time faculty, two as instructional technologists, and seven as Kindergarten-12th grade (K-12) instructors. These roles were often held simultaneously with the K-12 instructors, administrators, and technologists working as higher education adjuncts too. Of the nine participants who gave information about how many institutions they were currently employed in, seven people worked in only one institution with two others identifying that they worked at more than one institution simultaneously. The institutions people worked at were varied with ten community college, two university, and one K-12 institutional type identified. Six people had not taught online prior to taking COAT, and 11 people had prior online teaching experience ranging from one course to over ten years.

Additional information about participants included prior experience as online students with 15 (63%) people having taken online courses before participating in COAT and three saying they had no online student experience prior to COAT. Participants also talked about the subjects they taught online which included accounting, art, astronomy, business, child development, communication, computer science, English, health, history, medical assisting, research methods, and statistics.

Analysis of Research Results

This study drew on grounded theory techniques to inform data analysis decisions and followed Saldaña's (2009) recommendation to approach coding method choices with "pragmatic eclecticism" (p. 47) by letting initial data collection and review occur before deciding on which coding method(s) to use. Data analysis for the three focus groups was ongoing with preliminary analysis beginning after the first focus group ended and further analysis continuing through iterative cycles of initial and focused coding which informed data collection decisions for subsequent focus groups. Constant comparison (Strauss & Corbin, 1998) of new data against previously collected data and existing codes against new codes and emerging categories occurred throughout the process. Detailed notes were kept in reflection blogs and analytic memos during the focus group data collection and analysis period.

Important Elements

All 24 focus group participants identified at least one element of COAT that had positively influenced their subsequent online teaching practice, and their comments were grouped into the category *Taking COAT influenced subsequent online teaching practice.* This category encompassed 138 quotations which were organized into a code family (see Figure 1). This code family included one category (placed top center in Figure 1); five codes that stated a particular element of taking COAT which influenced later practice or a specified impact on later practice that was attributed to taking COAT (shown with the relationship *is a* in Figure 1); one code that was seen as contributing to later teaching practice (shown with the relationship *contributes to*), and 11 subcodes (shown with the relationship *is part of*). Some of the codes are associated with more than one code and these relationships are depicted with *is associated with* relationship arrows. The numbers after each code in Figure 1 show the groundedness and density of the code. "Groundedness counts the number of links to quotations; density counts the links to other codes and memos" (Friese, 2012, p. 140).

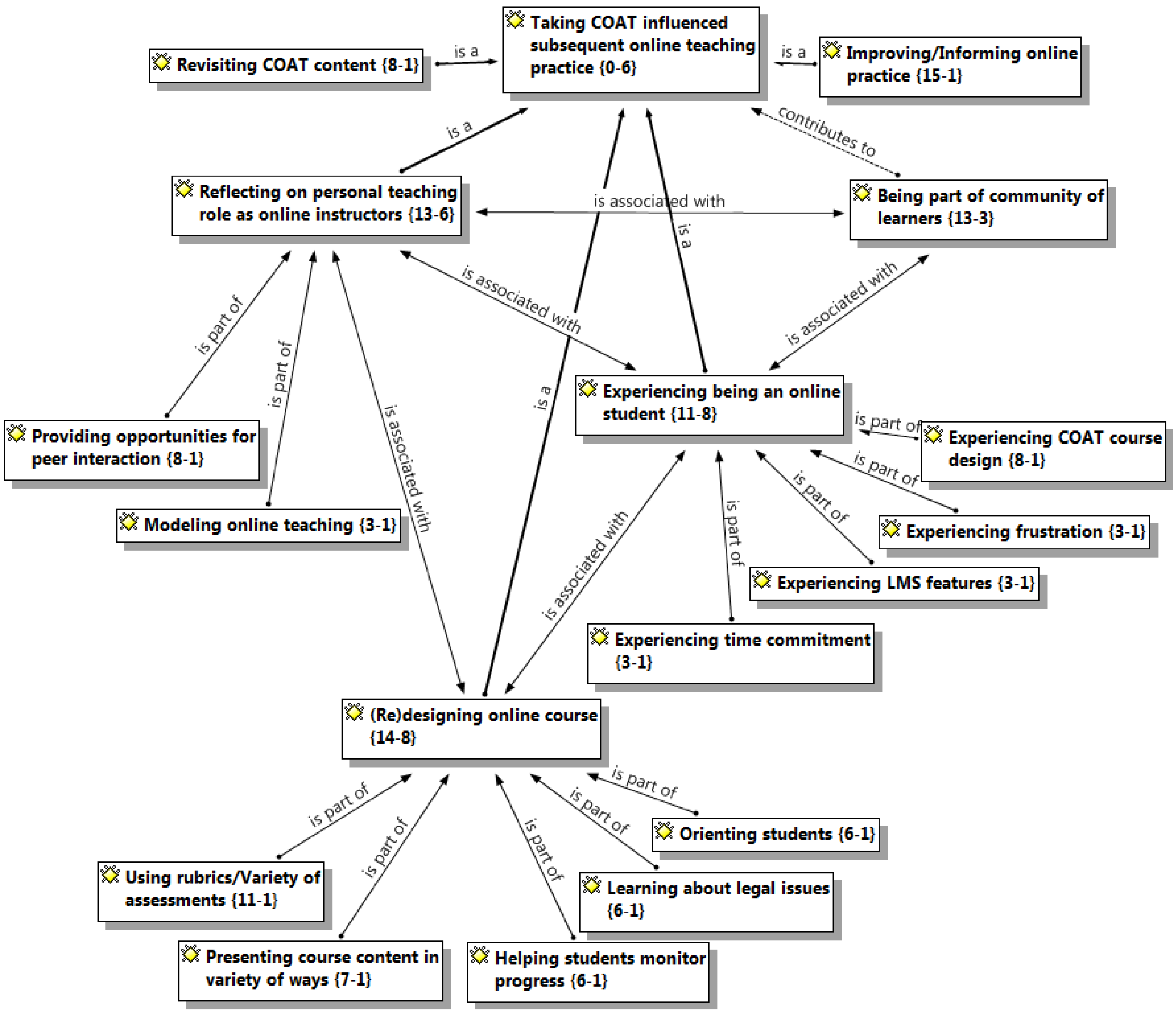

Figure 1. Concept map of responses to ways in which taking COAT influenced subsequent online teaching practice.

General comments on COAT's influence on online practice.

Two codes were populated with general comments that participants made about COAT influencing later teaching practice. Eight quotations referred to participants revisiting COAT content as reference materials for later teaching practice, and 15 quotations were general comments about COAT's influence on improving or informing later practice. These comments ranged from COAT being seen as an essential part of later online teaching success; to enhancing existing online teaching practice; to COAT being seen as a minor aid to later teaching practice. The majority of quotations (115 out of 138) were more specific about what elements of the COAT course influenced later practice and these quotations were grouped into four codes which are presented next in conjunction with their subcodes.

Experiencing being an online student.

As shown in Figure 1, this code has four subcodes with a combined total of 28 linked quotations that were made by 16 (out of 24) focus group participants. To be included in this code, quotations had to explicitly highlight that the experience of being positioned as a student in the COAT course influenced participants' subsequent online teaching practice. These experiences could be positive or negative. The 11 quotations directly linked to the code were all positive comments about experiencing life as an online student affecting later online teaching practice. For some participants COAT was their first experience as an online student:

> I think participating as a student in the COAT training was of utmost importance. As a novice to online teaching, I really needed to be a student. Plus participating as a student opened my eyes to so many things I would have never even considered if I was just reading about these topics.

Others had taken online courses: "I have been an online student before, but this course helped me to focus on the student experience a little better because I was taking the course as an instructor wanting to provide a better experience for my students." This concept of benefiting from looking at their own teaching practice through the lens of an online student was mentioned by multiple participants; for example,

> I could see what instructional techniques worked well, and which ones did not. Being in the student role made me look at both sides of a situation. Did I as a student learn something from the exercise? Would I as an instructor get valuable feedback from this exercise. If it doesn't meet both criteria, it must be changed.

This idea of learning from what participants did not like about experiencing life as an online student in COAT was detailed more in two of the four subcodes. Three different participants described feeling frustrated by parts of their COAT experience. For one, the frustration led her to be mindful of students' possible frustration with the same element in her own courses:

> I had not been in the 'online' student role for ~7 years when I took the COAT course. I was not familiar with the learning platform used to deliver the COAT course... This unfamiliarity gave me an opportunity to become frustrated and remember many students will experience this when they are in my class.

This idea of negative experiences in the COAT course leading to more awareness of their own students experiencing the same feeling was also apparent in the quotations linked under the subcode *Experiencing time commitment*; for example,

> I also felt that there was an enormous amount of material presented, and was overwhelmed near the end of the class with all of the requirements. I actually went back to my classes again and rethought some of my expectations, juggling assignment positions within the time frame.

Experiencing the COAT course design as a student also led to changes in participants' later practice with eight quotations related to this idea. For example, one participant highlighted copying design features from COAT that she liked into her own courses:

> As a result of taking the COAT course I modified my own courses to incorporate some of the instructional design features from the COAT course... for example, a separate button for "Weekly Course Work," and separate folders for each week.

Three participants mentioned that COAT introduced them to features of the LMS they had been unaware of which led to them using these features in their own practice.

COAT was designed to give participants the experience of being an online student in a paced, facilitator-led, cohort-based course while learning about teaching in a similarly configured online learning environment. The code *Experiencing being an online student* and its four subcodes had 28 quotations that specifically highlighted that the way the course was purposefully structured to position participants as online students had an impact on later practice. This code is also associated with three other codes which were populated with quotations that can be seen to relate in part to participants' experience in the course as students, but primarily highlight different elements of the COAT course, some of which were expected results that aligned with the COAT project's planned outcomes, and others which were unexpected outcomes. An expected outcome was for participants to reflect on the role of an online instructor.

Reflecting on personal teaching role as online instructors.

This code and its two subcodes encompassed 24 quotations that focused on how taking the COAT course prompted participants to reflect on their role as an instructor and to make changes to both the types of activities they included in their subsequent online courses and their presence in their courses as a result of this reflection. For five participants, a key takeaway from COAT was their role shifting to being a facilitator of the learning process. Other participants discussed how COAT had made them think about their readiness for teaching in the online environment, the importance of their response time to students, how to deal with disruptive students online, and the need for setting up open-ended activities to engage students in the learning process.

A subcode that dug deeper into the idea of student engagement grouped together eight quotations about providing opportunities for peer interaction. Five of these quotations referred to using group work/wikis; for example,

> I was personally terrified of the idea of working in a team online, but my COAT experience was exceptional and I vowed to use team experiences whenever possible in my online courses. This has been difficult for some of my students, and some of my student evaluations have been quite negative because of the group work I require, but some of the students share the wonderful experience I got during my group work in COAT and I think the potential for this experience is worth the risk and negativity some will maintain. I feel working in an online group takes the online educational experience to a whole different level, and really represents the best of what online teaching can offer. I only wish it could be a good experience for them all.

This previous quote also demonstrates how this subcode/code can be viewed as being associated with the code *Experiencing being an online student*, as the experience of doing group work in COAT led to the participant incorporating group work into her subsequent courses which resulted in continued reflection on her teaching practice. Another subcode that is also associated with the experience of being an online student in COAT is *Modeling online teaching*. This subcode contained three quotations that referred to participants learning from the COAT facilitator modeling good online teaching practice.

Being part of a community of learners.

Just over half of the focus group participants (13 out of 24) identified that a positive benefit of taking COAT was that it provided them with the opportunity to interact with other instructors who were participating in the course, and these interactions played a part in influencing later practice (shown as the relationship *contributes to* in Figure 1). For example, one participant who had not taught online prior to COAT stated: “During the COAT class I appreciated learning from other students who either had taught online already or who were teaching in real time while taking the COAT class. Their stories and examples were invaluable.” Participants who had already taught online before COAT also found being part of a community of instructors/learners beneficial: “I agree, the COAT course gave me a place to talk to other teachers, to troubleshoot issues with like-folks. We do tend to teach in isolation.” Participants also expressed the wish that the community of learners had survived the end of the course. This desire to interact with other instructors separate from the assigned course curriculum or discussion prompts was demonstrated in the focus groups with the many side discussions that took place between focus group participants that were not directly related to the focus group discussion prompts.

Unimportant or Misleading Elements

Focus group participants were asked to discuss any elements of the COAT course that were unimportant or misleading. Seven people stated that they could not identify any such elements, and six participants identified a variety of elements that they found less helpful or even misleading. There were few commonalities among these elements with individual participants identifying different aspects of the course ranging from student integrity information to the choice of textbook. Other participants made comments that were critical of the COAT course, though not coded as identifying unimportant or misleading elements. For example, constructive criticism in the form of recommendations was made with comments ranging from what was seen as an overwhelming amount of work to improvements to the course design. In addition to providing feedback on the COAT course, participants made suggestions on further training or networking opportunities that the COAT project should consider.

Discussion

In order to reflect on the categories and codes that emerged from the data analysis phase, metaphors were used to abstract the findings to a more conceptual level. Metaphors of immersion in a foreign/alien culture and of COAT being a pebble making ripples in pools of practice led to a further review of relevant literature.

Immersion in an Online Learning Environment

Two-thirds (16 out of 24) of focus group participants identified that their experience of being an online student in the COAT course had influenced their subsequent online teaching practice. Their comments about seeing an online course from a student's perspective, experiencing frustration with the course navigation, and feeling overwhelmed resonated with a metaphor of how making the transition to online learning and teaching can be compared to living in a foreign country. Being immersed in a new environment and faced with a different culture can first cause frustration, confusion, self-doubt, and fear that can then lead to rethinking what is taken for granted as *normal* or *commonplace* behaviors. In a similar way, moving from a campus-based to an online learning environment can be a discombobulating experience that can make instructors question what they feel they know as *truths* about teaching and learning. Brookfield (1993) argued that "experiencing what it feels like to learn something unfamiliar and difficult is the best way to help teachers empathise with the emotions and feelings of their own learners as they begin to traverse new intellectual terrains" (p. 21). The findings from the COAT alumni research study extends this idea to experiencing what it feels like to learn something ***in an unfamiliar and difficult***

learning environment is the best way to help instructors approach their subsequent online teaching from a more student-centered perspective.

This idea of comparing learning how to behave in new academic environments to immersion in new cultures is not original, and examples can be found in the literature of situated learning and communities of practice. For example,

> To talk about academic disciplines, professions, or even manual trades as communities or cultures will perhaps seem strange. Yet communities of practitioners are connected by more than their ostensible tasks. They are bound by intricate, socially constructed webs of belief, which are essential to understanding what they do (Geertz, 1983). The activities of many communities are unfathomable, unless they are viewed from within the culture.... In a significant way, learning is, we believe, a process of enculturation. (Brown, Collins, & Duguid, 1989, p. 33)

COAT participants, as adult learners, found that the sometimes frustrating experience of being situated as a student within an unfamiliar, authentic online learning environment contributed to them rethinking their teaching practice.

The instructional approach of learning from the COAT facilitator modeling online teaching practice was informed by Bandura's (1977) social learning theory. This approach aligns with cognitive apprenticeship (Brown, Collins, & Duguid, 1989). The idea of apprenticeship also appears in research focused on the teaching beliefs and practices of higher education instructors with Kane, Sandretto, and Heath (2002) arguing that

> As preparation for teaching, university academics can be said to have completed an 'apprenticeship of observation' during their years as undergraduate and graduate students (Lortie, 1975). Their beliefs and conceptions of good teaching are a result of this apprenticeship and a 'trial by fire' in the lecture theatre, classroom, or laboratory. (p. 199)

Teaching online adds a new dimension to this *trial by fire*, and one focus group participant's comments echoed the ideas in the above quotation:

> I second the point about experiencing an online class as a student. We all sat in the traditional classroom, so we know what takes place - what we like and what we didn't

> like. An instructor who has not taken an online class is at a real disadvantage.

Being situated as a student in an online course, that had content focused on online teaching theories and practice, allowed participants to observe the COAT facilitator model online teaching skills and strategies while she also participated in discussions about what she was doing and why she was doing certain actions.

In addition to learning from the COAT facilitator, alumni also learned from the other COAT participants, especially those who had prior online teaching experience. Over half of the focus group participants (13 out of 24) identified that taking COAT provided them with the opportunity to interact with other instructors and these interactions played a part in influencing later practice. The code *Being part of a community of peers* that emerged from the analysis of the data in this study is not a new concept and is embedded in the literature on communities of practice (CoP). Hildreth and Kimble (2008) argued that "Teaching is a very personal and ‘individual’ activity, yet teachers benefit greatly from links with other teachers, both with colleagues in their own establishment and with colleagues in the wider teaching community" (p. x).

Reflection on the learning that occurred in the community of COAT peers while they were immersed in an authentic online learning environment as students led to a review of the literature on situated cognition (Brown, Collins, & Duguid, 1989); CoP (Lave & Wenger, 1991); practice fields (Barab & Duffy, 2000, 2012); and collectives, networks, and groups (Dron & Anderson, 2007). Lave and Wenger (1991), in their book on situated learning, introduced CoP as nonacademic learning environments where novices learn from more experienced practitioners through legitimate peripheral participation, a form of apprenticeship. CoP as a concept has been applied to many fields since its inception, and Hildreth and Kimble (2008) considered it to have evolved into an “umbrella term” (p. xi) that now covers a range of group types with similar characteristics of being informal learning environments with voluntary membership of people interested in discussing practice and learning from each other while sharing resources and knowledge in a specific area. This knowledge is often tacit in nature.

Andriessen (2005), in his research into the classification of knowledge community archetypes, concluded that “the same term of ‘community of practice’ has been applied to different types of communities, that is, to strategic communities, to informal communities and to informal networks” (p. 209). According to Dron and Anderson (2007) “individuals join Networks to associate with others of like interest or vocation, or who know more, or who would like to learn similar things” (p. 2461). They differentiate between groups as formal, structured, closed phenomena and networks as being informal, unstructured, and open. The COAT course is an example of a group and the COAT Facebook presence that was created by a COAT participant, independent from the COAT project, is an example of an emerging network. The unexpected, off-topic, side discussions in the focus groups were a demonstration of COAT alumni’s desire to network informally.

In a similar manner, using Barab and Duffy's (2012) definition of educational practice fields, "Contexts in which learners, as opposed to *legitimate participants*, can practice the kinds of activities that they will encounter outside of school" (p. 34), COAT can be seen to be a type of practice field where participants practice online teaching and learning activities and skills separate from their real-life teaching situations. However, what is missing from this picture of COAT as a practice field is the reality that COAT participants were also already legitimate participants in communities of educators, and some had extensive prior online teaching experience which was demonstrated in the learning afforded by the community of peers. Figure 2 draws together ideas of formal, semistructured, and informal learning spaces in relation to the concept that emerged from this study of immersion in an online learning environment helping participants become enculturated into the practice of online teaching and learning. In Figure 2, the left oval represents COAT participants being positioned as students in an authentic, structured, facilitator-led training course. Within that learning space, opportunities were designed for semistructured peer-to-peer discussions in the Cyber Café where colleagues, with varying levels of experience of online teaching, gathered around topics of their own choosing. Experiences with elements within the formal COAT course and the semistructured internal network of peers were identified as influencing later teaching practice. The area to the right of Figure 2 represents informal learning spaces that COAT alumni, as practitioners in the workplace and as members of communities of online educators, may choose to join to network and contribute to communities of practice.

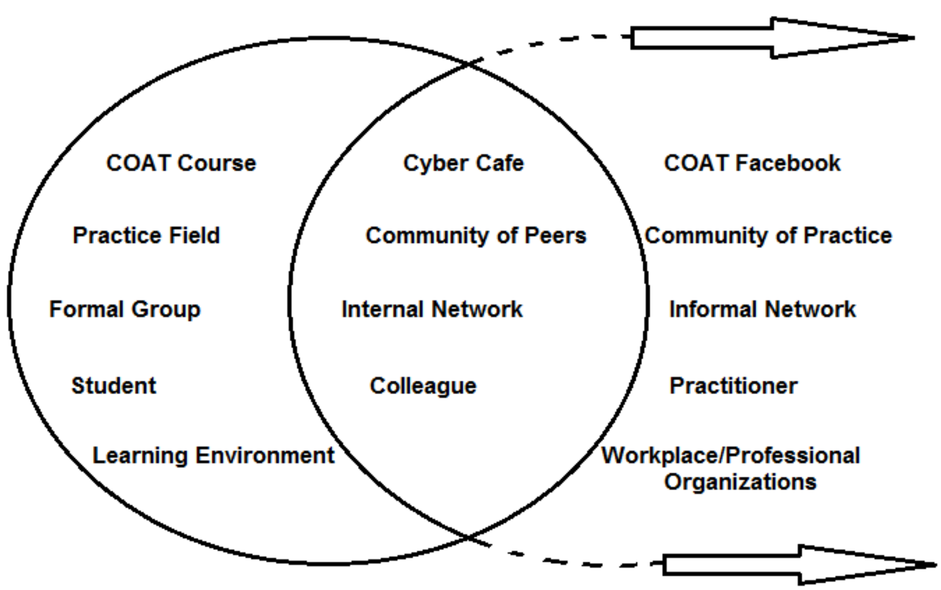

Figure 2. Networks of practice.

The first principle for designing training for online instructors emerged from the concept of being immersed in an unfamiliar online learning environment:

> Training for online instructors should be designed using a situated learning perspective that positions instructors as students in an authentic learning environment that is similar to the targeted teaching environment.

The recommendations that participants made for COAT to consider training for online teaching in nonLMS learning environments resonate with this design principle as the authentic learning environment could include any number of new and emerging learning technologies and social media. It is important to stress that all the design principles that emerged from this study are situational principles for designing faculty training. “Situational principles are ones that are not universal – they only apply in some situations. They exist on a continuum from situations that are very common (close to universal) to ones that are highly local (apply very rarely)” (Reigeluth & Carr-Chellman, 2009, p. 57). By including the voices of the diverse professionals who participated in COAT, it is hoped that practitioners working in similar situations to the instructors who participated in this study will find these design principles useful and possibly transferable to their teaching and learning environments.

Pools of Practice

All 24 focus group participants identified at least one element of COAT that influenced their subsequent online teaching practice. A primary influence was on course (re)design with 18 focus group participants making comments on how taking COAT had influenced their subsequent online course development, design, and redesign. Research participants also identified other influential elements of COAT such as learning about LMS features, pedagogy, online instructor role, and so on. In addition, other influences on online teaching practice were identified such as prior teaching experiences, other professional development opportunities, and institutional input. Using the metaphor of the COAT course being one of many pebbles making ripples in individual pools of practice helped to conceptualize some of the ideas captured in the data analysis. In the same way that a pebble is a concrete object with defined edges, COAT is a specific course with defined learning outcomes. The number and type of ripples from a pebble being thrown into a pool may be expected or unexpected depending on the situational circumstances. The impact of COAT on an individual’s practice may align with the defined learning outcomes of the training, but may be unexpected depending on the instructor and the teaching context. Figure 3 portrays that a training course such as COAT is one of many possible influences on the professional practice of individual instructors and that the ripples from a training course are diverse, specific to a particular teaching context, and may be unanticipated. Figure 3 shows some examples of other possible influences on practice, but more *pebbles* are possible depending on the instructor’s prior and current learning and work-related experiences.

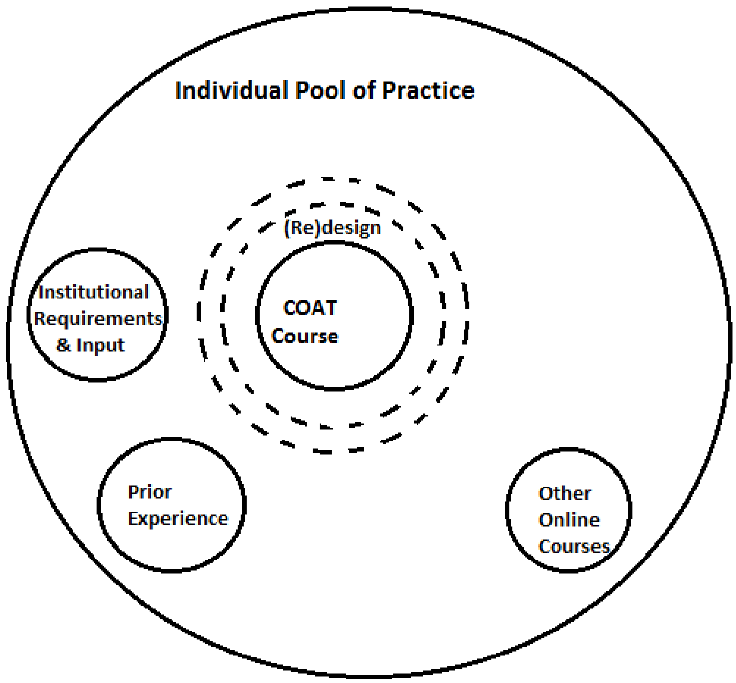

Figure 3. Individual pool of practice.

(Re)designing online courses.

COAT was designed to prepare instructors to teach predesigned courses, and, although basic instructional design principles were introduced in the COAT course, the emphasis of the COAT content was on the delivery, not on the design of online courses. Some participants in this research study were disappointed with the lack of emphasis on designing courses. The data collected in this study highlighted that for many instructors course design issues were one of their major concerns, as they are asked to design and then teach online courses with limited, and sometimes nonexistent, prior online teaching and instructional design experience or institutional support. Second, instructors have an almost implicit responsibility to customize the course to meet the divergent and particular needs of students, thus many both want to and feel a responsibility to edit and improve existing courses that they are hired to teach. The assumption of the COAT project that participants would teach courses predesigned by teams proved to be incorrect. The findings demonstrated that COAT's impact was broader than planned with an unexpected outcome being that a key takeaway from the COAT course was its impact on participants' (re)designing online courses which highlighted the need for attention within the COAT project for offering optional skill development in course design. Participants in this study made suggestions that COAT could consider on how course design could be further explored either in the current course or in potential advanced courses.

Other professional practice.

Another unexpected outcome of participating in the COAT course was the impact the training had on professional practices other than online teaching practice. Four focus group participants commented that COAT had affected their campus-based teaching practice. In addition to COAT's impact on campus-based teaching, six focus group participants said COAT had impacted their nonteaching practice in the areas of instructional design, managing online programs, and training faculty.

The second principle for designing training for online instructors emerged from the findings on unexpected outcomes from taking COAT:

> Training for online instructors should prepare participants for diverse teaching situations which might include requirements to (re)design online courses and opportunities to teach in emerging learning environments.

Conclusion

The COAT project originated in the desire of a group of instructional designers, online faculty, and administrators from various institutions to collaboratively tackle the growing problem of how to best provide quality, accessible training for instructors who are making the transition to online teaching. Using a DBR methodological approach within an overall interpretivist research paradigm, this study evaluated whether the content, structure, and instructional approaches of the COAT course effectively helped instructors teach their subsequent online courses. Research participants identified that the experience of being situated as students in an authentic online course focused on online teaching and learning positively influenced their later online teaching, campus-based teaching, and nonteaching professional practice. This study provided detailed feedback for the COAT project, and the design principles that emerged from this study may be of interest to researchers and professionals who are involved in developing training for instructors who teach online. The findings from this study expand knowledge and contribute to the research literature on training for both experienced and inexperienced online instructors. Other recent studies focused on training for online instructors have resulted in similar findings to this study (see, for example, Eliason & Holmes, 2010; Kukulska-Hulme, 2012; MacDonald, 2010; McQuiggan, 2011; Storandt, Dossin, & Piacentini Lacher, 2012; Terantino & Agbehonou, 2012). By combining the findings from these research studies that were conducted in different contexts, the resulting design principles become more grounded in diverse situations and learning environments thus adding to the likelihood of transferability as effective design principles and practices to additional contexts.

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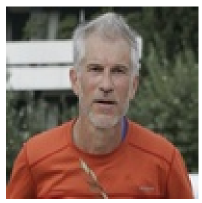
Learning Needs Analysis of Collaborative E-Classes in Semi-Formal Settings: The REVIT Example

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Abstract

Analysis, the first phase of the typical instructional design process, is often downplayed. This paper focuses on the analysis concerning a series of e-courses for collaborative adult education in semi-formal settings by reporting and generalizing results from the REVIT project. REVIT, an EU-funded research project, offered custom e-courses to learners in several remote European areas and received a 'best practice' distinction in social inclusion. These e-courses were designed and developed for the purpose of providing training in aspects of the learners' professional domains related to the utilization of information and communication technologies. The main challenge was to prove that it is possible and economically feasible to provide meaningful training opportunities via distance education, by utilizing existing infrastructure ("revitalizing schools") and by making use of modern digital technology affordances coupled with suitable distance learning techniques and Web 2.0 tools. ADDIE, the generic instructional systems design model, enhanced with a rapid prototyping phase, was put forth in order to allow stakeholders to interact with a prototypical e-course, which served as an introductory lesson and as a reference point, since its evaluation informed the design choices of all subsequent e-courses. The learning needs approach adopted in REVIT combined learner analysis, context analysis, and needs analysis into a coherent analysis framework in which several methods (observation, estimation, document analysis, survey, and dialogue) were exploited. Putting emphasis on the analysis phase and decoupling the design from the delivery of the e-courses facilitated adaptation and localization. Adaptation and localization issues concerning the adoption of the REVIT distance learning framework, taking into account the socio-cultural and pedagogical context, are discussed. A central result reported is that the analysis phase was crucial for

the success of the whole endeavour and that carrying it out properly is not straightforward or easy. The analysis framework presented in this paper could be useful in other similar e-learning situations whose "educational-identity" also involves distance and adult learning in a semi-formal setting.

Keywords: Distance education; adult learning; instructional design; analysis in e-learning; collaborative e-class

Introduction

Although analysis and evaluation are regarded as crucial phases in the instructional design process since "[they] concern the immediate needs of an organization" (Horton, 2003, p. 25), they are often overlooked in e-learning projects (Shelton & Saltsman, 2011, p. 567; Rothwell & Kazanas, 2008; Wang & Wilcox, 2006; Trolley, 2006). Spending too little time in analysis is a mistake commonly made not only by inexperienced (Cook, 2005), but also by expert instructional designers. Indeed, a research study (Visscher-Voerman & Gustafson, 2004) that investigated how expert instructional designers actually work with regard to the implication of the ADDIE model revealed that only 17% (4 out of 24) conducted a full analysis, while the others performed a limited one. Nevertheless, failing to fully explore the analysis phase in an e-learning project can bring about a negative impact on the relevancy and the quality of the educational endeavor (Shelton & Saltsman, 2011). The learning needs analysis is a key step of the instructional design process since the data gathered in this phase drive the nature of the intervention and its outputs inform the creation of learning objectives (Cook, 2005). It also has a significant impact in the continuous professional development of those receiving the training (Forbes et al., 2006). A limited number of case studies exist in the recent literature, which refer to the analysis phase in educational contexts related to continuous professional development in non-credit lifelong learning. Examples include a survey of the information needs of rural and non-rural primary care physicians (Gorman, 2001) and a study that examines the training needs identified in adult rural communities (Frossard & Frutos, 2011). Yet, these examples do not incorporate the analysis as a phase of their instructional design model.

The research question for REVIT was: Can we provide attractive, meaningful, and relevant educational opportunities to adult professionals living in remote areas (in Europe) utilising existing infrastructures, Web 2.0 affordances, and available human resources in a way that is sustainable and economically feasible? Consequently, the purpose of the paper is to systematically explore a multifaceted analysis strategy to address instructional design in the context of a scalable and economically feasible example that provides lifelong learning opportunities to people who are usually excluded from mainstream educational activities, such as the inhabitants of remote areas. A central result reported here is that the initial analysis phase was crucial for the success of the whole endeavour and that carrying it out properly is not straightforward or easy.

The REVIT project (REVITalizing Remote Schools for Life-Long Distance e-learning, http://revit.cti.gr, Lifelong Learning Programme/Transversal Programme/Key Activity 3: ICT-European Commission, EACEA, January 2009 to December 2011) was addressed mainly to adults who were interested in receiving further training in aspects of their current or envisaged professional domain; usually those were aspects related to the utilization of information and communication technology. For this purpose, e-courses were designed and developed based on the actual needs of the specific remote application areas, as these were elicited from local people in Cyclades (Greece), Fornetka (Poland), Ullava (Finland), Kula (Bulgaria), and Palaichori (Cyprus).

Figure 1 illustrates two points about the REVIT project: 1) the geographical distribution of the application areas and 2) the fact that in each application area a dyad of project partners existed. The five dyads (the dyad of project partners shown in the map of Figure 1 in Italy is an exception) co-operated closely throughout the project duration towards the completion of the main project goal, that is to provide training via distance and online education in aspects of the learners' professional domains related to the utilization of ICT. These dyads were comprised from one partner located in the application area (usually the municipality of the area), which liaised with the locals, and one partner in the same country, which liaised with the project consortium (this partner could be a university or a research center or an adult training center).

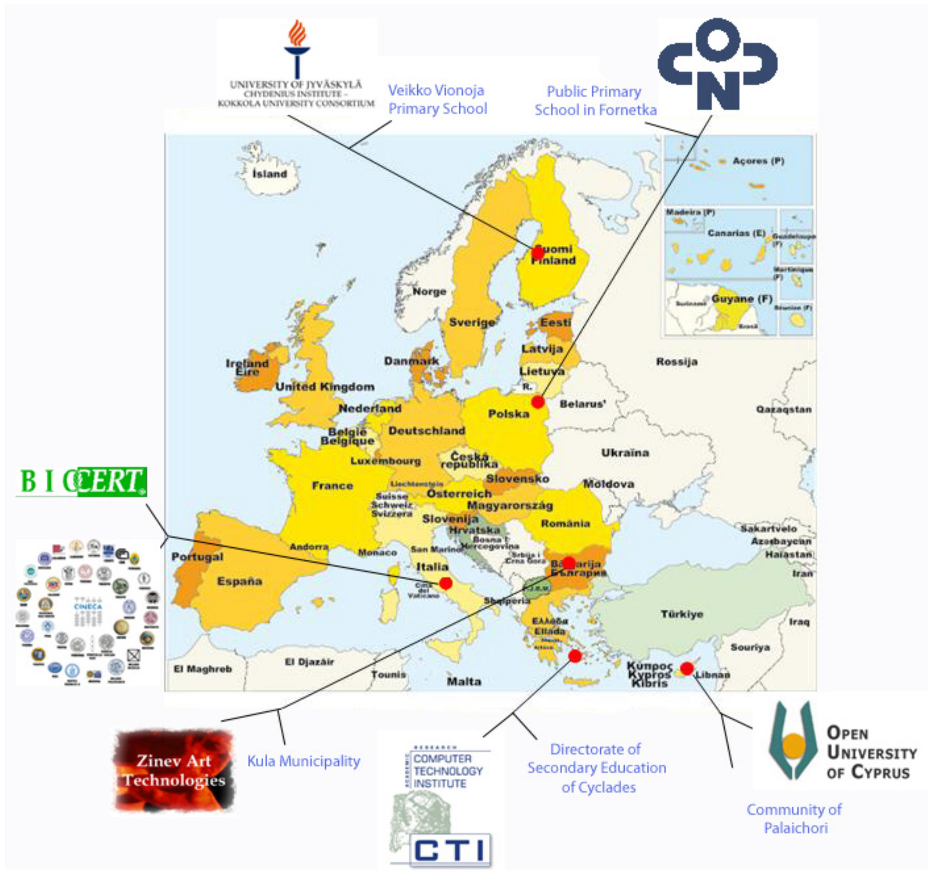

Figure 1. The REVIT partnership.

The REVIT project placed a good deal of effort in conducting an extensive analysis and a comprehensive evaluation. The methodology and the results of the evaluation phase of the REVIT project are available online (Dagdilelis, 2010) while this paper focuses on the analysis phase. Design, development, and implementation can be treated as a 'black box', since the combination of the pre-analysis and the post-evaluation confirms that the needs were met, given the actual commitment of the learners.

Another similar endeavor that was running in parallel with the REVIT project was the SoRuraLL! project (Rurall Social Networking for Lifelong Learning, http://www.sorurall.eu) which investigated the potential for enhanced lifelong learning offered by social networking tools and platforms to those living in geographically and socio-economically disadvantaged rural areas. These projects exchanged ideas and experiences in domains of relevance (i.e., social applications for lifelong learning) in a set of conjoint events (meetings, conferences, etc.).

Research Method and Theory Used

The Instructional Design Methodology Adopted in the REVIT Project

The many definitions of instructional design (ID) come from two different perspectives: a process or a discipline. Here the definition adopted is the following: "the entire process of analysis of learning needs and goals and the development of a delivery system to meet those needs. It includes development of instructional materials and activities; and tryout and evaluation of all instruction and learner activities" (Berger, 1996).

As a process, ID mostly complies with the ADDIE model (Visscher-Voerman & Gustafson, 2004), an acronym for analysis-design-development-implementation-evaluation. Although the ADDIE model has received much criticism (Bruce, 2004; Colón et al., 2000), most of the instructional systems design (ISD) models are based upon it (Allen, 2006). Contradictory as this may seem at first, a satisfying explanation is given in Stolzer et al. (2011, p. 26): The criticisms for being too systematic (i.e., cumbersome, inflexible, linear) refer to the ADDIE model as originally proposed which resembled the waterfall model of software development (MacCormack et al., 2003). Recently the model has evolved "into a more dynamic process in which the user can go back to the other phases as needed and revise steps as determined by the evaluation" (Stolzer et al., 2011, p. 26). In REVIT, ADDIE was enhanced with a rapid prototyping stage (Boulet, n.d) between design and development, as an extension of the design phase (Kruse, n.d). The model adopted in REVIT is shown in Figure 2, where its two key elements (dynamic nature and rapid prototyping phase) are depicted.

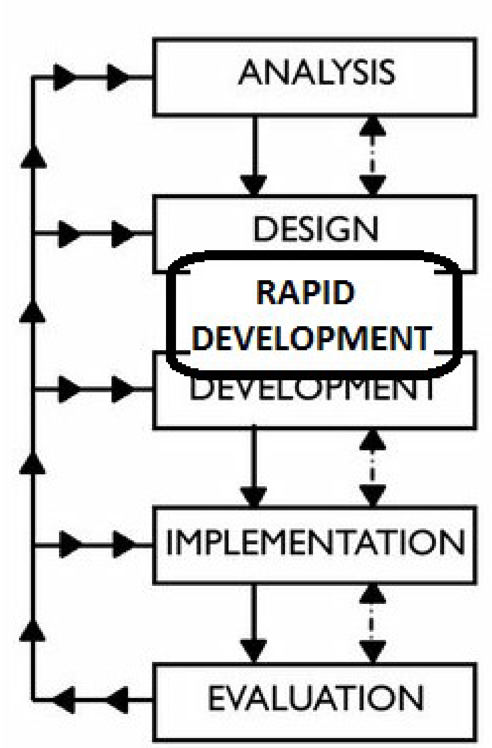

Figure 2. The instructional design model adopted in REVIT. Figure modified from Hodell (1994, p. 5).

A central issue in instructional design is independence of phases, in particular from people involved. Each phase should be based exclusively on the output of the previous one and not depend on the same person being, for example, both designer and implementer. The several advantages of this independence come at the cost of process rigidity. Having the same person or team in several roles provides flexibility but hinders independence. In REVIT we opted for a more flexible approach, in which people working in each stage of ADDIE were encouraged to liaise with persons in the previous and subsequent phases. Thus, persons carrying out the needs analysis were different from the course designers and from those delivering the course (tutors), but were available for interaction beyond formal documents. In this way and by adding a rapid prototyping phase for the first delivery of each course we were able to uphold a dynamic nature of the REVIT instructional design model.

A prototypical e-course (i.e., a series of lessons that constituted a course named "Introduction to Web Technologies") was implemented and evaluated after the completion of the high-level design of the e-courses. The evaluation results were used to make corrective actions in the overall design and also informed the development of all subsequent e-courses.

The REVIT Distance Learning Framework

The REVIT distance learning framework is shown in Figure 3. The picture of the school depicts a basic idea for the sustainability of this European research project: the exploitation of the existing infrastructure and human resources of schools in the remote areas. For the residents of these rural areas, their often small multigrade school plays an important role as a centre of culture and education for the whole community. Moreover, research work, for example Miller (1993), illustrates the important role of rural schools in their communities and the promising approach of collaborative partnerships between communities and schools for community revitalization and survival. The school acted as a central place in the REVIT framework where the local moderators and the learners could get together during the delivery of the e-courses. The e-tutor, knowledgeable in the subject of the course, was the teacher delivering the e-courses at a distance. The local moderator was the person in charge of the learning process inside the classroom. This role was usually undertaken by one of the school teachers in the application areas. Their main duty was to foresee and solve problems that would threaten the learning process (like technology issues). A second level of national support for each participating country was provided by a university or a research organization. So learners were benefiting from four sources: the local moderator, the distant tutor (instructor), the subject matter expert (too expensive to be a tutor for a small audience), and the university partnership (that catered for the instructional design as a whole and provided the technological solutions).

As an e-learning project whose “educational-identity” involves distance and adult learning, the REVIT specifications and constraints were raised by an amalgam of knowledge about adult learning and distance education. Basic principles for adult learning (Rogers, 1996; Rogers, 2005; Jarvis, 2004; Knowles, 1990; Rosemary et al., 2006; Schön, 1987) posit that adult learners are autonomous, self-directed, goal-oriented, and relevancy-oriented. Adults need to attain practical learning results that are forthcoming, tangible, and directly relevant to their own experiences and vocational or other aspirations. To create a learner-centered curriculum which is closely related to real-life situations and also close to the learners’ needs and aspirations, the instructional designer needs to know these needs and aspirations. Our aim was to foster community inquiry through “pragmatic technology” (Hickman, 1990; Bishop et al., 2009) with the concern to design a learning environment that meets actual learning needs, assesses knowledge in terms of its practical usage, and accommodates the learners’ lived situations. Moreover, there are different learning styles or characteristic ways in which adults prefer to learn (Rosemary et al., 2006) and in order to engage all learners, it is required to vary the methods in which information is communicated.

The project involved a collection of e-courses that combined a variety of media, tools, and methods:

- synchronous distance learning sessions, with the use of a virtual classroom including use of e-whiteboard ("Elluminate live" was used as a webconference tool);

- asynchronous learning sessions (Moodle was used as a learning management system);

- Web 2.0 tools (podcasts, wikis, chat, forum, blogs) and a virtual world environment (namely "OpenSim").

On the other hand, Moore's work on transactional distance acknowledges that the separation in time and space between students and their tutors may have a profound effect on learning and teaching in a distance education setting. This transactional distance can be defined as the gap of understanding and communication between the teachers and the learners caused by the spatiotemporal separation "that must be bridged through distinctive procedures in instructional design and the facilitation of interaction" (Moore & Kearsley, 2005, pp. 223-224). Towards this end, the REVIT learning material was subjected to instructional design procedures that aimed at creating meaningful, practical, and relevant learning experiences. Also, the affordances of computer supported collaborative learning and e-learning 2.0 tools (mentioned above) were exploited in order to eliminate the transactional distance and to offer opportunities for dialogue and interaction. Social networking functionalities (Facebook, Twitter) were also incorporated in the REVIT distance learning framework to establish and maintain ties with experts, e-tutors, instructors, learners, and other communities.

Additionally, in alignment with the basic principles of learner-centered design – "understanding is the goal", "motivation is the basis", "diversity is the norm" (Soloway et al, 1994) – the topics of the courses were not predefined, but decided by the learners after constructive discussions with the instructional designers. An appropriate adjustment from what is academically valued in a knowledge domain to what is valued by the specific learners, while carefully examining learners' characteristics, ensures that they will perceive content (rather its transformation into knowledge) as worth knowing (Sims, 2001; Parchoma, 2003).

The e-courses included topics like "e-business", "organic farming", "rural tourism" and others. Eleven e-courses were offered in total, ten designed for adults and one for pupils. Each e-course lasted for a semester (10-13 weeks).

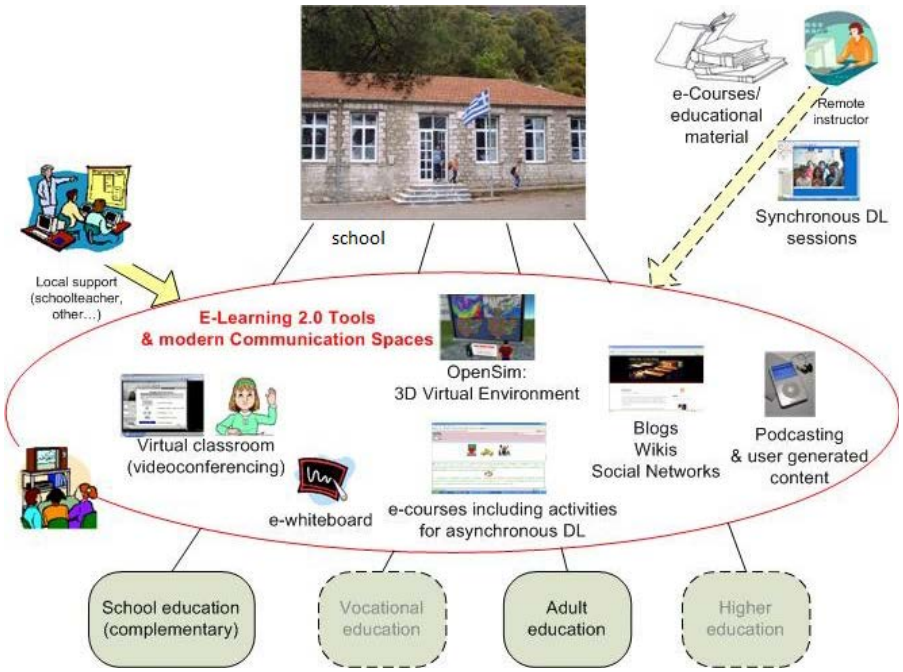

Figure 3. The REVIT distance learning model.

The REVIT Learning Needs Analysis

The design of a course starts from the educational objectives. They rely on a learning needs analysis, that is a set of activities for assembling information about the learners, their needs, wants, and the environment in which learning will take place. Based on the educational objectives, lesson plans, materials, tests, assignments, and activities are developed. The learning needs analysis clarifies the purposes of the educational program.

Learner-centered and participatory models of instructional design emphasize learners' characteristics – demographics, needs, preferences, and experiences, among others (Parchoma, 2003). Learning needs identification includes:

- Learner analysis (Schwen, 1973; Chen, 2011, p. 94). Learner analysis identifies learner characteristics and individual differences that may have an impact on the learning process (Chen, 2011, p. 94).
- Context analysis (Dick & Carrey, 1990; Tessmer, 1990). Context analysis is a systematic review of the settings in which instruction takes place and may involve parameters such as facilities, equipment, and so on.
- Needs analysis (Rodriguez, 1998; Chen, 2011, p. 94). Needs analysis is used to determine the extent to which a learning need exists by conducting a needs assessment (Chen, 2011, p. 94).

The analysis conducted for REVIT included investigation, elicitation, and commitment.

Investigation was a feasibility study on the local technical and social space. For the technical space an investigation of the available facilities in the application area (Tessmer, 1990) was conducted for several parameters and factors involving the technical infrastructure (Internet connections with adequate bandwidth and available computers, cameras, and microphones in the support environment, i.e., the school and homes of participants). Another important factor for REVIT was the adequacy, suitability, proximity, and availability in practice of the physical resources, mainly the school or community classrooms.

For the social space, in order to clearly form the profile of the learners, a few visits in the application area were organized. Except for learners' demographics and needs, in the context of adult learning in informal settings using distance education, elements like learners' sociocultural context (Vygotsky, introduced by Tudge & Scrimsher, 2003), motivation (Jones & Davis, 2011; Bandura, 1978; Salomon, 1981; Gagné, Briggs, & Wager, 1992), and expectations from the educational program (Jones & Davis, 2011) were considered as highly important parameters and, consequently, informed the design decisions. Since planning instruction with the learner's expectations and needs in mind always helps in achieving the learning objectives and being aware of the fact that the learners have high expectations from the use of technology in distant courses (Jones & Davis, 2011), this was something that needed to be reclaimed as an educational requirement. Motivation has been reported frequently (for example, McNair & Quintero, 2008; Marcinkiewicz, 2011) as a key success factor of learning with the use of ICT at a distance. Similarly, the learners' sociocultural context plays an important role in distance education in general (Valcke & Leeuw, 1998), but also specifically in our case where the application areas were remote villages in five European countries.

Geographical factors such as distances and accessibility always affect blended learning where students do whole physical meetings, albeit rarely. Relationships are always important and in small places more so. Availability varied daily (for teachers), weekly (in islands where the visiting boat schedule affects the life of the whole island), and yearly (for farmers). Local technical help (usually by a volunteer teacher, agronomist, or just a young person) can be a make or break factor at the beginning.

Elicitation was the main stage of the needs analysis, in which learners were helped by the instructional designer to conduct a self-diagnosis regarding the learning tasks that might be most helpful to them. Here the instructional designer acted as a counselor who helps the students identify the knowledge and skills that are most beneficial to them (Brookfield, 2009). Informal communication was encouraged at this stage by the project team since it could convey valuable feedback concerning the learners' attitudes towards the educational venture at stake.

Elicitation involved a variety of interviewing and questioning techniques, like small group or public discussions, brainstorming (McDermott, 1982), and diagnostic questionnaires in the form of online survey (Patterson, 2009) or in the traditional, written (offline) survey method, in order to obtain relevant performance data in topics of interest (Rorgiquez, 1990). Samples of the online questionnaire used in the Polish application area, as well as a sample of the questionnaire handed out in written form to the learners of the Bulgarian remote area, are shown in Appendix A. More details about the description of the methodology in each country concerning this stage are described in Appendix B. In practical terms, after a few visits in the application areas, the instructional designer team was able to estimate topics of common interest and the actual number of the participants in each of them. The method of informal discussion ("speaking their language") proved helpful as a means of detecting educational needs in informal or semi-formal settings, as well as potential barriers.

For REVIT, taking into account the sociocultural context meant:

- Courses were addressed to adult learners who may feel excluded from educational opportunities and also have a strong sense of belonging to the regional community. This created the pedagogical requirement of promoting collaborative learning in order to establish a sense of online learning community that would motivate the learners on the one hand and the expectation that the learners living in the same remote area would strongly affect each other's opinion about the value of the program, on the other.
- Some courses were attended by learners from multiple remote areas. Dealing with different languages constituted the main barrier in this case. Two ad hoc solutions were devised: Courses with learners from Palaichoni (Cyprus), Koufonisi and Ios islands (Greece) were offered in Greek; and courses on 'English as a Foreign Language (EFL)' were offered in English to learners from several countries.
- Remote places are usually situated a long distance from metropolitan centers, are not densely populated, and are most commonly inhabited by older than younger people, who mainly practice "traditional professions" such as agriculture, fishery, and, in some cases, tourism. This has created the requirement that attracting learners' interest would be related to the ways that ICT tools could help them practice their jobs better and the additional expectation that the learners probably wouldn't have a clear vision about these ways.

Receive learners 'commitment of participation (Rodriguez, 1990). Our aim was to agree on a learning contract. In theory, a learning contract is "a formal, written agreement ... about what the learner will learn and how that learning will be measured" (Boak, 1998, p. 1). The use of learning contracts may foster the creation of online learning communities (Mahoney et al., 2000) and contribute to establishing trust and building a sense of community (Allan & Lawless, 2003). In REVIT practice, the learning contract was a good presentation of the learning goals aiming at reaching consensus about them with the learners (10-20 learners in each remote area). In small communities, oral commitment expressed in public can be much more binding than private written commitment or even financial commitment.

Gaining the learners' commitment is an important process in promoting among the learners the sense of greater responsibility and control of their learning.

A prerequisite to asking the learners' commitment was to discuss with them the following aspects:

- The technological tools used throughout the e-courses. The intended use (purpose: tuition/ communication/else, and mode: synchronous/asynchronous) of each tool was explained to the learners, avoiding technical terminology. If possible, the person (usually the instructional designer) who conducted the needs analysis logged into the online learning platform (or portal, etc.) and performed a live demonstration of these tools.
- Learner tasks while using these tools. For example, we explained the extent and the frequency in which they would have to participate at the on-line sessions, use the forum, do some exercises, and so on.
- The duration of the e-courses, the description of educational activities at a high level, and the various roles.

Outputs of the Analysis Phase: The REVIT Learning Goals

From the learning needs analysis emerged that the first educational goal would be to provide the level of digital literacy required to use the REVIT learning tools and services effectively. It was expected that the learners wouldn't have a good ICT background which was confirmed from the learner analysis. To remediate for this, the e-course "Introduction to Web Technologies" was the first to be designed and offered to all the perspective learners. Of a value by itself, this course helped reduce the learners' cognitive barriers related to the lack of ICT-competence. The learning needs analyses conducted by five coordinated teams in the five remote areas converged into another 10 e-courses. For each e-course, the learning objectives reflected the competencies needed from the learners' standpoint and were clearly stated in terms of knowledge, skills, and attitudes. For instance, in the "EFL Teachers using Web Technologies" the main educational aim was training EFL teachers to make successful lesson plans. The learning objectives were explicitly stated as follows:

- Knowledge-oriented: trainees acquire new knowledge on lesson planning methods by reading articles, listening to lectures, etc.
- Skills-oriented: trainees tailor lesson planning models to meet their own teaching needs; ability to work together in a professional inter-european context; exchange of problems and concerns with fellow practitioners.
- Attitudes-oriented: trainees appreciate the importance of lesson planning (self-assessment, course improvement, data-gathering/exchanging, etc.).

The REVIT methodology for needs analysis of trainees proved to be well adapted and efficient, as judged a posteriori by the participants (see Table 1 and Table 2). The contacts with the locals have led to an authentic investigation of the local culture and the important points in the life of eventual participants. For instance, in Ios island (Greece) the time of the arrival of the boats (with tourists) was very important for the local economy and life and, indirectly, affected the synchronous courses. In most cases, the course topics were important for the professional and personal life of learners (see Table 3). Also, the initial assumption that the learners wouldn't have clear ideas on how ICT would help them in their professional development was confirmed by the learning needs analysis, as well as that the learners living in the same remote area would strongly affect each other's opinion about the value of the program. The latter information was provided by the local moderator who liaised between the project team in each application area and the locals and who was in constant contact with both sides (via physical meetings with locals and via computer mediated communication with the project team).

Table 1

Quality of the E-Courses

The distance courses of REVIT were satisfactory and helped you to achieve your personal goals		
Answer	**Count**	**Percentage**
Completely disagree (1)	1	0.76%
(2)	2	1.52%
(3)	12	9.09%
(4)	17	12.88%
Completely agree (5)	70	53.03%
No answer	4	3.03%
Non completed	26	19.70%

Table 2

Difficulty of the E-Courses

The distance courses of REVIT were rather hard to follow		
Answer	**Count**	**Percentage**
Completely disagree (1)	43	32.58%
(2)	17	12.88%
(3)	21	15.91%
(4)	14	10.61%
Completely agree (5)	6	4.55%
No answer	5	3.79%
Non completed	26	19.70%

Table 3

Impact of the E-Courses on the Trainees' Professional Life

The REVIT e-courses will help you in your job or you future professional plans		
Answer	**Count**	**Percentage**
Completely disagree (1)	2	1.52%
(2)	6	4.55%
(3)	16	12.12%
(4)	16	12.12%
Completely agree (5)	59	44.70%
No answer	1	0.76%
Non completed	32	24.24%

The questionnaires, addressed to trainees via an online survey component that was integrated in the REVIT DL platform, were answered by 136 people in total (80% of the total number of participants). The repartition of the answers to the countries is 24% from Bulgaria, 17% from Cyprus, 18% from Finland, 17% from Greece, and 24% from Poland.

How Results Impact Theory and Practice

Bridging Theory and Practice

A variety of interviewing and questioning techniques were used in the analysis process in order to provide a contextualized approach that would harness socio-cultural diversity and foster the elicitation of actual learning needs, while also studying previous work concerning lifelong learning (LLL) best practices in rural areas derived from previous projects. The REVIT team mainly examined projects that targeted the adoption of innovative techniques and entrepreneurship by adult professionals. Examples include: training initiatives of the Chambers of Commerce in Italy[1], Ecologica[2] (online learning for organic farming), and others. Moreover, the team built on the experiences gained by the MustLearnIT project[3], a venture also acknowledged as a "best practice in social inclusion" aimed to provide learning opportunities for children in remote rural communities in a way that included their teachers and the community as a whole. The impact of the MustLearnIT project has both inspired and triggered the REVIT project and the experiences gained by the former provided valuable insights on various aspects of the latter, like how to adapt the REVIT distance learning methodology to the context of school education (one of the REVIT e-courses was addressed only to pupils).

The flexibility in the needs analysis meant that various techniques were used in the participating countries. For example in Cyprus analysis of national statistical data concerning barriers in the uptake of LLL by adults living in remote areas clearly showed that the main reason for not participating in formal or informal LLL activities was lack of time due to family duties (41.4% in rural areas) followed by the fact that the training program was not compatible with the job time schedule (30.2% in rural areas).

On the other hand, in order for the REVIT project partners to follow similar methodological approaches as far as needs analysis was concerned, specific guidelines were formed early in the project indicating the most appropriate methods for examining educational needs of schools located in small, remote villages. Thus, the partners had to select one or more of the following methods:

- observation,
- estimation,
- document analysis,
- survey,
- dialogue.

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[1] http://www.chamberofcommerce.it/inglese/formare-.asp
[2] http://www.ecologica.net/website/
[3] http://mustlearnit.cti.gr/

An example: If prospective learners already had internet access and were digitally literate, then an online questionnaire would be more appropriate. With the use of these methods each partner country that participated in implementing courses in the REVIT project provided a study on

- the selected target groups in the remote communities it addresses;
- the identified educational requirements of these groups it addresses;
- the adaptations to the DL models/schemes, platform(s), and ICT based tools that were made to accommodate the previous two points and other local conditions.

Dealing with Constraints and Obstacles

The project managed to reach the outcomes described below under tight timetables and economic constraints agreed before the start of the project with the funding agency. REVIT was considered a best practice in the field of social inclusion (U. Haller-Block, personal communication, 22 May, 2012) by its funding agency, the Education, Audiovisual & Culture Executive Agency of the European Commission (EACEA). The development of a learner-centered curriculum and the provision of the e-courses was one of the main priorities agreed between the funding agency and the REVIT research team. This gave the team the opportunity to conduct the extensive analysis described in this paper, speaking in economic terms (i.e., budget allocated for this purpose). The economic feasibility of the educational venture was achieved mostly by keeping low costs for the design, development, and implementation of the e-courses, while keeping high quality outcomes in each of these phases. Rapid prototyping has helped towards this direction and also the fact that in this particular e-learning project the duration of the e-course was at most three months. The subject matter experts were called to create the e-courses at a low cost, a 'light' version of the course material that was easier (since the course was addressed to beginners) and limited (since the course had limited duration) compared to the materials that they were using in their everyday teaching practices. The subject matter experts in some cases could also play the role of the e-tutor, depending on their availability and competencies. This also illustrates the principle of separation between the development and the implementation of the e-courses that was adopted from the start of the project.

Concerning the needs analysis, it is not very clear how local conditions could be determined precisely in all cases: discussions with as many as possible people of the target area, knowledge of the infrastructure, and the explanation of all mutual duties and obligations; all these elements seem to be necessary. However, it is true that this thorough needs analysis is difficult and may be too expensive for a large scale application. In a small community it is easier to contact eventual participants and to determine their needs with accuracy, while in larger areas it is more difficult. In this case, a balance should be established.

A significant number of drop-outs was observed (42 out of 212 adults that originally participated in the program). Even if, in general, a large percentage of drop-outs is expected in distance courses (Tyler-Smith, 2006; Wang et al., 2004) this still remains an important open question. Lack of time was an important factor for these dropouts, as the evaluation results revealed. Also, learners reported that the difficulty level of the learning activities was sometimes too challenging and other times too easy for them; or that the heterogeneity of the learners' backgrounds made it impossible to balance interest and learning. Other examples relate to course length and computer availability: Even if the course length was appropriate for some, it certainly was not so for everybody; a computer at home does not guarantee ready access at convenient times. On the other hand, only a very large scale project which could vary these parameters in distinctively different ways and provide personalized instruction could give proper answers. It would also be interesting to revisit the areas a few years later and gauge (a) how learning has progressed over time and its impact on the participants' professional lives (i.e., what learning has been retained and put to use) and (b) what the opinions of learners, drop outs, and non-participants are, in retrospect, about the value of the endeavor as an educational program. Finally, although the analysis resulted in topics that had an impact on the trainees' professional and personal lives, it should be noted that this detailed analysis was a factor for a considerable increase of the total cost.

Which of the REVIT Conclusions can be Generalized?

The know-how gained from the design and the implementation of the project can be capitalized as a "model" (or at least as elements of a model) for future projects or courses that could be organized under similar circumstances. This project is different from the usual distance learning courses (and that is the point where new, important know-how is gained) in that courses were not created in abstracto for some virtual community of users/learners, but were designed and constructed specifically for people living in these remote areas with educational needs defined through a thorough examination.

Although the e-courses were well-prepared, in some cases contradictory estimations from participants emerged. This phenomenon (contradictory statements) was observed for instance in the case of their preference for printed learning material, as opposed to digital learning material. Previous research (Moore & Kearsley, 2005, pp. 91-92) has actually confirmed the REVIT experience, that is, some learners prefer printed materials, giving reasons of reliability, portability, and habit. This put forth the pedagogical requirement of having the learning material available in various formats (including in printed form) and then letting the learners choose the most appropriate for them.

The participants (learners) in the e-courses represented a set of people with diverse characteristics (age, sex, profession, level of education, country) which is an indirect indicator of the reproducibility of the findings. Also, the components of each course were defined independently from the content, which was provided by experts of the field, and adapted to the standard forms of the e-courses, ready to be delivered at a distance. Finally a third person, a teacher or a local moderator, was responsible for the delivery of the course (the “teaching”). The separation of the form and the content may seem unusual, since in typical lessons the same person prepares the courses (form and content) and also delivers them (i.e., teaches). But the REVIT method produced models of reusable courses which have low cost and can be easily tested with several criteria (efficiency, conformity to a set of standards, etc.). These courses were often “re-localized”, that is adapted to local conditions (language, etc.) outside the borders of the country of their initial production, overcoming cultural and language barriers. It is worth noting that the process of localization of the didactic material was not a trivial one: It went far beyond a simple translation; it was an adaptation in the sense of transformation to the local culture and this was a demanding process.

It is clear, on the other hand, that the REVIT’s learners, living in remote areas, have particular sociocultural characteristics, affecting the success of a distant course, such as practicing traditional professions, and having a strong emotional “connection” to the members of their local community. The local communities were mobilized and affected positively by the REVIT educational venture. The participants’ dispositions seem to be the best assurance for the continuation and the extension of these courses – finally for the idea of lifelong learning. These side effects cannot be easily measured. However, the trainees, almost unanimously, declared that they prefer courses organized in groups and they also expressed clearly their preference for a specific group size: 3-5 persons. They had the feeling of belonging in a small class where it is easy to collaborate with each other, without being divided into sub-groups.

The E-Course Settings and their Enactment

In order to provide some insights on the important aspect of the interactivity of the distance courses, a sample of five e-courses was selected randomly and examined. In particular, overall course design documents and specific lesson plans (usually 8-11 lesson plans per course) were analyzed. The evaluation rubric proposed by Roblyer and Wiencke (2003) in their seminal work titled “Design and Use of a Rubric to Assess and Encourage Interactive Qualities in Distance Courses” was used. It consists of a scale of interaction which ranges from low to high in conjunction with five interactivity dimensions: social (rapport-building), instructional, technological, learner driven, and instructor driven. The results can be summarized as follows (a four-point scale is used where the value 1 is assigned to *low interactivity* and the value 4 to *high interactivity*):

- Concerning the social aspect, all the courses have a score equal to 3, since “in addition to providing exchanges of personal information among learners, the instructor provided at least one other in-class activity designed to increase communication and social rapport among students”.

- Concerning the instructional aspect, four courses have a score equal to 4 ("in addition to requiring learners to communicate with the instructor, instructional activities require learners to develop products by working together cooperatively and sharing feedback") whereas one course has a score equal to 3 ("in addition to requiring learners to communicate with the instructor, instructional activities require learners to communicate with one another").

- Concerning the interactivity of technology resources, all the courses have a score equal to 4 ("in addition to technologies used for two-way synchronous and asynchronous exchanges of written information, additional technologies, e.g., teleconferencing, allow one-way visual and two-way voice communications between instructor and learners").

- Concerning the learner engagement and the instructor engagement, there is not enough evidence derived from the document analysis to decide upon these aspects.

Finally, concerning the cost-effectiveness of the e-course design and development, it was enhanced by various parameters that can be summarized as follows:

- the adoption of e-learning standards (such as the SCORM[4] technical standard for course packaging and the LOM[5] metadata application profile schema for course description);

- the adoption of open source or freeware solutions (such as the eXe XHTML authoring tool[6], the Moodle course management system[7], the OpenSim virtual world[8] and, finally, Web 2.0 tools. It should be noted here that the Elluminate webconference™ platform, which is a commercial solution, was hosted by one of the project partners and was used by project stakeholders at no extra cost);

- the collaborative design and subsequent extensive use of templates (course design template and lesson design template in a word format and template scenario for the development of the REVIT lessons in an eXe XHTML editor compliant format) and, finally;

- a set of guidelines and other supportive information for authoring and localizing a REVIT e-course.

The above choices not only minimized effort and cost, but also had a positive impact on the re-usability and the ease of localization of the e-courses. Methodologically speaking, after the completion of the analysis phase, the development of the course syllabus, and the ensuing lesson plans, learning activities and resources followed as a computer

4 Sharable Content Object Reference Model (SCORM)
5 Learning object Metadata (LOM)
6 eLearning XHTML editor, http://exelearning.org/
7 Moodle CMS, https://moodle.org/
8 OpenSimulator, http://opensimulator.org

supported collaborative design process between the partners that had an interest in the specific e-course. Having a European perspective in the selection of the activities and the resources by keeping a balance between local needs, while having a European audience in mind, was a focal requirement for the sake of an easier re-localisation of the e-course.

Note: The analysis framework presented in this paper adheres to a balanced approach between local choices with a pan-European perspective and instructional design theory with practice, while keeping a certain flexibility level in the pathways taken during the analysis in each application area and also utilizing the facilities of the schools.

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Appendix A

Sample of the Diagnostic Questionnaires

The online survey questionnaire (used in the Fornetka application area) was comprised of the following questions:

- Demographics (age, sex, field of working)
- Educational context (Readiness to participate in distance E-course in Primary School in Fornetka, Areas of interest concerning the distance E-course, I have the following ICT skills)
- ICT facilities (I have the following Internet connection at my home)

The questionnaire handed out to the learners in Kula (BG) in a written format contained the following fields:

- Demographics (Sex, age, occupation)
- Prior knowledge (What are your computer skills?)
- Willingness/Readiness (Would you be interested to attend e-courses at High school “Vasil Levski” in Kula?, If your answer to the previous question is “no”, would you attend e-courses from your home/work?)
- Interests/aspirations (What ICT skills are you interested in developing?, Which of the following topics of potential e-courses interests you most?, Would you be willing to participate in an e-course with fellow trainees from different age groups?)

Appendix B

Methodology Description in a Country Level

This section presents the needs elicitation methodology (method, instruments, protocols, participants/ respondents) in a country level.

A. Ullava, Finland

Method: online questionnaire

Protocol: The questionnaire was send via the teachers, at first to all the parents of the pupils in Veikko Vionoja and Rahkonen school. It was not possible to send the questionnaire to all the adults in the application area and this sample was chosen to present the needs of adults in Ullava. Teachers had in their disposal the email addresses of the parents. The data was collected electronically by SPPS/Mr. Interview software.

Instrument: online survey tool with 12 questions, 10 closed, multiple choice questions and 2 open-ended questions at the end of the questionnaire so that participants could elaborate about their interests and needs towards distance E-learning and videoconference based learning. The first 7 questions of the questionnaire are identical with the ones in the questionnaire that was administered in Fornetka, Poland (see previous section) i.e. demographics (3 questions), educational context (3 question) and ICT facilities (1 question).

Respondents: 27 persons completed the questionnaire successfully.

B. Fornetka, Poland

Method/Protocol: Physical meetings and discussions with the community of Fornetka, including the local people, the authorities and the local co-ordinator. The aim of the first meeting (semi-public) was to inform the community about the project and anticipate their interest to participate as the application area in Poland. The second meeting was organized with the perspective learners in order to investigate their needs. The third meeting was public with invited representatives of local authorities. A fourth public meeting was held at Fornetka, in order to finalize the list of the educational needs and get the commitment of the people that would participate in each course.

Instrument: Between the second and the third meeting an online questionnaire was administered to the perspective learners (see Appendix A).

Respondents: 40 persons completed the questionnaire successfully.

C. Kula, Bulgaria

Method/protocol: The local project team together with the local moderator in Kula after having conducted questioning (using the online questionnaire) and interviewing (focus groups) during their visits in the area, identified the educational needs of the potential beneficiaries. A follow-up public meeting was scheduled for getting commitment from the participants in the e-courses. From the questioning, discussions and meetings conducted the educational needs were finally specified.

Instrument: A short questionnaire with 10 questions was disseminated among potential local beneficiaries (see Appendix A).

Respondents: 21 questionnaires were successfully filled in and returned to the local moderator in Kula.

D. Koufonissi and Ios islands, Greece

Method/protocol: a two-staged method was adopted, that is, Stage 1) interviews with local people and reports from local teachers, Stage 2) observation and dialogue methods (visits to both islands, organization of infodays and parallel collection of data needed). Also, contacts with the school directors (early in Stage 1) were established.

Instrument: Attending members of the local community in each island were requested to complete a questionnaire in order to determine the learners' profiles. The learner profile questionnaire contained personal profiling information, educational and professional background, computer literacy information and further learning interests.

Respondents/participants: 129 preferences on a list of potential REVIT e-courses (but this number does not indicate the exact number of participants, since several persons expressed interest in more than one course).

E. Palaichori, Cyprus

Method/protocol: Members of the project team visited the community of Palaichori four times, in order to specify the educational needs of the locals. The aim of the first meeting was to inform the community about the project and anticipate their interest to participate as the application area in Cyprus. During the second and the third visits, meetings with perspective learners were organized and the methods of discussion and brainstorming were used in order to elicit their educational needs. Also, the team used the school infrastructure and equipment (internet connection, projector, speakers) in order to demonstrate the main components of the REVIT distance learning system, its tools and services. In the last meeting in Palaichori, the list of the educational needs was finalized, consensus was reached and the project team gained the learners' commitment in the courses.

Instrument: A brainstorming protocol was used with notes taking from a member of the research team, in parallel.

Participants: 40 preferences on a list of potential REVIT e-courses (but this number does not indicate the exact number of participants, since several persons expressed interest in more than one course).

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Online Interaction in Higher Education: Is There Evidence of Diminishing Returns?

  

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Abstract

Online interaction is considered to be a key aspect of effective e-learning and improved academic achievement. However, few studies have examined how effectiveness varies with the degree of interaction intensity. Using data for 17,090 students from three Catalan universities, in this paper we study the productivity associated with five different levels of interaction intensity in learning. We also compare the results obtained for fully online education with those for face-to-face learning. The analyses show that interaction in online education has diminishing returns, while in face-to-face learning it does not do so in a pure way. These results have implications for determining the optimum level of interaction that should be sought when designing courses and educational policies.

Keywords: Online interaction; academic achievement; higher education

Introduction

Interaction is usually defined as a two-way communication process requiring two objects and two actions (Moore, 1989; Muirhead & Juwah, 2004; Wagner, 1994). With the focus on people's learning, interactions can occur in formal and informal educational contexts alike (Anderson, 2003). Interactions in formal educational contexts mainly take place between any combination of two of the following three elements: students, lecturers, and content (Anderson, 2003; Gunawardena & McIsaac, 2004; Miyazoe & Anderson, 2010a).

The use of the Internet to strengthen student interaction is considered to be a key aspect of the effective incorporation of e-learning into higher education (LaPointe, 2003; Swan, 2004; Zhao, Lei, Yan, Lai, & Tan, 2005). Moreover, it has recently been shown that online interaction is the reason why students on face-to-face courses obtain better results (Castaño-Muñoz, Duart, & Sancho-Vinuesa, 2013; Means, Toyama, Murphy, Bakia, & Jones, 2009).

Despite the importance of online interaction, to date there have been few analyses of the varying effects of different levels of such interaction on academic outputs (e.g., satisfaction or academic achievement).

In an early approach to this topic, Anderson theorised on the possibility that by adding together degrees of interaction in distance education, students may gradually derive less satisfaction. This idea is reflected in Anderson's equivalency theorem (2003), later renamed interaction equivalency theorem (Miyazoe & Anderson, 2010). Specifically, the second thesis of this theorem postulates that for distance education, "High levels of more than one of these three modes will likely provide a more satisfying educational experience, although these experiences may not be as cost or time effective as less interactive learning sequences" (Anderson, 2003).

Miyazoe empirically addressed this theorem in an unpublished study (see Miyazoe & Anderson, 2010b) on a sample of 236 students from Japan and Taiwan. This study analysed the preferred types of interaction depending on learner characteristics, learning modes, and content orientation. The results show that majority student satisfaction can only be achieved with just one type of interaction; when more types are added, fewer students are satisfied and returns diminish as a result. In addition, the study found different preferences in different learning modes, thus raising the need to differentiate between face-to-face, online, and blended learning in the analysis of online interaction.

Regarding academic achievement, Bernard et al. (2009) performed a meta-analysis of the results from 77 studies and applied the idea of diminishing productivity to the analysis of the impact of online interaction on academic achievement. The result of the aforementioned study provides empirical evidence of the fact that in courses with the highest levels of internet-mediated interaction, the academic achievement returns do not increase proportionately with the level of interaction. In fact, the returns increase to a lesser extent.

This result is especially important because of its extensive and pioneering nature. However, despite the methodological strength of the approach, there are three points of Bernard's analysis that constitute limitations:

- The absence of studies analysing the effects of different degrees of interaction intensity compels the authors to create a relative intensity scale. Specifically, they define a scale of three categories (low, medium, and high) on the basis of intensity differences between the control group and the treatment group. Thus, an intensity difference is considered to be 'one', both in the comparison of the two groups with low and medium intensities and in the comparison of the two groups with medium and high intensities. Bearing in mind that the initial idea is that of diminishing productivity, it is plausible to surmise that the effects of the first of the proposed comparisons will be higher than those of the second. Therefore, it can be argued that the comparative scale may bias the results obtained.
- Fully online courses or hybrid courses that tend to be more online are considered as the object of analysis only: More than 50% of interactions take place online. This fact excludes from the analysis those courses with mainly face-to-face interactions that are, however, complemented through internet use.
- The effects between the two types of instruction are not separated out and, therefore, the specificities of internet use for interaction in the case of face-to-face learning cannot be analysed.

In this research paper, the aim is to overcome some of the aforementioned methodological limitations. To do that, we shall go a stage further and separately analyse how the academic achievement returns vary with the level of interaction on a scale of five intensities, incorporating into the analysis those courses that, while taught mainly in face-to-face mode, use internet-mediated interaction as a way of improving learning and making a distinction between study mode (fully online vs. face-to-face).

By doing so, the aim is to contribute to a field in which relatively little is known: the analysis of the productivity of internet use for interactive learning. In addition, we shall go a stage further and check the limits of the interaction equivalency theorem by providing empirical data on academic achievement.

However, unlike the study undertaken by Bernard et al., in this study, of the three types of interaction in learning that are habitually analysed (student-student, student-lecturer, and student-content), only interactions with people — and not with content — will be taken into account.

Having information available on this aspect may be of great importance when it comes to establishing the optimum amount of resources (including study time) that need to be invested in internet-mediated human interaction and — from the viewpoint of teaching staff and of institutions — in the facilitation and promotion of interaction to attain greater academic achievement. Despite that, it should be borne in mind that the decision to use internet-mediated interaction does not depend solely on a particular university.

Data and Methods

Data

An online survey was used to obtain the data for the research. In 2006, the survey was sent out to students attending three Catalan universities of different types. Two face-to-face universities — one generalist (University of Barcelona, UB) and the other technical (Universitat Politécnica de Catalunya, BarcelonaTech, UPC) — and one online (Open University of Catalonia, UOC). These data were complemented with information on academic achievement from the Government of Catalonia's administrative registers for the face-to-face universities, and from the university's own registers for the online university. It has to be noted that all the face-to-face universities analysed are public universities with such comparable characteristics as tuitions, so the effect that price could have in academic achievement is controlled when comparing between them. In online mode we only use one semi-public university.

The method for collecting data only allowed the selection of those students who had not dropped out of their studies and who were internet users. This served to filter out only those students who could be analysed.

Information was available on a total of 17,090 students, 8,046 from the face-to-face universities (5,452 from the UB and 2,594 from the UPC) and 9,044 from the online university. The characteristics of the students were similar to the distribution of the population (Table 1), except for academic achievement (due to the fact that the method for collecting data eliminated students who were not taking courses).

Table 1

Comparison of Sociodemographic Characteristics and Study Areas: Universe versus Self-Selected Sample

	Face-to-face		Online	
	Universe	Sample	Universe	Sample
Gender				
F	49.23%	43.28%	49.98%	48.39%
M	50.77%	56.72%	50.02%	51.61%
Age				
<21	28.96%	36.29%	X	X
>=21	71.04%	63.71%	X	X
<=31	X	X	38.40%	36.81%
>=31	X	X	61.60%	63.19%
Area				
Psychology and education sciences	9.12%	12.08%	15.70%	16.02%
Computer engineering	10.72%	11.32%	19.65%	21.20%
Other engineering	22.76%	24.46%	NA	NA
Humanities	11.33%	9.27%	10.73%	12.16%
Documentation/information	1.39%	3.14%	5.16%	6.37%
Economics and business	17.27%	11.44%	38.34%	34.83%
Law and political sciences	6.76%	3.88%	10.42%	9.42%
Health sciences	7.93%	9.58%	NA	NA
Exact and natural sciences	8.52%	11.38%	NA	NA
Other social sciences	4.19%	3.46%	NA	NA
Academic achievement	74.06	66.89	78.26	62.5

Note: NA = not available

Measuring online interaction intensity.

In order to measure online interaction, a set of dichotomous questions was employed to establish the purposes of students' internet use. In particular, questions were asked on four topics. These were as follows:

When studying a course subject, what do you use the Internet for?	
- Communication with lecturers	Yes/No
- Communication with fellow students	Yes/No
- Cooperative work with fellow students	Yes/No
- Participation in online discussions on a particular subject	Yes/No

So, while adhering to the definition given earlier, we asked about every use regarding the active and collective creation of curricular knowledge through two-way communication with another person or other people, whether lecturers, students, or other internet users interested in a particular subject. The third potential agent in the interactive process — content — was therefore not considered (Anderson, 2003; Moore, 1989). The possible difference in quality of the content of face-to-face and online models doesn't suppose a problem for the comparison between them because previous analysis has shown that mere interaction with content doesn't have significant effects in academic achievement (Castaño-Muñoz; Duart, & Sancho-Vinuesa, 2013). It allows us to assume a similar quality level of the accessible material.

In order to draw up an index to reflect the level of interaction, the number of uses from those described previously was added up for each category, giving, as a result, an ordinal variable with five categories (zero to four uses). Underlying the creation of an index of this type is the assumption that the higher a student's number of uses, the greater the interaction intensity in the teaching-learning process. The distribution of the intensity indicator by study mode is shown in Figure 1.

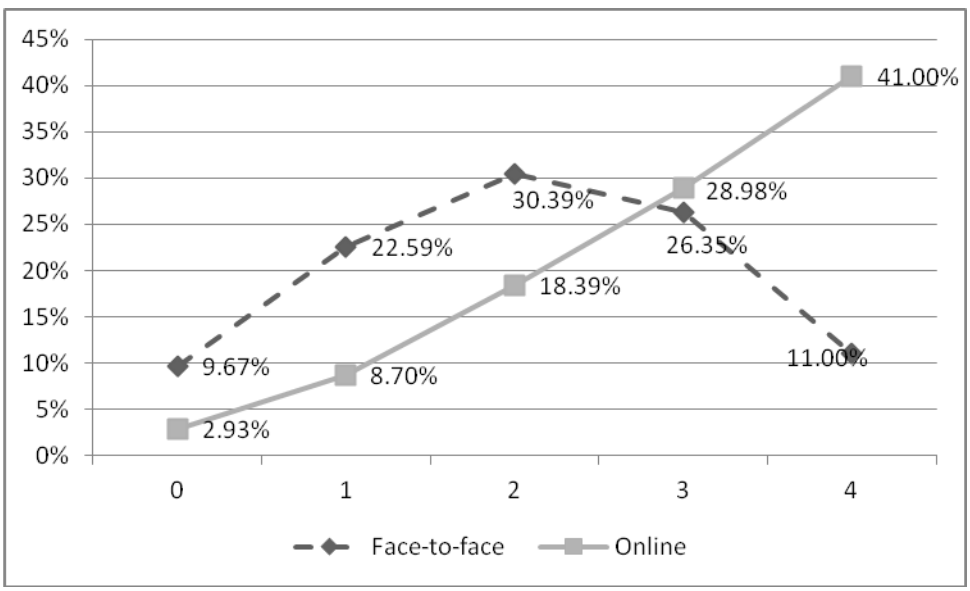

Figure 1. Indicator of intensity of academic uses of the Internet for interaction.

As shown in the figure, interactive uses of the Internet are not particularly widespread in face-to-face universities. Of the students at such universities, 9.67% do not use the Internet to communicate with anyone and 22.59% only make one of the proposed uses, mostly to communicate with lecturers, while in the case of individual uses there is practically no-one who does not make at least two. In addition, for the purpose of future analysis, it should be noted that in the case of face-to-face universities, the distribution of the variable measuring the *level of interactive use of the Internet for education* is similar to the normal distribution, whereas in the case of the online university, it is rising.

Measuring academic achievement.

In order to measure academic achievement, information contained in the administrative registers of the universities was used: information on the number of credits (courses) taken and the number of credits passed per student on this course. Credit data were aggregated by year and therefore both semesters of this course count. In addition, a decision was taken not to measure credits for which official recognition (and therefore exemption) had been obtained.

An analysis of the number of credits for which the students had enrolled highlights the fact that those at face-to-face universities enrol for many more ordinary credits per course than students at the UOC. The mean among the former is 60.87 credits, whereas the figure at the UOC is half that number: 30.35 credits, with a lower standard deviation (Table 2).

Table 2

Description of the Variable for Ordinary Credits Taken on the Course

	Mean	Standard Deviation	Minimum	Maximum
Face-to-face	60.87	18.42	3	195
Online	30.35	14.36	4.5	123.5

In face-to-face mode, of the 60.87 taken credits, students pass a mean of 45.06, whereas at the UOC, of the 30.35 enrolled credits, students pass a mean of 24.3 (Table 3). Once again, the standard deviation is lower at the UOC owing to the fewer credits that students take.

Table 3

Description of the Variable for Ordinary Credits Passed on the Course

	Mean	Standard Deviation	Minimum	Maximum
Face-to-face	45.06	21.88	0	120.5
Online	24.30	14.36	0	123.5

Using the information about ordinary credits taken on the course and ordinary credits passed on the course, an academic achievement rate was calculated by dividing the credits passed by the credits taken and multiplying the result by 100, that is to say, the percentage of credits passed over the credits taken for each student.

Course academic achievement rate = (Ordinary credits passed on the course / Ordinary credits taken on the course) x 100

This academic achievement indicator was chosen because it is one of the official indicators that Catalan universities use. However, in order to ensure the reliability of the results, they were tested against the results that would have been obtained if the achievement indicator had been a measure of effectiveness: *number of credits passed per course* (variable that would measure effectiveness, whose distribution is similar to the normal distribution).

Table 4 shows the descriptions of the academic achievement rate for the two study modes presented. As shown, UOC students have a slightly greater academic achievement than face-to-face students. In other words, UOC students enrol on fewer courses and, on average, pass 78.26% of them, while students at face-to-face universities take a lot more credits and pass a slightly lower percentage of them (74.057%).

Table 4

Descriptions of Academic Achievement Rates, by Study Mode

	Mean	Standard Deviation	Minimum	Maximum
Face-to-face	74.057	28.81	0	100
Online	78.264	29.91	0	100

The distributions show that, among our universe of study of active students, academic achievement is high. In both modes, the bulk of students is concentrated in more than 90% of credits passed over credits taken. That is to say, it was found that the credits passed depend greatly on the credits taken, especially in the case of the UOC.

The figures shown suggest that there are two paces of study depending on the educational mode employed to take a degree course. On the one hand, students at face-to-face universities take twice the number of credits in comparison to students at the online university. On the other hand, students at the online university take fewer credits but manage to pass a slightly higher percentage of them. The fact that face-to-face students take more courses than in online learning explains why their pass rates may be lower given a fixed time interval.

Methods

In the productive process of any good or service, if there is any variation in terms of inputs quantities, then a variation in the output quantity is to be expected. The productivity of a factor can be defined as the change in the production of an output that occurs as a result of a variation in one of the inputs when the others remain stable.

In order to empirically check whether Anderson's theorem works in online and face-to-face education, this article analyses the productivity of internet-mediated interaction in the academic achievement production process. In this respect, a regression was performed, where the dependent variable is academic achievement and independent variables are those considered to be fixed (detailed further on) plus the *Intensity of interactive use of the Internet for education* variable. The last of these variables was introduced as a set of dummy variables and takes the zero-use category as a reference.

Regarding the fixed inputs, several variables were controlled for, including those referring to sociodemographic characteristics, to the student's relationship with technology, to the type of studies the student is taking, and, more indirectly, to the time available for study.

Taking account of the above, the analyses performed in this research are based on the following equation:

$$Ach_i = \Sigma b_j X_{ij} + \Sigma c_k BD_{ik} + \Sigma d_m Est_{im} + \Sigma f_n T_{in} + \Sigma g_p IUInd_{ip} + \Sigma h_{qI} Treat\_Intensity_{iq} + \varepsilon$$

Where:

Ach_i = Academic achievement

X_{ij} = A vector j of the students' characteristics: *Age, gender* (male/female).

BD_{ik} = A vector of variables referring to the different relationships that the students have with technology, based on digital divide dimensions (Dimaggio, Hargittai, Celeste, & Shafer, 2004; van Dijk, 2005).

- One dummy variable that separates the best situated students from the worst situated students in the classic digital divide, without taking account of the purpose of the use. This variable is the result of the cluster analysis and centres on dividing users into two clusters based on infrastructures, experience of use, skills, and time spent online.
- A series of variables referring to the purpose of internet uses. To measure non-academic purposes of internet use, the six indices arising from an analysis of main components performed on a set of 16 uses were incorporated. For these uses, the students indicated their degree of intensity of use on a Likert scale from 1 to 5. There were six resulting

factors: *downloads and audiovisual content, relations, Web 2.0, common uses, e-commerce,* and *employment.*

Est_{im} = A set of dummy variables referring to the type of studies that the student is taking and a continuous variable referring to where the student is up to in those studies.

- Three dummy variables distinguishing the study mode: online or face-to-face. Within the face-to-face mode, another dummy variable was used to distinguish those individuals that had taken at least one course with online content.
- Ten dummy variables distinguishing the area in which the degree course was taken by the student: *Psychology and education, computer engineering, other engineering disciplines, humanities, documentation and information, economics and business, law and political sciences, health sciences, exact and natural sciences,* and *other social sciences.*
- Three dummy variables distinguishing the type of degree course taken by the student: diploma or technical engineering qualification, undergraduate degree or higher engineering qualification, or second-cycle degree.
- One continuous variable measuring the number of credits that the student had passed.

T_{in} = A vector including variables used as proxies to avoid, in conjunction with the sociodemographic variables, any possible biases stemming from not directly observing the time available for study. The number of *credits taken during the course* was controlled for in order to measure the student's subject workload and a dummy variable distinguishing between students who combined their studies with work and those who did not.

$IUInd_{ip}$ = Internet Use Index for individual learning (0-5)

$Treat\_Intensity_{iq}$: A series of dummy variables indicating the intensity of internet use for interaction. Intensity zero was taken as the reference to establish the returns of each intensity level, in comparison to students who did not interact via the Internet.

ε = the error term

One possible weakness of the model is the lack of a direct measure of the motivation of the student. However it's possible to affirm that when including a proxy as the grade in the exam of entrance to the university the results of the estimations don't vary significantly (however it has to be noted that it can be tested only in face-to-face-mode).

To partially correct the possible selection bias in the calculation of effects, the propensity score matching technique was used to match, as closely as possible, the results to the causal effects and to reduce the selection bias and the dependence of parametric models (Ho, Imai, King, & Stuart, 2007).

The data analysed in this paper were divided into different levels of analysis (*university*, *area*, and *type/duration of studies*). If the existence of an intra-class correlation were to be ignored, then it might lead to erroneous results; that is why a decision was taken to use a cluster correction for the standard errors calculation.

By following the aforementioned steps, the increase in the students' academic achievement brought about by one, two, three, or four interactive uses could be estimated in comparison to students who did not interact via the Internet (assumed to be a zero increase), partially avoiding the selection bias of the variables observed.

Results

The estimates of the productivity of internet-mediated interaction for learning, separating online education from face-to-face education, are shown in Table 5 and, more graphically, in Figure 2.

Table 5

Total and Marginal Productivity of Interactive Uses of the Internet in Education, by Study Mode

	Total productivity Face-to-face	Marginal productivity Face-to-face	Total productivity Online	Marginal productivity Online
0 interactive uses	Ref	--	Ref	---
1 interactive use	0.889	0.889	9.05*	9.05*
	(1.50)(a)	(1.50)	(4.56)(a)	(4.56)(a)
2 interactive uses	4.96***	4.07***	13.79***	4.74***
	(1.82)(a)	(1.29)(a)	(4.05)(a)	(1.50)(a)
3 interactive uses	6.20***	1.24	16.08***	2.29***
	(1.58)(a)	(0.81)(a)	(4.06)(a)	(0.52)(a)
4 interactive uses	7.57***	1.37	18.23***	2.15***
	(1.94)(a)	(0.86)(a)	(3.88)(a)	(1.08)(a)

Note: (a) Cluster-corrected robust standard errors

***Significant effect at 99% **Significant effect at 95% *Significant effect at 90%

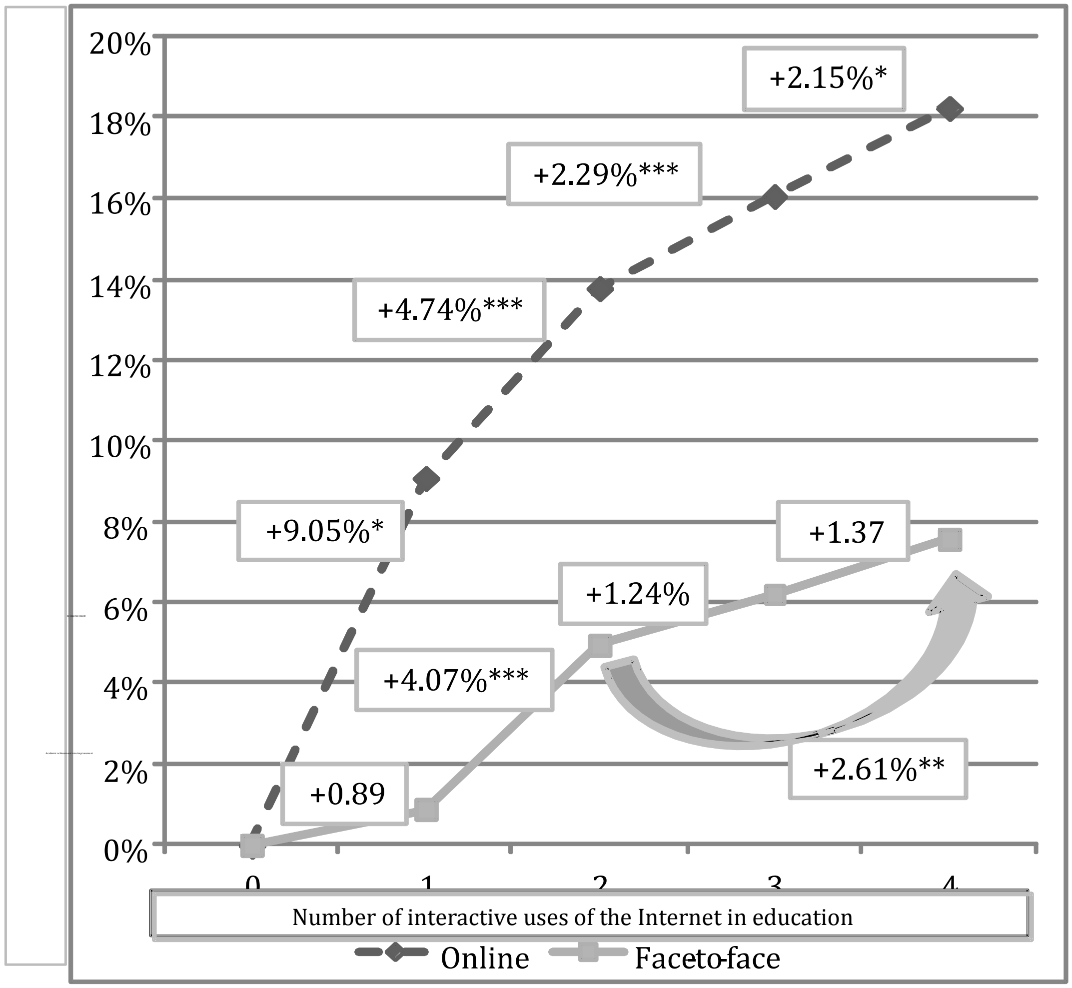

Figure 2. Total and marginal productivity of interactive uses of the Internet in education, by study mode (graphic representation). ***Significant effect at 99% **Significant effect at 95% *Significant effect at 90%

The data show that the incorporation and promotion of internet-mediated interaction can have a significant repercussion on academic achievement and on the time students take to graduate, especially on longer degree courses. On these courses, students interacting via the Internet achieve a higher percentage of passes per course and these gradually accumulate over more courses.

When comparing the two study modes, it is possible to observe how internet-mediated interaction benefits the online education students. On the one hand, the estimates indicate that, on average, a student studying online who makes four uses passes 18.23% more courses than a student who does not make any, and 9.18% more than a student who only makes one. On the other hand, at face-to-face universities, the difference is lower, since an average student with a maximum-use intensity (four uses) passes 7.57% more credits than a student with a zero-use intensity.

An explanation for this difference is that at the online university the only way of interacting with lecturers and students is via the Internet, whereas at the face-to-face universities, such interaction is more of a complement than a necessary condition for interaction. Therefore, the returns of using it are lower in percentage terms. However, account should also be taken of the fact that online education students on average take on a lot fewer credits than face-to-face education students. Therefore, the number of credits that they pass as a result of online interaction is similar in both study modes.

When analysing the two study modes separately, it is found that in the online mode, there is evidence of diminishing returns: In the lowest intensities of use, the marginal achievements are higher than in the highest intensities.

Shifting from zero to one use significantly increases achievement with a confidence level of just 90%, due to the minimal number of individuals that make zero use or only one use in this study mode. The shift from one to two uses and from two to three uses occurs with a significance higher than 99% in both cases. Finally, the shift from three to four uses occurs with a significance lower than 95%, despite the fact that it is in these categories where almost 70% of the individuals studying at the online university are concentrated.

In the face-to-face mode, it is shown that internet-mediated interaction does not follow a pure diminishing return trend; it only does so from minimal use. The dynamic that breaks the diminishing trend is the fact that in the lowest intensity of use, using the Internet for interaction does not show itself to have any significant returns in comparison to the students who do not use it at all.

Therefore, it is found that productivity is low in a first stage, that the returns increase more than proportionately in a second stage, and, ultimately, that marginal productivity is lower in a third stage. As the results show, in the face-to-face mode, a simple increment of one to two uses is significant at 95% and even at 90%. However, it is worth noting that while neither shifting from two to three nor three to four uses has this degree of significance, increasing the intensity from two to four uses does indeed have it, which demonstrates that although the returns diminish, they do not stagnate.

By comparing the study modes, when going from the second level of intensity there is a trend towards diminishing returns. However, the main difference can be found in the first stage of use (from zero to one use).

In the online mode in the first stage, maximum marginal productivity is estimated at 9.05%. Since there is no possibility of interaction, it is the stage that distinguishes active students from those who either do not take any courses or who do so completely individually without any interaction during their learning process. It is hard to imagine a student actively taking courses fully online and learning in a way that is so individual that it would preclude all of the four proposed modes of interaction. In addition, as the online teaching-learning methodology usually fosters interaction by incorporating it into continuous assessment (Means et al., 2009), it is even harder to imagine the case of a student having zero interaction and, at the same time, good academic results.

In the face-to-face mode, on the other hand, the first stage does not bring any statistically significant returns. In line with the theory of production, this can be interpreted as evidence of the existence of two things: a) a stage of adaptation to internet use and b) an entry cost to the dynamic of using the Internet interactively for learning. This stage can be considered as one of approach, exploration, and learning about internet use for interactive learning, which opens doors and enables students to move towards the intensity of use of subsequent stages, where returns other than zero do indeed exist.

Discussion and Implications

On the basis of the aforementioned results and in accordance with previous literature, it is possible to assert that internet use for interactive learning has a positive impact on academic achievement and that such impact depends on the intensity of such use (Bernard et al., 2009).

In the online mode, ceteris paribus, the productivity associated with interaction intensity follows a diminishing trend from the start. While our analysis only takes account of the interaction between humans and not with content, this trend coincides with the theorem proposed by Anderson for the impact of online interactions on satisfaction in distance education (Anderson, 2003; Miyazoe & Anderson, 2010) and, albeit with different methodologies, with existing empirical research on this topic (Bernard et al., 2009; Miyazoe & Anderson, 2010a), thus making the results obtained more robust.

The diminishing returns found in online education have two possible explanations: First, the limiting factor condition (necessary for production) of internet-mediated interaction for taking courses in the university studied, and, second, because greater knowledge is achieved in initial interactions than in subsequent ones. However, the main novelty that our analyses contribute is the postulation of the existence of differences between the online mode and the face-to-face mode. The possibility of transferring the hypothesis of diminishing returns to the face-to-face mode has been tested and shown to be unfeasible. In the face-to-face mode, the productivity of internet-mediated interaction takes the shape of an *S*, which is typical of production functions. Therefore, it is not possible to speak of diminishing production from the start. In fact, in the lowest intensities of internet use for interaction, there are no significant academic achievement returns.

The interpretation of this evidence is as follows: There is a stage of exploration and of adaptation to the incorporation of online interaction in education, which means that at the initial levels, students do not fully benefit from it. So this stage needs to be taken into account when it comes to developing the pedagogical design of courses. Indeed, previous literature shows that this stage can have a positive impact on satisfaction (Miyazoe & Anderson, 2010b).

The consequences of these results on policies for implementing the Internet as a tool for interactive learning are several.

Firstly, from the perspective of distance education institutions, account needs to be taken of the fact that, as shown in Figure 1, there are very few students with a low intensity of use for interaction (2.91% do not make any use and 8.6% make only one). However, they should not be dismissed because their weight (weighted by the greater return they would obtain from increasing their intensity) is greater than their numeric weight. In online education, all costs being equal, if a choice needs to be made between fostering the intensity of use among low-use students or high-use students, it is comparatively more effective to concentrate on the former. However, given that these are in the minority, if general policies aimed at fostering interaction among the student population as a whole are carried out, focusing on medium-to-high-use students (the largest group) may be more effective when it comes to improving learning. However, it should be borne in mind that this type of policy would increase inequality among the few students that least use internet-mediated interaction and the others (Castaño-Muñoz, 2010).

From the perspective of face-to-face universities that incorporate the Internet to improve their effectiveness, the results show that it is necessary to ensure that students do not limit themselves to simply discovering this methodology because it does not provide any significant returns. Rather, they need to make certain that students go beyond the minimum-use barrier so that they are at least situated in a medium intensity of use. In the case of such universities, a high number of students that make zero or minimal use certainly exists (9.67% and 22.59%, respectively). So focusing on getting these “soft” users to increase their use to a medium use may be a highly effective policy when it comes to improving the effectiveness of online education. In order to make best use of the Internet, these data show that universities should strive to find out which students make least use of the Internet for interaction in their learning processes. Having established who those students are, universities should then implement programmes to foster internet use. In this respect, compensatory courses focusing on the acquisition of basic digital competencies and the habit of using the Internet for interaction and study purposes might be useful for students lacking them. Likewise, adapting technological tools to the student population (for example, interaction tools that students already use in their daily lives outside the classroom) might be advisable to improve students’ learning.

A limitation on the results presented is that the costs of implementing online interaction do not form part of the analysis. If the costs of shifting from one intensity level to another were constant, then the preceding assertions would be true. But if they required an initial investment and then lower costs, then institutions that want to maximise both effectiveness and efficiency should foster the most intensive use of the Internet for this purpose. In this respect, there are no data available on the cost to students or to institutions of implementing such interaction. Studying such costs should therefore be a future line of research in the field of the effectiveness and efficiency of internet use in education.

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Peer Feedback to Facilitate Project-Based Learning in an Online Environment


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Abstract

There has been limited research examining the pedagogical benefits of peer feedback for facilitating project-based learning in an online environment. Using a mixed method approach, this paper examines graduate students' participation and perceptions of peer feedback activity that supports project-based learning in an online instructional design course. Our findings indicate that peer feedback can be implemented in an online learning environment to effectively support project-based learning. Students actively participated in the peer feedback activity and responded positively about how the peer feedback activity facilitated their project-based learning experiences. The results of content analysis exploring the peer feedback reveal that learners were mostly supportive of peers' work and they frequently asked questions to help advance their peers' thinking. The implications and challenges of implementing peer feedback activity in an online learning environment are discussed.

Keywords: Peer feedback; online learning; project-based learning; online discussion

Introduction

The increasing prevalence of online programs and courses in higher education leads to burgeoning research on the effective instructional methods and strategies to promote and facilitate students' learning in this context. Among various instructional methods, the constructivist methods exemplify meaningful learning through hands-on problem solving activities that promote active knowledge construction (Jonassen, 1998). Project-based learning (PjBL) is one of the methods for creating meaningful learning experiences. PjBL uses a driving problem to trigger inquiry activities in which students ask questions, search for information, brainstorm, design, and test alternative solutions (Blumenfeld, et al., 1991). During this inquiry process, learners create a series of culminating artifacts by applying what they learned previously or what they have searched and acquired along the way. The created artifacts are external representations of students' solutions to the problem and can be shared and critiqued for further improvement. As projects are often relevant to the individual learner's context, PjBL promotes student-centered learning where students are offered the opportunity to assume more responsibility and independence of learning in a personally meaningful way.

Project-based learning has been studied in adult online learning settings for its effectiveness. Adult learners are often goal-directed and motivated to apply learning in solving real-life problems such as those in their professional contexts (Knowles, Holton, & Swanson, 2012, p. 66). PjBL that engages learners in solving real-life problems can be a particularly motivating and useful instructional method because it encourages and enables knowledge and skill application for adult learners. Koh, Herring, and Hew (2010) explored graduate students' levels of knowledge construction during asynchronous online discussions with respect to engagement in project-based learning. They found that a higher level of knowledge construction activities were more likely to occur during project-based learning when compared to non project-based learning. Based on their study, Koh, et al. (2010) proposed four guidelines for implementing online PjBL: 1) assigning students a design problem; 2) structuring project milestones to facilitate knowledge construction; 3) having students articulate their learning through the development of learning artifacts; 4) (instructor) facilitating activities toward higher level learning. This study adopted these guidelines in an attempt to design an effective PjBL online environment that inspires higher order knowledge construction.

Learning in an online PjBL environment is not without challenges. In such an environment, learners not only acquire new content knowledge, but also need to apply newly learned knowledge to solve complex problems. The application nature of learning is likely to impose heavy cognitive loads on learners, especially novices in the field. Purposefully structured tasks and learning support are essential to scaffold students' learning in an online PjBL environment (Koh et al., 2010). Learning support can be presented in several formats, and feedback is one of them. Feedback refers to "information communicated to the learner that is intended to modify his or her thinking or behavior for the purpose of improving learning" (Shute, 2008, p. 154). Formative feedback, one type of feedback, is presented in a nonevaluative, supportive, and timely manner during the learning process for the purpose of improving learning (Shute, 2008) and can be given by instructors or peers (Phielix, Prins, Kirschner, Erkens, & Jaspers, 2011). Feedback has been suggested as one of the crucial instructional components for improving knowledge and skill acquisition, and for motivating learning (Shute, 2008). The lack of feedback can impact students' learning adversely and it has been argued as a reason for students' withdrawing from online courses (Ertmer, et al., 2007). Some research findings suggested that feedback may be more important in online learning environments than in face-to-face learning environments (Lynch, 2002; Palloff & Pratt, 2001), due to the lack of regular face-to-face interaction in the former. In addition to the affective impact, research suggested that a more explicit feedback process is needed in online learning in order to achieve the levels of student learning experiences and the depth of learning similar to those in traditional learning environments (Rovai, Ponton, Derrick, & Davis, 2006).

Rationale for Adopting Peer Feedback

Given the importance of the role feedback plays in learning, educators need to make sure of the frequency and quality of this instructional component when designing and teaching online courses. However, providing frequent and extensive feedback to every student can be an impractical task for online instructors (Liu & Carless, 2006). Feedback provided by equal-status learners, called peer feedback, can be a solution to meet students' needs of receiving frequent feedback to help them improve their learning process (Gielen, Peeters, Dochy, Onghena, & Struyven, 2010). Peer feedback refers to "a communication process through which learners enter into dialogues related to performance and standards" (Liu & Carless, 2006, p. 280), and can be considered as a form of collaborative learning (Gielen, et al., 2010). Peer feedback is mostly formative in nature with no grades involved. It provides comments on strengths, weaknesses, and/or tips for improvement (Falchikov, 1996), with the purpose of improving learning and performance. When students mutually provide feedback, they participate in collaborative learning where they construct their knowledge through social exchange (Gunawardena, et al., 1997) during the process of providing and receiving feedback.

The theoretical foundation of peer feedback is the social constructivist view of learning. This view emphasizes learning as a social activity and asserts that learners' interactions with people in the environment stimulate their cognitive growth (Schunk, 2008). During the peer feedback process, learners present their ideas to peers, receive and provide constructive feedback, and revise and advance their thinking for solving complex problems. Through this interactive process, learners collaboratively construct knowledge when they clarify their own thinking and gain multiple perspectives on a given issue, which enables the creation of more comprehensive and deeper understanding toward learning.

The Benefits and Challenges of Incorporating Peer Feedback

Benefits have been found for both receiving and providing peer feedback. When receiving feedback, learners invite peers to contribute experiences and perspectives to enrich their own learning process (Ertmer, et al., 2007). When providing feedback, learners actively engage in articulating their evolving understanding of the subject matter (Liu & Carless, 2006). They also apply the learned knowledge and skills when assessing others' work. This process involves learners in thinking about quality, standards, and criteria that they may use to evaluate others' work, which helps them become critical thinkers and reflective learners (Liu & Carless, 2006). Li, Liu, and Steckelberg (2010) investigated the impact of peer assessment in an undergraduate technology application course. They found a positive and significant relationship between the quality of peer feedback that students provided for others and the quality of the students' own final products, controlling for the quality of the initial projects. However, they did not find any relationships between receiving feedback and the quality of final products. They concluded that active engagement in reviewing peers' projects might facilitate student learning performance. Cho and Cho (2011) studied how undergraduate peer reviewers learned from giving comments. They found that students improved their writing more by giving comments than by receiving comments because giving comments involves evaluative and reflective activities in which students identified good writing, problematic areas in the writing, and possible ways to solve the problem.

Nevertheless, peer feedback activity may impose cognitive or affective challenges on learners. It is also likely that students may not possess the skills of providing useful and meaningful feedback (Palloff & Pratt, 1999) because students are not domain experts. Studies showed that students did not learn much from providing low quality comments (Li et al., 2010). Students can also have anxiety about giving feedback (Ertmer, et al., 2007) if they are not used to this activity, as they do not want to appear to be criticizing peers' work. In addition, peer feedback may not be perceived as valid by the receivers as peer reviewers are usually not regarded as a "knowledge authority" by feedback receivers (Gielen, et al., 2010), and, thus, learners refuse to take the feedback seriously.

Peer Feedback in PjBL

In the context of project-based learning, peer feedback has the potential to facilitate learning processes in different ways. Reviewing peers' project drafts may help learners reflect on their own work and improve their own project performance. However, there has been limited research examining the pedagogical benefits of peer feedback for facilitating project-based learning in an entirely online environment. Lu and Law (2011) studied online peer assessment activities to support high school students' project-based learning and examined the effects of different types of peer assessment on student learning. These high school students were enrolled in *face-to-face* public high schools while they participated in *online* peer assessment activities in the study. Lu and Law found that the feedback consisting of identified problems and suggestions was a significant predictor of the feedback providers' performances. They also found that positive affective feedback was related to feedback receivers' performances. While Lu and Law's study examined online peer assessment in a face-to-face learning context, our study aimed to examine how peer feedback supports graduate students' project-based learning in an entirely online environment.

Research Purpose and Questions

In this paper, we investigated whether a peer feedback strategy can facilitate project-based learning in an entirely online learning environment. We explored graduate students' participation in peer feedback activity in an online learning environment where students needed to solve complex instructional design problems. We also examined their perceptions of peer feedback in supporting project-based learning, and the quality of the provided peer feedback. Specifically, we asked the following research questions:

1. To what extent did graduate students participate in the peer feedback activity in an online project-based learning environment?
2. How did graduate students perceive the peer feedback activity in an online project-based learning environment?
3. What types of peer feedback did graduate students provide in an online project-based learning environment?

Research Method

Context of the Study

This study was conducted in the context of an online master's level course in a public university in northwestern USA. The subject matter of this course was instructional design. Moodle learning management system was the online learning platform used in this course. Twenty-one students were enrolled in this course and these students were geographically dispersed, with most of them living in different states in the United States. Many of the students were K-12 school teachers, while others were college instructors, technology coordinators, technical writers, and instructional designers in corporate settings.

This graduate course was project-based, and required students to work on a semester-long individual instructional design project accounting for 40% of their course grade. In this project, students were responsible for conceptualizing, planning, designing, and developing an instructional unit on a topic of their choice with the help of peers and the instructor. The project required students to apply knowledge and skills of instructional design when conceptualizing, brainstorming, designing, and exploring alternative solutions for their design problems, which is the core characteristic of project-based learning as defined by Blumenfeld et al. (1991).

The complex instructional design project was structured into five project milestones and each milestone was supported by a task-oriented discussion where peer feedback activity took place. Students submitted their project artifacts for peer feedback at each milestone. These milestones include: 1) proposing a plan for needs assessment; 2) conducting a task analysis to draw a task flowchart and identify a list of learning objectives; 3) creating a plan to assess learning outcomes; 4) creating instructional strategies; and 5) developing a plan for different types of formative evaluation. Each milestone lasted for two weeks. For each milestone, students read the textbook on the specific instructional design process, applied the knowledge to create a draft of each milestone task, and posted the draft to the designated discussion forum for peer feedback. Each project milestone task had its own dedicated discussion forum. In total, students participated in five peer feedback discussions, one for each milestone task, throughout the semester.

At the beginning of the semester, twenty-one students were assigned to three heterogeneous groups of six to eight learners by the instructor, based on their self-reported skills and experiences of instructional design. Within each milestone cycle, three deadlines were set for students: 1) post their artifacts within their group; 2) provide feedback to three peers within their group; and 3) address any questions, suggestions, or comments in the feedback they received. This design aimed to promote participation and foster reflection on whether students understand, accept, and agree on the feedback. At the end of the semester, students were encouraged to fill out an anonymous course evaluation survey on a voluntary basis to express their perceptions of the course activities.

Data Collection and Analysis

The human subjects approval was obtained for analyzing students' participation data, their course work, and the anonymous course evaluation survey data. This study applied a mixed-method design that collects both quantitative and qualitative data to answer our research questions. To answer Research Question 1, we examined students' postings on the five online discussion forums and tallied the frequency of discussion postings to examine student participation in the peer feedback activity. To answer Research Question 2, we collected qualitative data of students' perceptions of the PjBL and peer feedback activity through open-ended questions as part of the anonymous course evaluation survey at the end of the semester. The open-ended questions on the course evaluation survey read

> Please provide feedback on the following assignments. Indicate whether you think it helps you learn the subject

> or not. If it helps, please explain how it helps you learn. If you do not find it helpful, what changes would you suggest to make the assignment meaningful to your learning experience.

The students were specifically asked to comment on "Module Discussions" where they provided and received feedback from peers, and on "Instructional Design Project" where they worked on creating an instructional design document and developing instructional materials throughout the semester. Eighteen out of the 21 students provided qualitative feedback as part of the evaluation. We did not ask the students for permission to use their comments in the survey as quotes in our paper due to the anonymous nature of the survey data. We used thematic analysis to examine the responses to these open-ended questions for emerging themes.

To answer Research Question 3, we downloaded the discussion messages posted on the Moodle discussion forums and analyzed the messages to further explore the quality of the provided feedback. Specifically, we conducted a content analysis on the peer feedback entries posted in two forums, Discussion 1 on "Needs Assessment Plan" and Discussion 2 on "Task Analysis." Due to the large amount of data, we purposefully selected and analyzed these two discussions because of the differing structure of the feedback activity. In Discussion 1, students did not receive specific guidance and directions on the aspects to comment on—they were simply asked to look over peers' needs assessment plans and give constructive feedback regarding the ideas. Hoping to improve peer feedback quality, the instructor provided specific questions to guide student feedback efforts in Discussion 2 and the three following discussions. For example, one guiding question reads, "Does the stated learning goal appear clear, concise, and show an obvious outcome? How can the goal be improved?" The feedback entries were coded based on the coding scheme adapted from Lu and Law (2011) (see the next section for the coding scheme table). After examining the peer feedback in this study against the adapted coding scheme, we added some categories and sub-categories for the purpose of capturing the complexity of the peer feedback data. We expect that using the modified coding scheme will better capture the complexity of the data that help generate meaningful pedagogical implications.

Results and Discussion

Student Participation in the Peer Feedback Activity

The descriptive data that shows the detailed breakdown of the frequency of messages across five discussions by groups are presented in Table 1. The requirement of the peer feedback activity asked students to post one original post to share the design artifacts they created, respond to three original peer postings, and answer all the questions and comments from peers in one or several posts. As such, five messages per discussion can be considered the minimal posting requirement students have to achieve. The data show that students actively participated in the peer feedback activity and they achieved the required five postings throughout the discussions. On average, members in Group 1 posted 6 messages, those in Group 2 posted about 7 messages, and those in Group 3 posted about 5.7 messages throughout the five discussions. In general, the frequency of posted messages decreased in the later discussions across the groups.

Table 1

Means and Standard Deviations of the Numbers of Posted Messages per Person across Five Discussions

	Group 1 Mean (SD)	Group 2 Mean (SD)	Group 3 Mean (SD)	Average Mean
Discussion 1	6.80 (.45)	8.13 (2.53)	6.14 (2.54)	7.02
Discussion 2	6.40 (1.34)	7.88 (3.40)	5.71 (2.21)	6.66
Discussion 3	6.20 (1.64)	7.13 (1.25)	5.71 (1.50)	6.35
Discussion 4	5.80 (3.27)	6.50 (1.85)	6.00 (2.83)	6.10
Discussion 5	5.20 (3.03)	5.38 (2.77)	5.14 (2.12)	5.24

Note : There were 5, 8, and 7 students in Group 1, 2, and 3 respectively. Group 1 had six students to start with but one student stopped participating in the course since Discussion 2, so this student was dropped from the calculation.

Student Perceptions of Peer Feedback Activity

Positive perceptions of PjBL and peer feedback activity.

We analyzed learners' responses to the open-ended questions to help understand students' perceptions of their experiences in project-based learning and the peer-feedback activity. Students generally enjoyed the online project-based learning activity where they were able to work on an interesting and relevant topic of their choice and to apply their newly acquired design knowledge and skills. Some students considered the hands-on activity of creating an actual instructional design project the best component of the course. Other students specifically commented on the effective design of the project- based learning activity in which the project was organized into five milestones where learners were able to undertake a complex instructional design project one step at a time. The project would have been overwhelming and created a high level of anxiety if it were not broken down into several milestones or did not provide the opportunities of receiving peer feedback during the process. Two comments from the students read,

> Overall I enjoyed this process. It was a lot of work, but I liked how it was systematically designed to be put together throughout the semester and it was nice to have

> the same three peers helping you out in the discussion group.

> I liked the module discussions, especially since it forces you to work on portions of the project and get feedback. I think they are GREAT!

Overall, students were mostly positive about the peer feedback activity as revealed in the following comments:

> I liked how the discussions served as a rough draft to the overall ID project. Peer feedback is always good to get. I was pleased with the quality of the feedback.

> I thought it was very helpful and enlightening to give and receive feedback from peers.

> I thought this was helpful especially getting feedback from my peers because it made my project better.

> The most valuable part for me was seeing what other students were doing.

Issues of low quality of peer feedback.

A few students perceived the peer feedback activity more negatively, mostly because they did not get useful feedback and had spent a great deal of time providing quality feedback to their peers. Students commented that

> As far as commenting, two students generally gave me useful feedback, though most others did not.

> I perhaps worked too hard at giving substantial feedback during the first few modules even though I got much less on my project. It was very time consuming for me.

> The only downside was the discussion peer reviews started lagging near the end. Keeping students focused on the importance of giving quality feedback will really help.

These comments pointed out an important issue in the peer feedback activity. Despite that guiding questions were in place for most of the discussion activities to help students construct peer feedback, some students did not or could not provide helpful feedback. Providing constructive feedback requires critical thinking skills for evaluating the artifacts based on standards or criteria, identifying gaps or discrepancy in the artifacts, or offering different perspectives to consider alternative solutions. Students in this class varied widely in terms of their educational or instructional design related experiences. While the majority of the students were able to provide alternative perspectives, not everyone was capable of doing so due to the lack of experiences to draw from. Thus, advanced intervention is needed to enhance student performance on providing quality and constructive feedback. Admittedly, providing quality feedback also takes a considerable amount of time. Poor feedback quality may suggest that learners lacked motivation in helping peers out and that they failed to see the benefits of engaging in the evaluative and reflective activities of providing feedback.

Scheduling challenge due to the rigorous deadline structure.

Across five discussions, strict deadlines for feedback postings were established and reinforced through assessment criteria on the timeliness of postings. This design was intended to ensure sufficient time for students to provide feedback and respond to peer questions. However, some students did not like the multiple deadlines for the discussions. They commented that

> I found it difficult to have so many due dates as a large part of the class is driven by discussion boards. I like having one due date as in prior semester classes.
>
> It would be nice if there were not many steps to assignments that are due on various dates. This was a little confusing as far as what was due on each date.

One of the benefits of online learning is its flexibility (Ally, 2004). Although this was not a self-paced online course, some students still expected to have maximal freedom in terms of controlling the pace of their learning and completing their assignments. They may consider losing the flexibility of online learning when multiple discussion participation deadlines were imposed. However, the instructor's past online teaching experiences showed that students might wait until the last minute to participate if the discussion activities were not structured around the deadlines, which may lead to lower quality of provided feedback and lacking time for responding to or reflecting on the received feedback. As such, there is a fine balance between imposing more structured discussion to maximize learning and diminishing flexibility of online learning.

Types of Provided Peer Feedback

In total, 60 entries of peer feedback in Discussion 1 and 63 entries in Discussion 2 were coded using the coding scheme presented in Table 2. This coding scheme was adapted based on the scheme in Lu and Law (2011). Each peer feedback entry was broken into idea units for coding. A substantial entry of peer feedback usually contains several idea units that can be coded into different categories of comments depending on the coding scheme.

Table 2

Coding Scheme for the Types of Comments

Categories	Definitions	Examples of comments from the current study
Cognitive		
Problem identification	Addressing specific issues	Although I can guess from the context clues, I'm not sure exactly what CV & DP means.
Question	Asking questions to clarify or to prompt deeper thinking	Will you use a checklist of important features you would like to see the students using while you are assessing them?
Suggestion	Providing a method to deal with the problem	I just think to make it more manageable for you, it would be better to get more specific with what basic skill you are going to cover and to make sure it can be done in 3 hours.
Explanation		
Learning	Learning content-related elaboration or justification on the problems identified/suggestions/questions	[For your assessment, have you considered what questions you will ask to determine the current abilities of your students?] It may be good to know before you begin how many of them have worked on a Mac prior to the beginning of the lesson. If the majority of them do not have experience with Mac this may change how you structure your lesson on iMovie completely.
Explanation Personal	Personal-experiences-related elaboration or justification on the problems identified/suggestions/questions	Just a thought because as someone who has used Thinkfinity many times, I sometimes still get overwhelmed, so it might be nice to have a more narrow focus.
Affective		
Support	Praising the work or expressing positive comments on the ideas	I'm impressed with the detail of your plan at this stage.
Personal experience	Sharing relevant personal information or experiences for support or social exchange	As a biology teacher, I get a little too enthusiastic sometimes about teaching science :-)

Table 3 presents the results of the content analysis. As it is not our intention to compare groups, we discussed the findings using aggregated data from three groups as shown in the column "Overall." Based on the descriptive statistics, among six types of coded feedback categories, "Support" was the most common type of comment found in both peer feedback discussion activities. In Discussion 1, on average, one entry of peer feedback contained 1.33 pieces of the "Support" type of comment whereas one piece of comment contained one idea unit; in Discussion 2, one entry of peer feedback contained 2.4 pieces of Support. "Question" was the second most common type of comment in both discussions (M = .85 in Discussion 1; M = .87 in Discussion 2). "Problem Identification" was the least common type of feedback in Discussion 1 (M = .10) but its frequency increased in Discussion 2 (M = .38).

Table 3

Means of the Types of Comments in Each Feedback Entry by Discussions

Categories	Discussion 1				Discussion 2			
	G1 (*15)	G2 (27)	G3 (18)	Overall (60)	G1 (17)	G2 (28)	G3 (18)	Overall (63)
Cognitive								
Problem identification	0.00	0.04	0.28	0.10	0.47	0.25	0.50	0.38
Question	0.53	0.81	1.17	0.85	0.71	0.64	1.39	0.87
Suggestion	1.07	0.19	0.39	0.47	1.59	0.61	0.56	0.86
Explanation								
Learning	0.67	0.44	0.78	0.60	0.71	0.25	0.72	0.51
Personal	0.27	0.07	0.11	0.13	0.24	0.25	0.44	0.30
Total	0.94	0.51	0.89	0.73	0.95	0.5	1.16	0.81
Affective								
Support	2.13	1.00	1.17	1.33	4.12	1.50	2.17	2.40
Personal experience	0.80	0.56	0.78	0.68	0.65	0.29	0.28	0.38

***** Numbers in parentheses indicate the total feedback entries posted in the specific forum by each group

When we examined the postings across two discussions, the descriptive data showed that four types of comments, including "Problem Identification", "Suggestion", "Explanation-Personal", and "Support", increased from Discussion 1 to Discussion 2. However, "Explanation-Learning" and "Personal experience" types of comments decreased. These different patterns may be associated with the structure of the feedback activity; that is, guiding questions were provided in Discussion 2 but not in Discussion 1. For example, in Discussion 1, students provided more personal experiences in their feedback, which may be explained by the fact that students are more likely to relate to their own prior experiences instead of relating to the newly learned materials when they are not guided to do so. When students were asked to "assess" how well peer work addressed specific content knowledge and to "provide suggestions" for improvement in Discussion 2, they generated more comments on "Problem Identification" and "Suggestion." As found in previous research by Lu and Law(2011), the ability to identify problems and give suggestions was a significant predictor of the feedback providers' learning performance. Our findings revealed the potential of guiding questions in eliciting feedback types that may benefit student performance. Despite that descriptive statistics in this exploratory study seem to suggest that guiding questions make a difference, future studies with appropriate and deliberate research design are needed to examine if there is a causal relationship between the use of guiding questions and the generation of specific types of peer comments.

Based on the self-explanation research, explanations can enhance deeper learning when they go beyond given information (Chi et al., 1989). As such, it is likely to benefit learners if they can generate more explanations in their feedback (Gielen, et al, 2010). The learning potential of explanations led us to further code explanation types of comments into two categories, *learning* and *personal*, in hoping to understand what students explained in the peer feedback activity. Overall, learners generated more learning explanations than personal explanations in their feedback. While the purpose of the explanation is usually to support and strengthen one's argument, it is not clear if either learning or personal explanations are perceived as more persuasive as justifications for feedback receivers in terms of improving their work. However, we suspect that learning explanations have greater learning benefits for feedback providers than explanations based on personal experiences or opinions because when generating learning explanations, feedback providers are likely to apply newly learned knowledge and skills to justify or elaborate on their ideas in novel contexts (i.e., peers' projects). Future studies may further explore the roles of these two types of explanations in the peer feedback processes in terms of the perceived convincingness for feedback receivers and the learning benefits for feedback providers.

In general, the content analysis of the peer feedback showed that students were mostly very supportive of their peers' work and rarely criticized peers' work harshly. In the cases when students tried to identify problems or pinpoint areas for improvement, they tended to use disclaimers or gentle tones. This interaction pattern aligns with the findings in the study by Yu and Wu (2011). Yu and Wu examined identity revelation modes in an online peer-assessment learning environment and found that no severe level of negative comments or irrational emotions was presented in the group that used real names. However, negative comments and irrational emotions were found, although rarely, in the anonymity and nickname groups. They suggested that using real names benefited interpersonal relationships between assessors and those being assessed. In this study, the peer feedback activity was administered in online forums where students knew the identities of feedback providers and receivers. Students' mostly positive feedback and use of disclaimers or gentle tones may be the result of avoiding risking the interpersonal relationships among group members. In addition, the current peer feedback activity emphasized the formative feedback where learners collaboratively helped each other improve their plans and instructional design project ideas. It is also possible that learners were aware of the formative nature of the feedback activity so they were mostly supportive as they realized everyone was in the stage of idea forming and developing.

Implications, Challenges, and Limitations

This study examined graduate students' participation in and perceptions of peer feedback activity that supported project-based learning where students engaged in instructional design projects in an online environment. Several implications are discussed here. First, similar to the findings of Koh et al. (2010), students are likely to have positive project-based learning experiences when the complex projects are structured into attainable milestones that help reduce project complexity and scale, as it makes hands-on experiences manageable for learners in an online environment. Second, a series of peer feedback activities offering useful formative comments can enhance learners' project development processes. Having the opportunities to receive peer feedback can help learners validate ideas, identify issues, and revise drafts into a well thought-out project while peers contribute experiences and perspectives to enrich one's own learning process (Ertmer, et al., 2007). Receiving peer feedback has a considerable profit for learners who engage in the process of exchanging peer feedback (van der Pol, van den Berg, Admiraal, & Simons, 2008). Having the opportunity of providing peer feedback allows for the occurrence of higher order learning opportunities. Viewing examples of knowledge application in different contexts also helps broaden one's understanding of the applicability of knowledge. When reviewing their peers' work, learners can apply newly learned knowledge and their evolving understanding of the subject matter (Liu & Carless, 2006) in novel contexts (i.e., peers' projects) by critically evaluating the appropriateness of peers' application of knowledge and elaborate and justify their own thinking.

Three challenges were identified in this study. First, some learners were against the strict deadline structure imposed on the peer feedback activity to ensure feedback was provided and received in a timely manner. Admittedly, adult learners taking online courses mostly value the flexibility of online learning and scheduling. Educators and designers need to seek the fine balance between imposing structure to the peer feedback activity for the purpose of maximizing learning and diminishing flexibility of online learning. Second, the qualitative data revealed the issue of the low quality of peer feedback that could have resulted from learners not spending sufficient time on tasks or not being capable of providing constructive feedback. Guiding questions were incorporated into the design of the later discussions (Discussion 2 to Discussion 5) in order to scaffold learners' generation of more constructive feedback. Although the results of the content analysis on the provided feedback seem to show a positive impact, future research is needed to explore this intervention in depth.

Lastly, while learners perceived positive benefits of peer feedback, this study did not investigate whether learners really took into account the peer feedback to revise and improve their projects. Although many learners responded to the feedback they received due to the course requirement, not everyone responded or provided quality responses to the feedback they received. This may suggest that some feedback was not deemed as useful or it may simply indicate that some learners were not as engaged in the peer feedback activity as others were. Future design and implementation of the peer feedback activity may build in a conclusion activity that requires students to write reflections on how the received feedback helped advance their projects or shape their ideas. In addition, instructional interventions such as having students complete a posteriori reply forms may help raise mindful reception of the feedback (Gielen et al., 2010).

Due to the exploratory nature of the current study, we used rich qualitative and content analysis data to reveal the investigated phenomenon, while no inferential statistics were used to reach conclusions that extend beyond the collected data. As such, the findings should not be generalized beyond the described learning context. Future research is encouraged to further examine the pedagogical effects of peer feedback on students' learning outcomes with research design that can lead to findings appropriate for generalizations.

Conclusion

This paper examined students' participation in and perceptions of the peer feedback activity that supported project-based learning in an online graduate course. Our findings indicate that peer feedback activity can be effectively implemented in an online learning environment to facilitate students' problem solving and project completion. Students actively participated in the peer feedback activity and were mostly positive about it—they perceived the activity as helpful support for their project-based learning. Content analysis of the provided feedback revealed that students were mostly supportive of peers' work, and they provided constructive feedback that can help improve peers' work by asking their peers questions. In addition, providing guiding questions seems to be a useful instructional strategy which elicited peer feedback that identified problems and provided suggestions. This study provides empirical evidence to support the adoption of a peer feedback strategy for facilitating project-based learning in an entirely online learning environment. This study also reveals a variety of comments learners may provide when participating in peer feedback activities. As the literature indicates that learners may lack the skills to provide critical comments, educators and instructional designers may use the findings of this study to identify instructional intervention if they want to further guide learners' in constructing particular types of feedback to strengthen learners' critical thinking skills. Future research is encouraged to examine how peer feedback plays a role in learners' development of projects and in their project outcomes.

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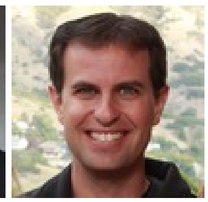
An Investigation of Practices and Tools that Enabled Technology-Mediated Caring in an Online High School





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Abstract

The ethic of care has been an important part of the dialogue related to learning in traditional K-12 learning environments particularly because emotional relationships and caring pedagogies have been shown to be particularly important for adolescent learners. However, as online learning has become increasingly popular, there are concerns about the perceived impersonal nature of the online medium, and how this might particularly affect adolescent learners. The purpose of this study was to examine technology choices when experiencing caring interactions in the online schooling context of Mountain Heights Academy (formerly Open High School of Utah). The caring experience of two teacher participants and four of their students was examined through interpretative phenomenological analysis. Results suggest that teacher choices regarding technology use are an integral part of creating caring relationships with students online. The ethics of caring is an essential model in understanding the communication of caring interactions in the online setting.

Keywords: Presence; immediacy; transactional distance; caring pedagogy; technology-mediated caring

Introduction

Caring has been recognized as an increasingly important concept in the K-12 context (Banks, 2009; Ferreira, Smith, & Bosworth, 2002; Goldstein, 1998, 2002; Lewis, et al., in press; Tosolt, 2010). Researchers and practitioners have acknowledged that teacher caring is imperative because education is predominantly a moral endeavor (Goodlad, 1984, 1990; Goodlad, Soder, & Sirotnik, 1990; Noddings, 1984). In experimental studies, caring has been found to increase student motivation and retention (Frymier & Thompson, 1992; McArthur, 2005), and student affect for the course and for the course instructor (Teven, 2007; Wilson, 2006). Caring has also been found to decrease disruptive behavior (Hasenauer & Herrmann, 1996; Lindmark, Marshall, Riley, & Strey, 1996) and increase learning outcomes (Baker, et al., 1997; Lewis, et al., in press; Shann, 1999; Valenzuela, 1999). Furthermore, in studies that have examined the student perspective, factors related to the teacher-student relationship rank of higher importance to students than teacher proficiency (Baker, et al. 1997; Pomeroy, 1999; Wallace, 1996).

Researchers have identified caring as an integral component of child development, motivation, and learning (Baker, Terry, Bridger, & Winsor, 1997; Wentzel, 1997). Goodenow (1993), for example, found that students experience cognitive changes that lead to an increased need for caring student-teacher relationships. Pomeroy (1999) revealed that in educational settings, adolescents have a need to be cared for in a way that is different from the parent-child caring relationship. In particular, students in this study recognized dialogue as a central factor leading to perceived teacher caring. Notwithstanding, students have reported a perceived decrease in the quality of the teacher-student relationship upon entrance to junior high school (Feldlaufer, Midgley, & Eccles, 1988; Hirsch & Rapkin, 1987).

Picciano and Seaman (2007) argued caring is particularly significant in the online context as the demand for online K-12 education has dramatically increased over the last several years. Conceptually, a need to examine caring in the information and communication technologies literature has been acknowledged (Damarin, 1994; Delacruz, 2009; Gleaves & Walker, 2006). There have been a few empirical studies related to caring in the online context (Bulmer & Rodd, 2005; Goldstein & Freedman, 2003), but much of the early distance education research focused on understanding learner-content interaction and issues of autonomy rather than the nature of the learner-instructor relationship. Additionally, more recent literature has characterized learner-instructor interactions as “teacher presence” in the community of inquiry framework (Anderson, Rourke, Archer, & Garrison, 2001) or as “social presence” in other research (Richardson & Swan, 2003), and “instructor immediacy” (Arbaugh, 2001) rather than building on the literature of caring.

Literature Review

Much of distance learning research has focused on the structure and number of interactions between instructors and students, as well as the ability to use verbal and non-verbal behaviors to reduce the psychological distance between persons in an online setting. While these views are important, we feel that a care-centered approach (Gilligan, 1982; Noddings, 1984) adds a more relational perspective to online interactions that can be useful in understanding how students feel cared for online. In this section, we first begin by reviewing traditional approaches to online learning research, including ideas related to online interactions, particularly the psychological, or transactional, distance between students and instructors. We then review research related to instructor presence and immediacy, before exploring how a care-centered approach to understanding online relationships might help build upon these foundations.

Transactional Distance Theory

Transactional distance refers to “a psychological and communication space to be crossed, a space of potential misunderstanding between the inputs of instructor and those of the learner” (Moore, 1993, p. 22). The focus of much distance education research built upon Moore’s work as scholars considered the “transactions” occurring in learning environments. His theory of transactional distance states that transactional distance decreases when dialogue (communications between student and teacher) increases and course structure (learning objectives, activities, and evaluations) decreases (Moore, 1993). Moore’s theory also states that learner autonomy, or the degree to which the learner is self-directed in learning, increases with greater transactional distance (Moore & Kearsley, 1996). Therefore, teachers have the responsibility of determining the appropriate structure and degree of dialogue in a course based on learners’ needs and autonomy (Moore, 1993; Moore & Kearsley, 1996).

Presence and Immediacy

Building upon Moore’s theories of transactional distance, scholars have studied how social presence and immediacy could describe teacher/student interactions, both online and first in face-to-face contexts (Anderson, et al., 2001; Mehrabian, 1971), particularly with the community of inquiry framework (Garrison, Anderson, & Archer, 2000).

Presence.

The community of inquiry (CoI) framework distinguishes between three interdependent elements—social, cognitive, and teaching presence (Garrison, Anderson, & Archer, 2000). Social presence is related to interpersonal interactions and communication and acknowledges the teacher and student role in creating a social environment. Cognitive presence refers to the dialogue that makes the construction of meaning possible, while teacher presence refers to how an instructor facilitates learning outcomes. Moreover, teacher presence has been divided into three categories: design and organization, facilitating discourse, and direct instruction (Anderson, et al., 2001). Research indicates a correlation between teacher presence and student satisfaction and performance (Bangert, 2008; Picciano, 2002; Shea, Pickett, & Pelz, 2003). These elements of presence have been identified as indicators of the quality of online instruction (Shea, Vickers, & Hayes, 2010).

Immediacy.

The element of social presence in the CoI framework includes teacher immediacy—verbal and non-verbal behaviors that reduce psychological and physical distance between individuals (Mehrabian, 1971; Andersen, 1979). The online context has largely focused on examining verbally immediate behaviors such as using self-disclosure, using humor, initiating discussion, offering praise, communicating attentiveness, and addressing students in a personal manner (O'Sullivan, Hunt, & Lippert, 2004). Research indicates that teacher immediacy is more easily afforded through synchronous online interactions (Pelowski, Frissell, Cabral, & Yu, 2005; Schwier & Balbar, 2002) and that increased teacher immediacy is related to increased student outcomes and affect (Arbaugh, 2001; Baker, 2004; McAlister, 2001).

A Care-Centered Approach

While much of distance education research has focused models such as these that emphasize transactions or interactions, research in the area of "caring" has focused on the relational aspect of the teacher-student interaction. Perhaps the foremost theory on caring pedagogies is Noddings' ethic of care theory, which has the potential to help online (and face-to-face) teachers better understand and foster teacher-student relationships.

Noddings' ethic of care theory.

In the field of philosophy, Noddings (1984) introduced a care-centered approach to ethics that revolutionized the discourse on moral theories and development. Noddings (1984) established that caring requires that the one-caring (the teacher) become *engrossed*, or receptive to the cared-for with the purpose of understanding him. The one-caring then experiences *motivational displacement*, or an energy that leads to the execution of actions that improve the cared-for and ensure their progress. The cared-for also contributes to caring through *reciprocity*—acknowledging the caring acts by reacting to them (Noddings, 1984).

Contributions to online teaching.

Although research studies on online social presence and immediacy are useful in understanding the process of learning, the caring model has the potential to enrich research on teacher-student interactions because its focus is not on prescriptive behaviors, but understanding and strengthening the teacher-student relationship. In the caring model, caring warrants more than presence, requiring teacher actions that are a product of teachers' receptivity to students' needs. Actions and behaviors are not the primary concern, and caring cannot be operationalized into a prescriptive list of actions or behaviors (Noddings, 1984). Rather, *engrossment* in the student characterized by receptivity—coming to a knowledge of the student—is of primary importance. The *engrossment stage* provides the necessary rationale and direction for the action that follows. In the ethic of care theory, actions are a byproduct of receptive dialogue and observation that lead a teacher to deeply understand a student. Thus, caring accounts for a complete interaction between student and teacher, including considerations of students' reactions to teacher actions (*reciprocity*).

The purpose of the current study is to explore caring relationships that may emerge in online settings and what technological choices facilitated a caring approach to teaching and learning. The research reported used interpretative phenomenological analysis (IPA) to answer these questions: What modes of communication do students and teachers use to communicate caring in the technology-mediated context of an open and online high school, what reasons do they have for using those modes, and how effective do they perceive these technologies to be at fostering caring? IPA is suitable for this study because it considers care through the examination of participants' experience rather than abstractions or theories (Reid, Flowers, & Larkin, 2005).

Methodology

Context

This study was conducted in the Mountain Heights Academy (MHA) (formerly the Open High School of Utah) because it is an online high school in which teachers strive to maximize the time they employ working one-on-one with each student. Teachers disseminate content online and alternately use the time saved to attend to students' individual needs. MHA's data-driven learning management system enables one-on-one connections to develop based on up-to-date student performance. Another unique quality of this online setting is its aim to encourage collaboration between teachers, students, and parents. This emphasis on using data to guide choices about online interactions, and the focus on collaboration between teachers, students, and parents, is a unique aspect of the MHA setting, and emerged in the interviews as something the participants felt improved the caring relationship. The design and implementation of these qualities, among others, have helped MHA win several awards including a Gold Medal in the United States Distance Learning Association's Best Practices competition (2012) and the 2012 Best of State award for best charter school in Utah.

Data Collection

Participants consisted of two female teachers at MHA, two female students, and two male students. Both teachers were selected by the MHA administration as demonstrating a high level of caring. We chose this kind of purposive sampling in order to do a case study of how technologies could support caring pedagogies with teachers inclined towards this approach already. Each participating teacher created a list of five female and male MHA students from their class at large. They created these lists of students with whom they believed they shared their most quality caring relationships. All of the student participants were Caucasian, with ages ranging from 12 to 18.

We employed a three-stage semi-structured thematic interview series (Schuman, 1982) to allow participants to share in-depth accounts of their experience. The first interview inquired about the participant's background and prior experience in the online setting while also aiming to understand how teachers were involved in students' learning experiences in general. The second interview focused on understanding the caring experience and technology choices made to support caring interactions. The third interview followed up on any topics needing additional depth. Questions were open-ended and designed to encourage participants to share experiences openly.

Analysis

Interview transcripts were analyzed using the principles of interpretive phenomenological analysis (IPA, Smith, et al., 2009). Each transcript was thoroughly read and reviewed multiple times. The lead author first read the transcripts making no annotations and then a second time including annotations in the margins. After making initial annotations, the lead author coded each transcript, independent of other interviews, identifying new themes as they emerged. In coding, she was influenced by Nodding's caring pedagogy theory, although she maintained openness to other ideas that seemed relevant to the broad topic of technology-mediated caring in this setting. After reading over the list of emergent themes for all interviews, a table was created with clusters of themes organized into broader categories for each interview. After carefully examining the themes from each interview, connections across interviews were determined, and another table was created with a list of superordinate and subordinate themes across interviews with direct quotes. Each interview was then reviewed one last time to confirm that the experiences shared remained fairly accurate in the selection of quotes and interpretations of the data.

Field notes and a reflexive journal documented subjectivity checks and other research activities. Member checks were conducted before and after data analysis to preserve the accuracy of participant responses. Peer debriefings were useful in developing the interview protocol as well as in revising data collection and analysis methods. Triangulation between sources was sought to strengthen evidence of the themes. A negative case analysis indicated that the themes that emerged were an accurate reflection of the data collected (Lincoln & Guba, 1985).

Findings

This study describes how teachers and students at an online charter high school experienced and facilitated caring, primarily looking at how they fostered relationships and their technological preferences for doing so. We refer to the caring that occurs in the online context as *technology-mediated caring (TMC)*.

Knowing the Student

In this study, teachers began caring interactions by first trying to understand students and their needs. Teacher participants explained that the process of "knowing" goes beyond just "being there." Teachers came to know students online through engaging in continuous dialogue, facilitating shared experiences, and maintaining vigilant observation to gain an understanding of the student's perspective.

Continuous dialogue.

At MHA, teachers engaged in dialogue to better know students and their needs. Technology facilitated dialogue by promoting teacher-student accessibility, enabling teachers to initiate dialogue, and facilitating promptness and clarity in communications. In addition, this theme revealed patterns related to teacher and student preferences. Teachers explained the importance of knowing and using the tools that students preferred in order to support the development of a caring relationship.

Teacher-student accessibility.

Both MHA teachers preferred technologies that increased teacher and student accessibility. Teacher 2 explained the daily process of letting her students know she was available and receptive. When she began work at her computer, she turned on all of her technology tools and set her status to "online" or "available," which she then communicated to the students in a class-wide email. Then, she began contacting students individually through Skype, Google Chat, email, or phone. During these interactions she remained attentive to Twitter and other tools that gave her information about students' status and needs.

Teacher 1 acknowledged the essential role of technology in providing students access to the teacher:

> I couldn't even imagine going back to teaching in a bricks and mortar classroom without having all this technology to reach out to my students. The fact that they can get a hold of me 24/7 is amazing. (Teacher 1)

In regards to student access, teachers mentioned that technologies that indicate student online access status (i.e., online, away, busy)—while not always accurate—were useful in facilitating dialogue. In general, participants indicated a preference for technologies such as Skype and Google Chat that provided them this access while displaying users' online status.

Promptness.

Participants also mentioned that caring involved prompt feedback and replies, something technology assisted with. Teacher 2 explained, "I do have kids that will text me quite a bit. . . . and . . . it takes me two seconds to text them back." One student said, "I can pull out my phone and . . . send them an email right there, and then normally I can expect within minutes to get another email back" (Student 2). Teachers and students also favored synchronous technologies such as chat and video that facilitated just-in-time help.

Initiating dialogue.

Teachers at MHA gained access to students by proactively initiating dialogue through automated messages. Although usually regarded as uncaring and impersonal, teachers used automated messages as opportunities to enter into dialogue with students, as well as an opportunity to balance their workload while ensuring a connection with each student individually. One teacher said:

> That's been a lifesaver . . . that program has really made it easy to make sure those kids are contacted . . . . A lot of times they'll respond to me and they'll say, "hey, thanks for the email; I needed that encouragement." And then that starts up another conversation with them. I'll be, "okay, great. How are you doing? Can I help you with anything? It's another way of opening up that communication door." (Teacher 2)

MHA teachers personalized the messages by ensuring the student's name was on each email and accurately targeted the student's academic needs. Teacher 1 explained that automated messages aided teachers in caring for populations of students who may easily become forgotten online—including high achieving students.

Shared experience.

At MHA, teachers demonstrated receptivity to students by achieving a shared student-teacher perspective. Teachers made technology choices that allowed the teacher and student to work together, share a workspace, and reach a joint understanding of the problem. One teacher explained that the online context allowed her to provide prompt feedback that felt like teacher-student collaboration. She explained:

> I bring it up and we work on it together within a Google doc, and so it's like instantaneous. And so I think the kids, because of instantaneous feedback, know that you care . . . it can be more of a joint collaboration. (Teacher 2)

The teachers valued the instantaneous delivery of technology messages because it allowed them to sustain shared synchronous teacher-student interactions that facilitated an in-depth understanding of student needs. Teacher 1 explained:

> Sometimes we'll have Google Docs open and we'll be working on the same assignment, but we'll also be calling each other back and forth on Skype so we can talk and we can hear each other's voices.

As in these examples with Google Docs, for direct instruction, participants favored technologies that afforded a shared workspace. Teachers used screensharing tools to share a workspace with students and mutually work on solutions to academic tasks. Oneeko features that facilitated a shared experience included annotation and file transfer capabilities, a whiteboard, webcam integration, and multiple user access. Teachers also used Google tools because they offered the affordance of a shared workspace in addition to built-in features such as chat and video capabilities for communication. These tools provided a synchronous-like experience between teacher and student. The choice of technology varied according to student preferences and the nature of the task. Problems that were more urgent, such as those clarifying content during direct instruction, were better addressed through synchronous, while less urgent problems related to grading and assignment criteria were addressed through asynchronous technologies.

Students valued how technology helped achieve a shared experience with teachers. One student said:

> I think it's pretty cool I can work on an assignment and send it to my teachers by email or I can put it in Moodle and download it as a pdf . . . and it will send me emails [if] they viewed it.. . . . It's also helpful when I can work on an assignment together with my teacher on Google docs. (Student 1)

For this student, technological affordances that indicated that the teacher had viewed or edited his project helped him feel cared-for. Such indicators fostered a sense of accountability in teachers and helped students perceive feedback as collaborative work.

Vigilant observation.

Teachers also learned about their students through observing students' online activity through various tools. Teacher 1 explained how important it is to observe each student's online activity to understand where to connect with students (Skype or Google Chat, for example). Teacher 2 explained that observing student status updates enabled her to detect when a student was struggling. She said:

> I think through online learning . . . it's easy to identify problems very easily. . . . Just the other day in a Skype handle [status field], the kid wrote something to the effect that . . . today he was feeling blue . . . . I just Skyped him really fast and said, "hey, I just saw your [status]. Are you doing okay?" . . . And so he knew that somebody cared. (Teacher 2)

Both teachers agreed that technologies allowing students to communicate openly on a personal level provided a rich source of data to help them come to know students and their non-academic needs.

Other helpful technologies were found within the school's infrastructure. MHA is unique in the integration of Highrise, a customer relationship management tool that allows teachers to post updated notes on each student interaction. These notes are accessible to all teachers. Teacher 1 explained that she checked Highrise before interacting with students to read updated notes by other teachers about the student's needs. This allowed her to interact with the student based on updated information. Teachers explained that Highrise facilitated caring interactions by creating transparency between teachers regarding the interactions they have with students.

Teachers were also observant with regards to grades and performance patterns. The school's learning management systems, Moodle and Genius, were instrumental in providing teachers with updated grade reports. Teacher 2 explained:

> Online you can . . . know exactly which kids are failing . . . . It's like you can target them and . . . it's like they've got an extra eye on them all the time. Whereas in a bricks and mortar school, they tend to slide through. . . . whereas here, they're easily identifiable. You can see them. (Teacher 2)

Teachers also used learning management systems to tag problems and schedule reminders to follow-up with students. This affordance was highly valuable because it helped maintain continual dialogue with students.

Technology Preferences

Teachers and students expressed distinct preferences in communication technologies for participating in caring interactions. Teachers utilized their knowledge of student technology preferences to support the teacher-student relationship and attend to students' needs.

Teacher technology preferences.

Both teachers expressed that they came to know students best through video technologies. Teacher 1 said:

> I do like the face-to-face on Skype . . . . The more they actually see me, the better, I think they relate to me. The video is really helpful in showing students that you care and that you know them.

The teachers believed video conferencing tools allowed them to be more observant and receptive of student verbal and non-verbal cues. Teacher 1 explained:

> If you're talking to them and they say, "No. I don't have any questions" but their body language is telling you something totally different, then I can follow up and sort of get it out of them what they really need help with, and I find that it's a lot more effective to do those kinds of conversations over video conferencing.

Although teachers agreed in their preference of video technologies, they acknowledged that the majority of students preferred using chat and texting technologies.

> I definitely have kids this year that they only want to chat, and I kind of wonder if I had started by calling them rather than sending them a message that that would have been the method of communication they would have gotten used to. (Teacher 1)

Teacher 1 also indicated that she preferred phone calls to emails and chat because it was more personable and synchronous. Teacher 2 listed Twitter as another tool of choice due to the visibility the Twitter feed affords to everyone in the school, reliability of the medium, and instantaneous speed. She recognized email as her least favorite medium due to its asynchronous nature. She also explained that students have a hard time initially connecting on the phone but agreed with Teacher 1 that they tend to warm up with time.

Student technology preferences.

All student participants indicated that the promptness and reliability supported by chat technologies was essential in helping them feel cared for. Students said they would rather use chat over video technologies due to speed and reliability issues. One student said about text chat technologies, “Even if you're working on an assignment, you can just quickly type in a question to one of your teachers and they'll instantly get back to you” (Student 4). In addition students preferred chatting because, as one student explained, “I can just type out something to them really fast . . . so I can still kind of work on my stuff while I'm waiting for them to type me back.” Another student stated, “[Google chat] helps if they're also working with another student, I can just send a little chat so they can still communicate with the student and look at it when they're done.” (Student 1)

Some students preferred chat because they did not feel comfortable connecting with teachers through non-text based tools such as phone or video conferencing. One teacher explained, “He's still really shy to talk to me. He doesn't even like talking on the phone, so . . . I know he's definitely more comfortable with (Skype chat)” (Teacher 1). One student said:

> I don't always like video chat, and I don't want people to see my face all the time. Depends on the day [laughter] . . . like if I'm just right out of bed then I don't like using the video. (Student 4)

Teachers agreed that most students found it difficult to use video technologies “until they get to know us and until we kind of create that bond,” as Teacher 2 explained.

Teacher 1 added this was similar to how some students would probably feel about in-person communication:

> He's just one of those kids that he will say what's on his mind on his computer that he would never really say to your face, I think. So, the fact that I could get him to open up to me and ask me questions about his essay assignment and what he needed to do and all of that and have an actual conversation with him over chatting—I don't think it would ever happen in a classroom face to face. (Teacher 1)

Overall, participants suggested that to achieve a caring interaction, the mediums mattered less than the content and quality of the interaction. For example, students recognized teachers’ attributes, clarity of communication, accessibility, and affective attitudes as caring more often than the use of specific mediums of communication. Students highly valued text-based technologies with higher speeds of connectivity and accessibility, while teachers valued technologies that allowed them to connect with students at higher degrees of fidelity.

Teacher technology choices that supported caring.

According to teachers, using tools that students preferred ensured better dialogue. Teacher 2 explained, “On (Skype) even if I get a smart aleck answer sometimes at least he's reciprocating to me.” For this teacher, getting the student to interact was more important than the specific technology used to mediate the interaction. Both teachers explained that they were willing to use any technology, even when it wasn’t their preference, to support the development of a student relationship. When asked about the role of technology in caring for students, both teachers explained that one of their top priorities at MHA was to investigate what tools each individual student preferred. Teacher 1 explained, “I think that giving them the choice to use the technology that they feel comfortable with shows them that I care.” Teacher 2 explained that she kept a spreadsheet documenting each student’s individual communication technology preference.

Both teachers explained that, first, they established a relationship of trust in which the student felt confident and willing to open up to the teacher through technology. Then, they helped students progress to using more complex technologies with greater affordances. Teacher 1 shared an experience with a student who resisted connecting online. She explained that she began calling the student on the phone to create a relationship with the student by asking about her general interests. Once the student felt comfortable on the phone, the teacher suggested they begin using Skype. The teacher explained:

> On one of the phone calls, I specifically said “well, next time why don't we just chat on Skype and see how it goes?” Because with all the screen sharing things we can do online, it's a lot easier to tutor a student on Skype or on Google Chat than it is over the telephone. So, I sort of pushed her in that direction.

This student explained that the teacher’s actions helped her feel more confident in herself, the technology, and her ability to connect with the teacher and other students. While the teachers understood that it was their responsibility to help students gain confidence in the use of technology through first establishing a caring relationship, they indicated that in coercing a student to use a technology the student was not comfortable with, they ran the risk of harming the relationship. Thus teachers believed their priority was in maintaining the caring relationship.

The role of technology in online learning was essential in continuously providing teachers with prompt and accurate information about students’ perspectives and circumstances. By getting to know students through shared experience, observation, and dialogue, teacher participants were prepared to execute caring actions to adequately meet student needs. Technology tools and features played a role in promoting continuous dialogue, facilitating a shared teacher-student experience, and enabling vigilant teacher observation. Based on this study, Table 1 provides some consideration in selecting tools to enable teachers to gain deep knowledge of their students.

Table 1

Technology Choices for Understanding and Knowing the Student

Elements of caring		Considerations regarding tools
Knowing the student	▪ Get to know students/ students get to know teacher through continuous dialogue ▪ Achieve shared teacher-student experience ▪ Observe student online activity ▪ Observe student performance and interaction patterns	***How well does this tool facilitate . . .*** ▪ dialogue? ▪ teachers coming to know students' personal/academic interests? ▪ students communicating their feelings and ideas openly? ▪ a shared experience? ▪ a shared workspace? ▪ teachers seeing the project from the students' perspective? ▪ teachers observing student interactions and performance patterns? ▪ teachers knowing students on a personal non-academic level? ▪ teachers demonstrating to students that they see them as individuals with personal needs? ▪ teachers helping students feel comfortable?

Discussion

This paper describes three themes related to understanding and coming to know a student—continuous dialogue, shared experience, vigilant observation. Perhaps the most salient theme, continuous dialogue, provided a way for teachers to come to a deep knowledge of each student. This theme is congruent with empirical research that has established dialogue as a critical element of the online learning process (Rovai, 2007; Stein, et al., 2005; Vrasidas & McIsaac, 1999). Teacher and student participants preferred technologies that increased teacher-student accessibility by displaying users' online statuses. Synchronous and mobile technologies that were more instantaneous, such as chat, video conferencing, texting, and mobile phone emails, were mostly favored over asynchronous technologies. Teachers used an automated message system to create opportunities to initiate dialogue with each student individually.

This theme is closely related to literature that has established affective responses (i.e., expression of emotions, use of humor, self-disclosure) among online users as an element constituting social presence (Ledbetter, Mazer, DeGroot, Meyer, Mao, & Swafford, 2011). In particular, self-disclosure has been recognized as an important element increasing social presence and supporting the construction of knowledge (Shamp, 1991) and improving student motivation and class climate (Mazer, Murphy, & Simonds, 2009). The present study suggests that continuous dialogue is critical in achieving self-disclosure. The continuous quality inherent in caring dialogue makes synchronous technologies most suitable for technology-mediated caring (TMC). However, continuous caring dialogue may also be achieved with asynchronous technologies when teachers make an effort to provide prompt and responsive replies. In regards to dialogue, students favored affordances that enabled promptness and mobility over affordances that communicated non-verbal cues (i.e., video).

Students felt understood and cared-for when they perceived that teachers jointly experienced the learning process with them by working together with the student towards a specific project. This concept is similar to Noddings' (1984) concept of "duality" in which the teacher and student "see" and "feel" together (p. 30). Although students usually preferred synchronous technologies that enabled workspace sharing and instantaneous feedback, asynchronous technologies such as email were also effective in communicating care when they indicated to students that the teacher had paid significant attention to their specific project or need. This theme suggests that along with knowing the student, knowing the students' projects and experiencing it from the students' perspectives is critical in communicating care online. This finding agrees with literature related to teacher presence that rejects the idea of the teacher as "the guide on the side" indicating that teaching is most effective with "the active participation of a subject matter expert in the critical discourse" (Anderson, et al., 2001, p. 9). We propose that this may be done most effectively through technologies (i.e., Google Docs, Oneeko) that enable a shared teacher-student experience.

Another way teachers came to know students was through observation. Observing students' online activity gave teachers relevant knowledge about where to communicate with each individual student as well as knowledge related to their personal lives. Technologies such as Skype or Twitter that enabled students to openly communicate emotional or personal aspects of their lives were helpful. Technologies found within the schools' learning management system and customer relationship management tool allowed teachers to observe patterns of interactions students had with other teachers. We found that observations of student online activity and interactions provide a wealth of knowledge that is useful in attending to students' personal and academic needs.

This study provides evidence that caring begins with achieving a deep understanding and knowledge of the one cared for. These findings are congruent with Noddings' theory of care, which states that caring begins with *engrossment*, or receptivity to the cared-for. To achieve receptivity, a teacher must feel what the student feels, and see what the student sees. Thus, *engrossment* requires presence, but also an attempt by the teacher to come to know the student (Noddings, 1984). To "know" the student means to have knowledge of the students' realities in terms of their academic and personal lives, and to understand the project or task from their point of view (Noddings, 1984). This study suggests that in technology-mediated contexts, this also involves knowing the students' positions in regards to their knowledge and preference of technological tools.

Students indicated a preference for chat technologies because they (1) enabled students to communicate with multiple people and work on academic tasks simultaneously, (2) were more reliable than video technologies, and (3) provided a safe distance for students with less self-confidence or desire to connect. However, teacher caring also involved helping students transition to technologies with greater affordances, while taking care not to damage the relationship. This transition enabled teachers to more effectively connect with students during direct instruction.

While some researchers have agreed that asynchronous technologies are less capable than synchronous technologies for facilitating immediacy (Rice, 1992; Short, Williams, & Christie, 1976), others believe it is not the medium's affordances but the perceptions of the interactions that take place within the mediums that determine the perceived immediacy (Gunawardena & Zittle, 1997; Richardson & Swan, 2001; Walther, 1996). This study suggests that although synchronous affordances were considered helpful in facilitating caring interactions, it is the attentive intentions behind teacher actions that help students perceive caring.

Limitations and Future Research

This study primarily examined teachers' experiences with caring online. Further research examining male teacher perspectives in the online setting may be useful in identifying gender differences related to technology-mediated caring (TMC). A small sample size and the lack of observation data may also be limitations of this study. Finally, we purposively sampled teachers that were best cases, or in other words, those who were perceived to have caring dispositions. These methodological choices were made to allow us to see how caring can occur and how it emerges in student and teacher relationships under favorable circumstances.

Future research could build off of this study to examine whether these findings are applicable across larger and more diverse populations. In addition, researchers could study the degree to which establishing a caring relationship in the face-to-face context, prior to entering the online medium, may affect students' willingness to connect with teachers online using technologies with increased affordances (i.e., video technologies). In general, the introduction of the ethic of care theory to the technology-mediated context generates the need for research that acknowledges the role of teacher observations, teacher intentions and rationales for actions that increase presence and immediacy, and student reactions to TMC. Beyond considering specific teacher actions and behaviors, these concepts account for the broader context of relationship. Ultimately, it may be student perceptions of teacher caring that serve to decrease the psychological distance between teacher and student.

Conclusion

In this study we examined teachers from an online charter high school, known for their caring dispositions towards students, to see how the technologies they used to mediate their interactions facilitate a caring approach to teaching. The findings suggest that arriving at a knowledge of the student through technology is possible and necessary for communicating caring to students. While a variety of technologies may be used to achieve technology-mediated caring, the content of the interactions and the attentiveness communicated to students may be of greater importance. These findings lead us to consider the importance of using a caring approach to pedagogy (Noddings, 1984) and the quality of the relationships in online learning beyond simply counting the number of interactions that occur or the level of social presence that is perceived.

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