Assessing the relationship of student-instructor and student-student interaction to student learning and satisfaction in Web-based Online Learning Environment

Ali Sher
George Mason University, RAK Campus, UAE

Abstract

This study shows the importance of interaction to student learning within Web-based online learning programs. The population of this study was students enrolled in multiple academic disciplines at a private university in the Washington, DC Metropolitan area. A Web-based research instrument was designed to assess students' characteristics, their perceptions of learning, satisfaction, student-to-student interactions and student-to-instructor interactions. Regression analyses were employed to analyze the relationship of interaction variables with student learning and satisfaction. Student-instructor interaction and student-student interaction were found to be significant contributors of student learning and satisfaction.

Introduction

The use of Web technology in learning settings has begun to change the face of education. The World Wide Web has become a useful instructional medium and has provided students with new learning experiences that were not previously possible. In a Web-based environment, at any time and any place, 24 hours a day, 7 days a week, students with the help of an Internet connection, can receive instruction, compose and submit assignments, and ask questions for their instructors and fellow students. They can actively participate in class discussion from home, office, or any nearest computer lab.

Not only does the asynchronous nature of a Web-based course eliminate the constraints of time and location, but it also incorporates interactive communication that is unique to face-to-face classroom-based instruction. These characteristics are bringing university and college courses within reach of more and more adult students who would otherwise be unable to attend classes or obtain a university or college degree. Additionally, the explosion of an adult student population, family and work responsibilities, travel costs, and transportation problems have resulted in demands for flexible and convenient learning opportunities.

Problem Statement

Like any other medium, Web-based instruction is not free from criticisms. Some are concerned with: the intensive commitment of time to both develop and take Web-based courses, the lack of face-to-face interaction among students and their instructors, the quality of education relative to classroom-based courses (Arbaugh, 2000a), the feelings of isolation among learners

(Weller, 2007), and lower rate of online learners' completion rate (Keith, 2006). Others contend that this lack of face-to-face physical interaction is one of the major limitations within distance education (Kirby, 1999; Kruger 2000) as students and instructors are physically separated from each other and course communication is mediated through Internet communication tools. This physical separation creates barriers to communication (Sorensen & Baylen, 1999) as many non-verbal cues such as eye contact and facial expressions are missing (Sutton, 2001).

In contrast, proponents contend that Web-based education is superior to learning in crowded college and university halls. Hill (1997) suggests that Web-based instruction is a revolutionary resource tool and a viable option for all types of learners. Jung (2001) contends that Web-based learning is a practical and viable solution to meet the learners' educational needs. The proponents further suggest that Web-based learning presents a more customized format in which instructors must interact with each student (Wagner, 2001).

Several researchers have called for moving beyond the comparative studies in order to better understand the distance learning environment and its impact on students' learning and satisfaction (Arbaugh, 2000b; Clark, 1994; Phipps & Merisotis; 1999, Russell, 1999; Surry & Ensminger, 2001). In an article, Surry and Ensminger (2001) criticized media comparison studies arguing that there are many unexamined variables in most of these studies that make their results impossible to interpret. They recommended studying the important elements of instructional methods in the technology mediated learning environment. One such key element is interaction within Web-based distance education courses.

One of the major criticisms of distance learning is the loss of face-to-face interaction between students and instructor and among students (Berge, 1999; Saunders & Weible, 1999) as students and instructors are physically separated from each other and communication tools are utilized to facilitate interactions among them. This criticism raises several questions: What is the nature and role of interaction in Web-based learning environment? What does interaction involve in Web-based learning? Does frequent interaction improve or hinder student learning in Web-based environment? Hence, it becomes very important to empirically investigate the relationships between students' perceived learning and interaction dynamics within Web-based distance learning environment.

This paper is further sub-divided into four sections. The first section of the paper describes theoretical constructs from the technology-based distance education and hypothesizes how they may influence effective Internet-based instruction. The second section describes the methods of the study using a sample of Web-based courses at an East Coast U.S. university. The third section describes results of the survey. The fourth section discusses the findings and its implications, and major conclusions.

Literature Review and Hypotheses Development

Several researchers considered interaction an essential element to student learning and to the overall success and effectiveness of distance education (Bruning, 2005; Burnett et al., 2007; Fresen, 2007; Kearsley, 2000; Kim, Liu & Bonk, 2005; Moore, 1993; Northrup, 2001; Sutton, 2001; Thorpe & Godwin, 2006; Walker, 2005; Yildiz & Chang, 2003). Shale and Garrison (1990) stated that "in its most fundamental form, education is an interaction among instructor, student and subject content" (p.1). Hillman, Willis, and Gunawardena (1994) considered interaction among students and interaction between instructor and students as "educational transaction" (p.1). Moore (1993) suggested that there is a transactional distance in distance

learning environment as instructors and learners do not interact in the same physical and temporal space. In order to overcome potential shortfalls due to transactional distance, Moore identified three types of interaction essential for learning in distance education:

i. <u>Learner-content interaction</u>: It is the method by which students obtain information from the course materials. The content can either be in the form of text, audio or videotape, CD-ROM, computer program, or online communication.

ii. <u>Learner-instructor interaction</u>: This refers to the interaction between the learner and the instructor. This can take the form of instructor delivering information, encouraging the learner, or providing feedback. In addition, this can include the learner interacting with the instructor by asking questions, or communicating with the instructor regarding course activities.

iii. <u>Learner-learner interaction</u>: It is the exchange of information and ideas that occurs among students about the course in the presence or absence of the instructor. This type of interaction can take the form of group projects, or group discussion, etc. The learner-learner interaction can foster learning through student collaboration and knowledge sharing.

Kear, Williams, Seaton, and Einon (2004) suggested that there are three uses of information and communication technology (ICT) in a distance learning course. The first use of ICT is to support a resource-based learning approach where the students are given a wide choice of learning materials. The second use of ICT is to allow students to participate in virtual communication. The third use of ICT is to promote an active approach to learning.

In computer-mediated and Web-based distance learning courses, few studies have examined the relationship between interaction and student learning and satisfaction. Much of the current examination of interaction in computer-mediated courses takes the form of counting participants' email or the number of characters sent; however, this provides a superficial view of what really happens in an online course (Hillman, 1999). The number of messages sent or the characters in email do not indicate any evidence concerning student learning. The study of Hara and Kling (2001) suggests the importance of feedback. Hara and Kling qualitatively investigated students' experiences in a Web-based course. Although students were taught by a qualified and experienced instructor, they felt frustrated due to technical problems, lack of adequate feedback, ambiguous instructions on the course Web site and in instructor's e-mail messages.

Moreover, online interaction has been investigated from different angles, for example, Järvelä and Häkkinen (2002) examined the quality of interaction in Web-based asynchronous conferencing among pre-service teachers. They found three types of Web-based discussions: higher-level discussions (24%), progressive discussions (40%), and lower level discussions (36%). The authors conducted a more specific analysis for each discussion level based on social cognitive theory of perspective taking. They found that high-level perspective taking was in relation to higher-level discussion.

Sabry and Baldwin (2003) explored the relationship between sequential/global style dimension and three types of Web-based interaction: learner-tutor (L-T), learner-learner (L-L), and learner-information (L-I). The results indicated that that higher percentage of sequential-moderate (SEQ-MOD) learners used L-I and L-T interactions frequently as compared to global-moderate (GLO-MOD) learners, while the reverse applied to L-L interaction. Sequential-strong (SEQ-STNG) learners scored higher percentage of frequent use of L-L interaction as compared to global-strong (GLO-STNG) learners, however, the reverse applied to L-I interaction and L-T interaction.

Easton (2003) conducted a qualitative study to explore communication processes that affect the roles of online distance learning instructor. She found that many communication skills required of online instructor are similar to those needed for effective face-to-face teachings. She concluded that online instructors need to develop new course management techniques for teaching virtually. They need to define the virtual "time and place" and ensure that students are notified. In addition, they need to determine when it is appropriate to use various forms of mediated communication, such as e-mail or discussion boards.

A study by Arbaugh (2000b) examined the effects of interaction dynamics on student learning in Internet-based MBA courses. He found that ease of interaction, classroom dynamics and instructors' emphasis on interaction were significantly associated with students' perceived learning. However, the findings might be influenced by the fact that the subjects participating in the study were also attending traditional campus-based courses as they were enrolled in a regular-MBA program. In a study conducted by Volery (2001) within a Web-enhanced course, one of the critical success factors associated with learning effectiveness was classroom interaction. Additionally, the researcher determined that the instructor's role will become one of a "learning catalyst and knowledge navigator" (p.77). There remains a need to examine the impact of interaction and communication dynamics on student learning and satisfaction in Web-based online learning programs.

It can be hypothesized from the above literature review that:

H_1: Student-to-Instructor interaction will be positively associated with student perceived learning in Web-based online learning programs.

H_2: Student-to-Student interaction will be positively associated with student perceived learning in Web-based online learning programs.

H_3: Student-to-Instructor interaction is positively associated with student satisfaction with Web-based online learning programs.

H_4: Student-to-Student interaction is positively associated with student satisfaction with Web-based online learning programs.

Methods

Sample and Data Collection

The sample for the study was taken from the thirty class sections that were conducted using Prometheus course software platform from Spring semester 2003. All students were enrolled in the online learning programs in Tourism Administration, Project Management, and Health Sciences at U.S. East Coast University. Each of these courses had no on-site meetings. Class section enrollments ranged from 6 to 20 students. Students completed a password-protected Web-based survey. The student response rate was 31.9 percent (208 out of 652).

Measures

Unless otherwise mentioned, each of the items was measured using five-point Likert-type scales, ranging from 1 as "strongly disagree" to 5 as "strongly agree".
Perceived Learning: Student learning was measured using Hiltz's six-item scale (1994). This scale has been used in several studies of distance learning environment (Arbaugh, 2000b; Hiltz, 1994) and has been found a reliable and validated measure. The coefficient alpha of perceived learning was 0.91.
Student Satisfaction: Student satisfaction was measured via a 6-item validated and reliable scale adapted from Arbaugh (2000a). This scale focuses on students' satisfaction with the Web-based course, their perceptions of its quality, and their intention of taking future courses via distance mode. He validated this scale through factor analysis. The internal reliability of this measure was 0.92 in Arbaugh (2000b). The items are listed on the following table:

Table 1
Student Learning and Satisfaction Variables

Research Variables	Measure	Source
Perceived Learning	1. I learned to interrelate the important issues in the course material	Student Survey (6 items) from Hiltz (1994)
	2. I gained a good understanding of the basic concepts of the material	
	3. I learned to identify the central issues of the course	
	4. I developed the ability to communicate clearly about the subject	
	5. I improved my ability to integrate facts and develop generalizations from the course material	
	6. I learned concepts and principles in this course	
Satisfaction	1. The quality of the course compared favorably to my other courses	Student Survey (6 items) from Arbaugh (2000a)
	2. I was very satisfied with this course	
	3. If I had another opportunity to take another course via this mode I would gladly do so	
	4. I gained more interest in the subject matter of this course	
	5. I feel that this course served my needs well	
	6. I would recommend this course to another student	

Student-Instructor Interaction**:** This was measured using a 5-item scale adapted from Johnson, Aragon, Shaik, and Palma-Rivas (2000). The coefficient alpha of this measure was 0.85.
Student-Student Interaction**:** This was measured using a 5-item scale adapted from Johnson, Aragon, Shaik, and Palma-Rivas (2000). The coefficient alpha of this measure was 0.84.

Table 2
Student-Instructor Interaction Variables

Research Variables	Measure	Source
Student-to-Instructor interaction	1. The instructor encouraged me to become actively involved in the course discussions	Student Survey (5 items) from Johnson et al. (2000)
	2. The instructor provided me feedback on my work through comments	
	3. I was able to interact with the instructor during the course discussions	
	4. The instructor treated me as an individual	
	5. The instructor informed me about my progress periodically	

Table 3
Student-Student Interaction Variables

Research Variables	Measure	Source
Student-to-Student interaction	1. I was able to share learning experiences with other students	Student Survey (5 items) from Johnson et al. (2000)
	2. I was able to communicate with other students in this course	
	3. Increased contact with fellow students helped me more out of this course.	
	4. A sense of community existed with fellow students taking this course.	
	5. This course encouraged me to work in small groups/teams	

Control Variables:

The control variables used in this study were student prior experience with Web-based courses, Internet experience, student age, gender and language.

Results

Demographic Analysis

This section will provide a demographic profile of the respondents.
Gender: 135 or (65%) of the total respondents were female, while the remaining 83 or (35 %) were male.
Level: 151 or (73%) of the total respondents were graduate students enrolled in graduate programs, while the remaining 57 or (27 %) were undergraduates.
Language: English was the first language of 177 or (85%) of the total respondents, while the remaining 37 or (15 %) spoke other languages as their first language.
Age: In the age category the distribution of the respondents was as follows:
54 or (26 %) were between 21 to 30 years old; 77 or (31%) were between 31 and 40 years of age; 59 or (28%) were between the ages of 41 and 50 years; and finally 18 or (9%) were between the ages of 51 and 60.
Previously course taken/Prior course experience: Prior to Spring 2003, students' prior online course experiences are listed in the following table:

Table 4
Prior Online Course Experience

Number of online classes taken previously	Number of respondents	% of total
0	40	19.2
1	13	6.3
2	28	13.5
3	10	4.8
4	5	2.4
5	9	4.3
6	23	11.1
7	8	3.8
8	19	9.1
9	11	5.3
10	15	7.2
11	7	3.4
12	13	6.3
13	7	3.4

Internet Experience: Majority of students had more than 5 years of Internet experience. Expected Course Grade: All students reported their expected course grade. Majority of students reported B and above as their expected grade.

Analysis of Study

This research used the Cronbach's alpha value in order to assess the internal consistency of the results across items within a scale. Alpha values were calculated for each multi-item scale. All the calculated alpha values are found to be above 0.83 indicating the fact that all scales are reliable.

Having demonstrated the overall reliability of the instrument, a mean score was calculated for each construct based on the individual student responses for the purpose of hypothesis testing. A single value has the advantage of simplifying the test of the relationships between variables, by reducing the number of variables that need to be tested simultaneously. For the present study, perceived learning was computed by taking the average score of six items of learning on the instrument, student-instructor interaction was computed by taking the average score of five items of student-instructor interaction, and student-student interaction was

computed by taking the average score of five items of student-student interaction on the survey instrument. A brief description of the minimum and maximum values, mean and standard deviation of each construct under study is shown in table 5.

Table 5
Descriptive Statistics of Constructs

Construct	Minimum	Maximum	Scale range	Mean	Standard Deviation
Perceived Learning	2.00	5.00	1 to 5	4.08	.70
Student Satisfaction	1.17	5.00	1 to 5	4.11	.84
Student-Instructor Interaction	1.00	5.00	1 to 5	4.00	.76
Student-Student Interaction	1.40	5.00	1 to 5	3.69	.85

Hypothesis Testing

Regression analysis is used to predict a continuous dependent variable from a number of independent variables (Tabachnik & Fidell, 1996). Regression is also used to find out the relationship between variables. The regression analysis does not necessarily require assumptions of causality, and in this case no such assumption has been made. Separate stepwise regression was performed for each dependent variable, student learning and student satisfaction according to the following procedure:
1. All possible simple linear regressions were considered. The predictor variable that explained the largest significant proportion of the variation in the dependent variable was the first variable to enter the regression function.
2. The next variable to enter was the one remaining variable that made the largest significant contribution to the regression sum of squares. The significance of the contribution was determined by an F-test. For this regression analysis, any new variable had to have F-statistic value of over .05 to be included.
3. Once an additional variable had been in the equation, the individual contributions to the regression sum of squares of the variables already in the equation were checked for significance using F-tests. If the F-statistic was less than .10, the variable was deleted from the regression equation.
4. Steps 2 and 3 were repeated until all possible additions were non-significant and all possible deletions were significant.

Testing Research Hypotheses 1 & 2

To test the relationships of perceived learning with student-instructor interaction and student-student interaction, student-to-instructor interaction and student-to-student interaction along with control variables were regressed on students' perceived learning. Stepwise regression

was performed according to the procedure aforementioned. Table 6 shows a summary of the regression models in which perceived learning was entered as a dependent variable. Table 6 shows the regression coefficients. None of the control variables: age, gender, level, language, course experience, and Internet experience had any significant relationship with perceived learning.

Both study variables, student-instructor interaction and student-student interaction, were significantly associated with perceived learning. Student-instructor interaction was associated with perceived learning ($R^2 = .402$, $p < .01$). The multivariate regression equation showed that both student-instructor interaction and student-student interaction were significantly associated with perceived learning, when examined together ($R^2 = .504$, $p < .01$).

Table 6
Model Summary- Perceived Learning as a Dependent Variable

Model	R	R^2	Adjusted R^2	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	Df1	df2	Sig. F Change
1	.634	.402	.399	.54043	.402	138.657	1	206	.000
2	.710	.504	.499	.49353	.102	42.006	1	205	.000

It can be seen from table 7 that the beta coefficient for student-instructor is positive and significant ($b = 0.634$, $p < .01$). Also, when examined together, the beta coefficients for the student-instructor interaction and student-student interaction were positive and significant ($b = 0.427$, $p < .01$), and ($b = 0.380$, $p < .01$).

Based on these findings, we reject the null hypothesis that student-instructor interaction is not positively associated with student learning and accept the research hypothesis that student-instructor interaction is positively associated with student learning. Also, we reject the null hypothesis that student-student interaction is not positively associated with student learning and accept the research hypothesis that student-student interaction is positively associated with student learning.

Table 7
Model Coefficients- Perceived Learning as a Dependent Variable

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.754	.201		8.722	.000
	Student-Instructor Interaction	.582	.049	.634	11.775	.000
2	(Constant)	1.368	.193		7.082	.000
	Student-Instructor Interaction	.392	.054	.427	7.285	.000
	Student-Student Interaction	.310	.048	.380	6.481	.000

Based on these findings, we reject the null hypothesis that student-instructor interaction is not positively associated with student learning and accept the research hypothesis that student-instructor interaction is positively associated with student learning. Also, we reject the null hypothesis that student-student interaction is not positively associated with student learning and accept the research hypothesis that student-student interaction is positively associated with student learning.

Testing Research Hypotheses 3 & 4

To test the relationships between student satisfaction and student-instructor interaction, and student-student interaction, student-to-instructor interaction and student-to-student interaction along with control variables were regressed on student satisfaction. Stepwise regression was performed according to the procedure aforementioned. Table 8 shows the summary of the regression models in which student satisfaction was selected as a dependent variable.

Table 8
Model Summary- Student Satisfaction as Dependent Variable

Model	R	R^2	Adjusted R^2	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.735	.541	.538	.56934	.541	242.357	1	206	.000
2	.772	.596	.592	.53543	.055	27.918	1	205	.000

Table 8 shows the regression coefficients. None of the control variables: age, gender, level, language, course experience, and Internet experience had any significant relationship with student satisfaction.

Table 9
Model Coefficients- Student Satisfaction as Dependent Variable

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	.873	.212		4.121	.000
	Student-Instructor Interaction	.811	.052	.735	15.568	.000
2	(Constant)	.531	.210		2.536	.012
	Student-Instructor Interaction	.643	.058	.583	11.006	.000
	Student-Student Interaction	.274	.052	.280	5.284	.000

Both study variables, student-instructor interaction and student-student interaction, were significantly associated with student satisfaction. Student-instructor interaction was associated with student satisfaction (R^2 = .541, p < .01). It can be seen from table 9 that the beta coefficient for student-instructor is positive and significant (b = 0.643, p < .01). The multivariate regression equation showed that both student-instructor interaction and student-student interaction were significantly associated with student satisfaction, when examined together (R^2 = .596, p < .01). Also, when examined together, the beta coefficients for the student-instructor interaction and student-student interaction were positive and significant (b = 0.583, p < .01), and (b = 0.280, p < .01).

Based on these findings, we reject the null hypothesis that student-instructor interaction is not positively associated with student satisfaction and accept the research hypothesis that student-instructor interaction is positively associated with student satisfaction. Also, we reject

the null hypothesis that student-student interaction is not positively associated with student satisfaction and accept the research hypothesis that student-student interaction is positively associated with student satisfaction.

Open-Ended Question Categorization

Sixty students responded to the open-ended question, "Any additional comments you would like to make?" Some of the comments dealt with the instructor, advantages of distance learning, interaction, course subject, structure, and about other students. Comments related to interaction are categorized according to their responses into the Table 10.

Table 10

Open-Ended Responses

Key Interaction Issue	No. of times reported
Student-to-Instructor Interaction	5
Student-to-Student Interaction	7

Discussion

The significance of the above findings is that both student-student and student-instructor interactions are significant contributors to the level of student learning and satisfaction in a technology-mediated environment. Due to the physical separation of learners from instructor and other learners, technology plays a vital role in providing a learning experience compatible with a face-to-face class. As technology has made learning possible at a distance, these findings suggest that the use of communication tools incorporated in a distance learning environment bridge both physical and time dimensions to bring the faculty and students together as a virtual community. The use of technology greatly facilitates and enhances interaction among students and between instructor and students. Hence, the efficient and effective use of technology in delivering Web-based courses is of critical importance to learning. This shows that students would like to use communication tools if they facilitate their learning efficiently and allow them to learn at anytime and anywhere.

Furthermore, these findings are consistent with the learning theories that emphasize the importance of interaction to the learning process. They support the assertions of online educators that interaction is one of the most important factors in learning outcomes (Collison, Elbaum, Havind, & Tinker, 2000; Pallof & Pratt, 2001; Salmon, 2001). In the executive summary of her major review of online learning literature, Meyer writes, "Quality learning is largely the result of ample interaction with the faculty, other students, and content" (2002, vii). The findings of the present study further support the findings of researchers who promoted interaction in instruction as a key element for students' learning and satisfaction (Arbaugh, 2000b; Chou & Liu, 2005; Sun & Zhan, 2006; Trentin, 2000).

Results from the open ended responses support the quantitative results that student valued more opportunities for meaningful interaction with instructors and other students. Students appreciated that working with peers in online course was helpful. For example, the following

comments substantiate the importance of student-to-instructor interaction and student-to-student interaction:

- I think more communication is needed with the professor and student and even classmates.
- Would like to see more team work and interaction between classmates to alleviate some of the stress of a capstone course.
- The best part of the course was that our team of 3, the Eastcoasters set up a conference call every Monday night for 45 minutes to plan and discuss our projects. This combined with an action log enabled us to communicate well and resolve problems more effectively.
- Need more verbal interaction and conference calls.

Age, prior course experience, and Internet experience were not significantly correlated with outcome variables. Students who have prior experience with online format could feel more comfortable as compared to those who have no online experience. However, in this study non-significant correlation was found between online experience and outcome variables. It is possible that students with no prior experience might have prior knowledge of the course content. Additional variables such as prior knowledge of the subject and work experience could better explain this non-significant correlation.

Students who have more Internet experience could feel more comfortable as compared to the students who have little Internet experience. However, in this study non-significant correlation was found between Internet experience and outcome variables. Based on the data, all students possessed at least one year of Internet experience. There are two possible explanations for this non-significant correlation. First, it is possible that one year of Internet experience might be enough to feel comfortable and thus succeed in Web-based online courses. Second, the students in the study were required by the academic departments to possess Internet skills necessary to navigate the Internet and participate in the classroom online discussion forum that might have contributed to this non-significant correlation. More refined operationalization of Internet experience variable may lead to significant findings.

Implications

Based on the study findings and observations, the following implications are drawn for the development of future technology and its implementations:

- Future CMS should be more user-friendly because if a system fails to be user-friendly, it will not be welcomed by users and will thus lose market. Hence, user-friendliness of the technology and comfort levels of the users ought to be factored into the development of future technology for Web-based programs.
- The technological aspects of Web-based programs (software, etc.) must be developed and continually makes them easier for people to interact with each other online more clearly and more efficiently in order to cultivate a sense of online community among these programs.
- Future CMS must make it easier for the instructor to design on-line learning community and create learning activities that promote interaction with the content, the instructor and the learners in the class.

Online students are often geographically isolated from the academic community. This increases burden on the instructor to facilitate interaction in the online classroom. The results of both the quantitative analysis and the open-ended responses indicate that students appreciate those efforts which help improve the quality and effectiveness of the learning experience. One of the study respondents remarked, "Our course has a very responsive instructor who communicates well with his students." It must be recognized that the importance of the instructor's role is not limited to direct interaction with students. An instructor also has a significant opportunity to either foster or hinder the positive influence of other factors in the learning process, such as student interaction with other students. As another participant said, "Our instructor tries too hard to make the on-line class like a live classroom, forcing the group into weekly discussions."

The data from this study imply that student-instructor interaction is one of the most critical factors in enhancing student satisfaction in an online course. Communication and interaction is critical in any form of education. Students and instructors must find ways to convey information, determine level of understanding, and create a workable feedback system. In a traditional face-to-face learning environment, students' facial expressions usually provide a clue if students are confused. However, in an online environment, if students are confused, there is no clue unless they choose to communicate about their confusion. Online technologies such as personal e-mail, chat room utilization, and discussion forums can improve interaction.

If an instructor or institution desires to create a satisfying learning environment, the results of this study suggest building learning environments that encourage both student-instructor and student-student interactions. The findings specifically suggest that the instructor must encourage students to actively participate in the course discussions; they must provide feedback on students' work and inform them of their progress periodically; and treat them as individuals. In addition, a learning environment that encourages sharing learning experiences, builds a sense of community among students, and supports teamwork is desirable. Open-ended responses showed the importance of interaction in the online learning environment.

Limitations of the Study

This study is a correlation analysis which cannot draw casual relationship among the variables investigated.

As with any research, particularly a field study, there were a number of limitations to this study. The dependent variables, learning and satisfaction, were perceptual measures, as students were asked a number of questions seeking to assess their perceptions of learning and satisfaction. The resultant construct of perceived learning and satisfaction exhibited good reliability as Cronbach's alpha was 0.91 and 0.93 for perceived learning and student satisfaction, respectively. However, more objective measures of learning and satisfaction would strengthen the conclusions reached in this research. Actual student grades were not available because of the confidentiality of student grade records by the university. Future studies should use more objective criteria such as actual course grades for assessing learning.

Moreover, this study collected data from students at a large university so results could only be generalized to other universities with online learning programs similar to this university.

Recommendations for Future Research

A comparative study with an identical research design is needed in different types of higher education institutions, such as community colleges as compared with four-year institutions. A comparative analysis of students' perceptions is needed in Web-based courses with and without interaction. A study of the types of Web-based courses/programs that are suitable for interaction can be undertaken.

Conclusion

Technology in online learning is becoming increasingly accepted in the system of higher education sector as the use of it contributes to the pedagogical experience. As more Web-based courses and programs are offered using CMS, care should be taken to make certain that the interactions of the learner, instructor, content, and technology are successful. The positive and significant relationship between interaction dynamics and student learning and satisfaction outcomes illustrates the importance of learner-instructor, and learner-learner interactions. It is imperative that Web-based distance learning programs provide students with what is valued in education: interaction with instructors and other students.

References

Arbaugh, J. B. (2000a). Virtual classroom characteristics and student satisfaction with internet-based MBA courses. *Journal of Management Education, 24*, 32-54.

Arbaugh, J. B. (2000b). How classroom environment and student engagement affect learning in internet-based MBA courses. *Business Communication Quarterly, 63*(4), 9-26.

Berge, Z.L. (1999). Post-secondary Web-based learning. *Educational Technology, 39*(1), 5-11.

Bruning, K. (2005). The role of critical thinking in the online learning environment. *International Journal of Instructional Technology and Distance Learning, 2*(5), 21-31.

Burnett, K., Bonnici, L.J., Miksa, S.D., & Kim, J. (2007). Frequency, Intensity and Topicality in Online Learning: An Exploration of the Interaction Dimensions that Contribute to Student Satisfaction in Online Learning. *Journal of Education for Library and Information Science, 48*(1), 21-35.

Chou, S., & Liu, C. (2005). Learning effectiveness in a Web-based virtual learning environment: a learner control perspective. *Journal of Computer Assisted Learning, 21*(1), 65-76.

Clark, R.E. (1994). Media will never influence learning. *Educational Technology Research and Development, 42*(2), 21-29.

Collison, G., Elbaum, B., Havind, S., & Tinker, R. (2000). *Facilitating online learning: Effective strategies for moderators.* Madison, WI:Atwood.

Easton, S.S. (2003). Clarifying the instructor's role in online distance learning. *Communication Education, 52*(2), 87-105.

Fresen, J. (2007). A Taxonomy of factors to promote quality web-supported learning. *International Journal on E-Learning, 6*(3)*,* 351-362.

Hara, N., & Kling, R. (2001). Research in brief: Student distress in web-based distance education. *EDUCAUSE Quarterly, 24*(3), 68-69.

Hill, J.R. (1997). Distance learning environments via world wide web. In B.H. Khan (Ed.), *Web-based instruction,* (pp. 75-80). Englewood Cliffs, NJ: Educational Technology Publications.

Hillman, D.C., Willis, D.J., & Gunawardena, C.N. (1994). Learner-interface interaction in distance education: An extension of contemporary models and strategies for practitioners. *The American Journal of Distance Education, 8*(2), 31-42.

Hillman, D. (1999). A new method for analyzing patterns of interaction. *The American Journal of Distance Education, 13*(2), 37-47.

Hiltz, S.R. (1994). *The Virtual Classroom: Learning without limits via computer networks.* NJ: Ablex Publishing Corporation.

Järvelä, S., & Häkkinen, P. (2002). Web-based cases in teaching and learning – the quality of discussions and a stage of perspective taking in asynchronous communication. *Interactive Learning environments, 10*(1), 1-21.

Johnson, S.D., Aragon, S.R., Shaik, N. & Palma-Rivas, N. (2000). Comparative analysis of learner satisfaction and learning outcomes in online and face-to-face learning environments. *Journal of Interactive Learning Research, 11*(1), 29-49.

Jung, I. (2001). Building a theoretical framework of web-based instruction in the context of distance education. *British Journal of Educational Technology, 32*, 523-534.

Kear, K., Williams, J., Seaton, R., & Einon, G.(2004). Using information and communication technology in a modular distance learning course. *European Journal of Engineering Education, 29*(1),17-25.

Kearsely, G. (2000). *Online education: Learning and teaching in cyberspace*. Belmont, CA: Wadsworth.

Keith, T.-S. (2006). Early Attrition among first time eLearners: A review of factors that contribute to drop-out, withdrawal and non-completion rates of adult learners undertaking eLearning Programmes. *Journal of Online Learning and Teaching*, *2*(2). Retrieved July 17, 2008, from http://jolt.merlot.org/Vol2_No2_TylerSmith.htm

Kim, K. J., Liu, S., & Bonk, C. J. (2005). Online MBA students' perceptions of online learning: Benefits, challenges, and suggestions. *Internet and Higher Education*, *8*, 335-344.

Kirby, E. (1999). *Building interaction in online and distance education courses.* Paper presented at the international conference of the Society for Information Technology and Teacher Education, San Antonio, TX.

Kruger, K. (2000). Using information technology to create communities of learners. In B. Jacoby (Ed.), *Involving commuter students in learning, New Directions for Higher Education,* (pp. 59-70). San Francisco: Jossey-Bass.

Meyer, K. (2002). Quality in distance education: Focus on online learning. In A.J. Kezar (Ed.), *ASHE-ERIC Higher Education Report,* (pp. i-vii). San Francisco: Jossey-Bass.

Moore, M.G. (1993). Three types of interaction. In K. Harry, M. Hohn, & D. Keegan (Ed.), *Distance education: New perspectives,* (pp. 12-24). London: Routledge.

Northrup, P. (2001). A framework for designing interactivity into Web-based Instruction. *Educational Technology, 41*(2), 31-39.

Palloff, R.M., & Pratt, K. (2001). *Lessons from cyberspace classroom: The realities of online teaching*. San Francisco: Jossey-Bass.

Phipps. R., & Merisotis, J. (1999). *What's the difference? A review of contemporary research on the effectiveness of distance learning in higher education*, Washington DC: The Institute for Higher Education Policy.

Russell, T. (1999). *No significant difference phenomenon*. Raleigh, NC: North Carolina State University

Sabry, K., & Baldwin, L. (2003). Web-based learning interaction and learning styles. *British Journal of Educational Technology, 34*(4), 443-454.

Salmon, G. (2001). *E-moderating: The key to teaching and learning online.* London: Kogan Page.

Saunders, G., & Weible, R. (1999). Electronic courses: Old wine in new bottles? *Internet Research, 9*(5), 339-347.

Shale, D., & Garrison, D.R. (1990). Introduction. In D.R. Garrison & D. Shale (Ed.), *Education at a distance: From issues to practice,* (pp. 1-6), Melbourne, Florida: Krieger.

Sorensen, C., & Baylen, D. M. (1999). Interaction in interactive television instruction: Perception or reality. Paper presented at the Conference of the American Educational Research Association (AERA), Montreal, Canada.

Sun, X., & Zhan, W. (2006). An exploration for influencing factors of interaction learning in web-based instruction. Paper presented at the 10th International Conference on Computer Supported Cooperative Work in Design*,* Nanjing, China.

Sutton, L. (2001). The principles of vicarious interaction in computer-mediated communications. *Journal of Interactive Educational Communications, 7*(3), 223-242.

Surry, D.W., & Ensminger, D. (2001). What's wrong with media comparison studies? *Educational Technology, 41*(4), 32-35.

Tabachnik, B.G., & Fidell, L.S. (1996). *Using multivariate statistics*. New York: HarperCollins

College Publishers.

Thorpe, M., & Godwin, S. (2006). Interaction and e-learning: the student experience. *Studies in Continuing Education, 28*(3), 203-221.

Trentin, G. (2000). The quality-interactivity relationship in distance education. *Educational Technology, 40*(1), 17-27.

Volery, T. (2001). Online education: An exploratory study into success factors. *Journal of Educational Computing Research, 24*(1), 77-92.

Walker, G. (2005). Critical thinking in asynchronous discussions. *International Journal of Instructional Technology and Distance Learning, 2*(6).

Wagner, J. G. (2001). Assessing online learning. Reston, VA: National Business Education Association. (ERIC Document Reproduction Service No. ED449386).

Weller, M. (2007). The distance from isolation: Why communities are the logical conclusion in e-learning? *Computers & Education*, *49*, 148-159.

Yildiz, S., & Chang, C. (2003). Case studies of distance students' perceptions of participation and interaction in three asynchronous web-based conferencing classes in the U.S. *Turkish Online Journal of Distance Education,* 4(2). Retrieved April 7, 2004, from http://tojde.anadolu.edu.tr/tojde10/articles/senem.htm