

The Pennsylvania State University

The Graduate School

College of Education

**THE EFFECTS OF LEARNING STRATEGIES ON
STUDENT INTERACTION AND STUDENT SATISFACTION**

A Thesis in

Workforce Education and Development

by

Keith D. Bailey

© 2002 Keith D. Bailey

Submitted in Partial Fulfillment
of the Requirements
for the Degree of

Doctor of Philosophy

May 2002

We approve the thesis of Keith D. Bailey.

Date of Signature

David L. Passmore
Professor of Education
Thesis Adviser
Chair of Committee

Judith A. Kolb
Associate Professor of Education

William J. Rothwell
Professor of Education

James B. Thomas
Professor of Information Sciences and Technology

Kenneth C. Gray
Professor of Education
In Charge of Graduate Programs in
Workforce Education and Development

Abstract

This study investigated the effects two learning strategies have on student-to-student interaction, student-to-teacher interaction, and student satisfaction. The participants of the study were 84 Pennsylvania State University students taking an Online IST 110 course, An Introduction to Information Sciences and Technology. Each of two sections completed one of two learning strategies used to complete the course Discussion Activities for two weeks. Upon completion of the two weeks of Discussion Activities, each of the participants completed an online survey designed to measure the student's perception of student-to-student interaction, student-to-teacher interaction, and student satisfaction. The findings suggest that a student's perception of student-to-student and student-to-teacher interaction may impact the level of student satisfaction. There is no difference in the level of student satisfaction between the two learning strategies. A blended learning strategy may be used to help increase a student's perception of student-to-teacher interaction. However, other learning strategies need to be explored in an attempt to increase the level of student-to-student interaction while completing course Discussion Activities. Implications from the findings and areas for future research are included.

Table of Contents

List of Figures.....	vi
List of Tables	vii
Acknowledgments	viii
Chapter 1 Introduction.....	1
HISTORICAL PERSPECTIVES	1
Purpose.....	4
The Problem.....	4
Significance of the Study	6
Research Questions.....	7
Assumptions.....	8
Theoretical Framework.....	8
Chapter 2 Review of the Literature	12
Learner Satisfaction	12
Online Learning Environments.....	14
Online Interaction	19
<i>Learning Environments and Interaction.....</i>	<i>22</i>
<i>Interaction through Computer-mediated Technologies.....</i>	<i>26</i>
<i>Student-to-Student and Student-to-Teacher Interaction.....</i>	<i>28</i>
Conclusion	36
Chapter 3 Methodology.....	37
Course Selection	38
<i>Course Structure.....</i>	<i>38</i>
<i>Course Resources.....</i>	<i>40</i>
Procedures.....	41
Population and Sampling.....	43
Research Variables	43
<i>Dependent Variables.....</i>	<i>44</i>
<i>Independent Variables</i>	<i>45</i>
<i>Control Variables.....</i>	<i>47</i>
Instrumentation	49
<i>Perception of Student-to-Student and Teacher-to-Student Interaction.....</i>	<i>49</i>
<i>Student Satisfaction.....</i>	<i>52</i>
<i>Instrument Validation</i>	<i>53</i>
Data Analysis.....	55
<i>Research Question One.....</i>	<i>55</i>
<i>Research Question Two</i>	<i>56</i>
<i>Research Question Three.....</i>	<i>56</i>
<i>Research Question Four</i>	<i>56</i>
<i>Research Question Five</i>	<i>57</i>

<i>Analysis Technique</i>	57
Chapter 4 Results	59
Survey Reliability	59
Demographics	59
Hypothesis One	60
Hypothesis Two	61
Hypothesis Three	63
Hypothesis Four	64
Hypothesis Five	65
Chapter 5 Discussion	67
Summary	67
Discussion and Implications	67
<i>Interaction and Student Satisfaction</i>	67
<i>Learning Strategies and Student Satisfaction</i>	71
<i>Learning Strategies and Interaction</i>	74
<i>Student Interaction, Learning Strategies, and Student Satisfaction</i>	79
Conclusion	80
Bibliography	82
Appendix A Course Interaction and Satisfaction Survey	86
Appendix B Student Interview Form	87
Appendix C List of Regression Tables	88

List of Figures

Figure 1: Diagram of Research Variables.....	7
Figure 2: Interaction on Student Satisfaction.....	68
Figure 3: Learning Strategies on Student Satisfaction.....	72
Figure 4: Learning Strategies on Interaction	75

List of Tables

Table 1: Summary, Definition, and Treatment of Data for Dependent Variables	44
Table 2: Summary, Definition, and Treatment of Data for the Dependent Variable.....	46
Table 3: Summary, Definition, and Treatment of Data for Control Variables.....	48
Table 4: Demographic Statistics for Participants Across Course Sections.....	60
Table 5: Regressions of Student-to-Student and Student-to-Teacher Interaction on Student Satisfaction	63
Table 6: Summary of Regression Analyses of Learning Strategies on Student-to-Student Interaction, Student-to-Teacher Interaction, and Student Satisfaction.....	66

Acknowledgments

I would like to take this opportunity to thank the key people who helped make my time as a doctoral student a positive experience. First of all, I would like to thank Dr. David Passmore, Dr. Judith Kolb, Dr. William Rothwell, and Dean James Thomas for serving on my committee. I would like to extend a special thanks to my committee chair, Dr. David Passmore, for his help and guidance throughout the process.

I want to thank Dean Thomas for his mentorship and for the opportunities he provided, Dr. Shawn Clark for his willingness to help me brainstorm and discuss ideas regarding the study, and Cole Campese for his assistance in conducting the study and his continuous support throughout the process.

I would like to thank my family and friends for supporting me through this endeavor. More specifically, I would like to thank my mom for spending the numerous hours editing my document and my dad for providing me with the encouragement, motivation, and direction needed to complete the degree.

Finally, I would like to thank Bristol for providing me with a means of relaxation and stress relief, and most importantly, Beth for the numerous brainstorming sessions we had, continual patience, love, and understanding throughout the process.

Chapter 1

Introduction

Historical Perspectives

The Internet is an evolving, dynamic medium used to transmit information across a large network of users. There were 259 million people using the Internet worldwide by the end of 1999 (Petska, 1999). Projections show that by the end of 2002, there will be approximately 490 million Internet users and by the end of the year 2005, there will be at least 765 million Internet users worldwide (Petska, 1999), predicting a rapid growth in users of the Internet.

The number of opportunities presented to these users for utilizing the Internet, closely follows the dramatic growth in Internet usage. Internet technologies such as the World Wide Web (WWW), email, Telnet, and FTP have increased the connectedness of users world wide, providing opportunities that may not have been available previously. For example, the World Wide Web (WWW), “a hypermedia system that uses universally accepted protocols over non-proprietary networks that incorporate the sharing of information” (Gilbert & Moore, 1998, p. 31), has provided users with the opportunity to search, research, and buy products and services. Other fields that continue to grow are in the areas of education and training through distance education, “structured learning in which the student and instructor are separated by time and place” (McIsaac & Gunawarden, 1996, p. 403).

According to the International Data Corporation (IDC), “corporate spending on e-learning will exceed \$9 billion by 2002, up from \$1.5 billion in 1999” (Rosen, 2000, p. 40). In fact, many big firms such as Cisco, General Electric, IBM, and AT&T, are

starting online academies to train new employees and to upgrade the skills of existing ones (Friedman, 1999).

According to the U.S. Department of Education, about 44% of United States colleges offered distance education in 1998 – an increase of about a third since 1995; in 1998, it was estimated that 1.3 million students in the United States took online courses (Thomas, 2000, September). This number is projected to grow by 33% annually, reaching 2.2 million by 2002, with 85% of two-year colleges and 84% of four-year colleges offering distance learning courses. These numbers are up from 58% and 62% in 1998, respectively, according to the IDC (Aase, 2000).

Web-based Training (WBT), computer-based instruction designed around Web-based technologies such as Web browsers and HTML (Imel, 1997), is one of the most popular and fastest growing forms of media used to deploy online distance education. WBT, also referred to as online learning, IBT (Internet-based Training), WBL (Web-based Learning), and WBI (Web-based Instruction) (Barron, 1998), has a primary benefit of providing learners with a way of obtaining access to course materials and communication tools wherever they have a connection to the Internet (Aase, 2000; Burgstahler, 1997).

One of the major research questions focusing on distance education has been, “Is learning as effective when delivered via alternative media as opposed to that which happens in the face to face classroom environment” (Edwards & Fritz, 1997, p. 1)? Repeatedly, over the past 70 years, findings to this question have shown no significant difference between learning delivered face-to-face versus learning delivered via an alternative media (Edwards & Fritz, 1997). Based on these findings, proponents of

distance education have argued that even though no significant difference between mediums was found, these mediums should be used based on their relative advantages (Edwards & Fritz, 1997).

One of the major limitations identified within distance education and online education is the loss of interaction (Kirby, 1999). As categorized by Moore (1989), interaction in an online environment can be categorized in three types: learner to content, learner to learner, and instructor to learner. The importance of these categories was emphasized by Palloff and Pratt (1999) who stated that the “keys to the learning process are the interactions among students themselves, the interaction between faculty and students, and the collaboration in learning that results from these interactions” (p. 5). Furthermore, interaction has also been shown to be an important component of education because “frequent student-faculty contact in and out of class is the most important factor in student motivation and involvement” (Regalbuto, 1999, p. 25). Finally, as stated by Kearsly in Box (1999), “The single most important element of successful online education is interaction among participants” (p. 2).

In an attempt to overcome the loss of interaction within distance education, computer-mediated technologies such as discussion boards, email, chatrooms, and video conferencing have been created (Miller & Miller, 1999). Each of these tools offers an opportunity to enhance the communication process and increase the learner’s ability to interact with one another virtually.

Through the use of modern technology, distance education courses can facilitate interaction from remote locations through the integration of these computer-mediated technologies. While the implementation of these technologies in distance and online

education provides many new opportunities for educators, it also creates many challenges. One of these challenges is to ensure that the technologies are effectively integrated into the course design thus allowing for interaction to occur and ultimately leading to an individual's satisfaction.

This integration requires careful consideration of the instructional learning strategies designed for a given activity. These strategies can be created to take on any number of forms. They can be created for delivery in a traditional class environment, an online environment, or a blended environment, incorporating the best of both environments.

Purpose

The purpose of this study was to evaluate the effects a blending learning strategy used to deliver course discussion activities, an online asynchronous approach and a blended (online asynchronous approach coupled with a traditional face-to-face) approach, have on student-to-student interaction, student-to-teacher interaction, and student satisfaction.

The Problem

The Internet is growing at a rapid rate. Based on the increased usage of the Internet comes an increased demand for distance and online education. In order for this new medium to prosper, it is important to understand the true impact the online environment has on education.

One of the major criticisms of utilizing the Internet as an online distance educational tool has been the loss of interaction among students and between the teacher and students (Berge, 1999). Fulford and Zhang (1993) contend that "perception of

interactions should be treated as a desired learning outcome” (p. 18). Furthermore, Fulford and Zhang (1993) state that “since perceptions of overall interaction are the critical predictor of learner satisfaction, future research should investigate the design of specific strategies for improving learner perception of interaction and for sustaining student satisfaction in distance education television classroom” (p. 19). It is important to investigate ways to improve interaction in a distance education setting.

Interaction has also long been thought of as a key to a student's success in traditional classroom settings (Kearsley, 1998; McCroskey & Andersen, 1976). It has been shown that students’ experiencing high levels of interaction have shown higher levels of achievement than those experiencing lower levels of interaction (McCroskey & Andersen, 1976). Furthermore, interaction within education has also been shown to be an important motivational factor (Regalbuto, 1999), along with being important to increasing learner satisfaction (Fulford & Zhang, 1993; King & Doerfert, 1996). Because one of the major limitations of this new educational medium has been identified as the loss of interaction among students and between the teacher and students, it is important to investigate ways to improve interaction in a distance education setting.

Computer-mediated technologies are network-based technologies developed to increase the ability for interaction to occur among students and between instructors and students. While these technologies have been developed as a substitute for face-to-face interaction, there is a question as to whether they are indeed able to be a substitute for the face-to-face interaction that occurs in a traditional classroom.

A majority of the research conducted around online interaction has focused on looking at online environments versus face-to-face environments and not on blended

approaches to allowing for interaction. Those studies that have looked at blended approaches have focused their efforts on studying the overall environment and not the individual learning strategies that make up a course. For this reason, it is of vital importance to start to investigate how well blended learning strategies can foster interaction in distance education courses. The question at hand is, will interaction that occurs through the use of computer-mediated technologies successfully replace the interaction that occurs in a traditional face-to-face environment, or will blended approaches, combining online with face-to-face strategies, prevail as a means of improving interaction and satisfaction within a distance education course?

Significance of the Study

As more and more organizations and academic institutions move towards implementing online education into their training and education programs, it is important to understand which instructional strategies allow for the greatest opportunities for student-to-student interaction, student-to-teacher interaction, and student satisfaction for a given instructional activity. This study was significant because it helped trainers and educators identify the learning strategies that most effectively improve student satisfaction and interaction among students and between teachers and students for a given instructional activity.

By understanding the impact different learning strategies have on student-to-student interaction, student-to-teacher interaction, and student satisfaction, designers and developers of online education will be able to make informed decisions regarding the types of learning strategies to use when designing courseware. Finally, this study will

provided the statistical data needed for designers and developers to quantify their decisions when implementing a specific instructional strategy for their online solutions.

Research Questions

Illustrated in Figure 1 are the three primary research variables investigated in this study. The specific research questions asked in this study have been organized based on the three numbered, shaded regions formed by the overlapping of the three primary research variables.



Figure 1: Diagram of Research Variables

More specifically, this study was designed to answer the following questions:

Region 1, Learner Interaction and Learner Satisfaction

1. What effect does student-to-student interaction have on learner satisfaction?
2. What effect does student-to-teacher interaction have on learner satisfaction?

Region 2, Learning Strategies and Learner Satisfaction

3. What effect do the learning strategies have on learner satisfaction?

Region 3, Learner Interaction and Learning Strategies

4. How much do the perceptions of student-to-student interaction differ between learning strategies?
5. How much do the perceptions of student-to-teacher interaction differ between learning strategies?

Assumptions

Several assumptions have been identified:

- The instructor followed the same procedure between course sections and environments to facilitate the course discussion activities.
- The students in both the leaning strategies had the prerequisite skills needed to utilize the technologies used in the course.
- The students were capable of and willing to report their perceptions with regard to their level of student-to-student interaction, student-to-teacher interaction, and satisfaction upon completion of the course discussion activities.

Theoretical Framework

Several authors have contended that one of the most critical elements of online education is the ability to foster interaction among students and interaction between teachers and students (Box, 1999; Kirby, 1999). “Frequent student-faculty contact in and out of class is the most important factor in student motivation and involvement,” (Regalbuto, 1999, p. 25) is a statement that defines interaction as an important component of education. Furthermore, “working with others often increases involvement in learning. Sharing one’s own ideas and responding to others’ reactions improves thinking and

deepens understanding”(Regalbuto, 1999, p. 26). Therefore, it is important to understand the importance of interaction as a function.

Before one can discuss the importance of interaction, it is important to first functionally define the term. Wagner (1994) defined interaction as:

reciprocal events that require at least two objects and two actions. Interactions occur when these objects and events mutually influence one another. An instructional interaction is an event that takes place between a learner and the learner’s environment. Its purpose is to respond to the learner in a way intended to change his or her behavior toward an educational goal. (p. 8)

Interaction does not occur as an event or series of events in a learning environment; rather, it occurs as events that should be well thought out and incorporated into the overall design of the course. In an article written by Wagner (1994), it was suggested that “interaction functions as an attribute of effective instruction, while interactivity functions as an attribute of contemporary instructional delivery systems, particularly those that use telecommunications technologies” (p. 7). In distance education, too often a strong focus is placed on the instructional delivery system and not on the instructional design, which is used to guide the integration of the technologies (Wagner, 1994).

In an attempt to define the construct of interaction, Wagner (1994) described several systems' models to help demonstrate the importance of interactions within an educational setting. Each of these models can be categorized by placing them into one of four domains: learning theories, instructional theories, instructional design, and instructional delivery.

Learning theories are “those theories that try to attempt to describe, explain, and predict learning” (Smith & Ragan, 1999, p.18). One of the theories about learning is that

there are five basic learning outcomes or domains. These domains have been categorized as follows:

- Verbal information or declarative knowledge
- Intellectual skills
- Cognitive strategies
- Attitudes
- Psychomotor skills (Smith & Ragan, 1999)

It is speculated that when a learner is learning within any one of these domains, he/she elicits methods of feedback, elaboration, learner control/self-regulation, and motivation (Wagner, 1994). Wagner (1994) also contended that each of these methods have a direct connection with the importance of interaction within an educational environment.

Unlike learning theories, which focus on how learning occurs, instructional theories look at the features of learning strategies and determine which environments may be developed to promote learning (Smith & Ragan, 1999). Through the use of instructional theories, designers of instruction create environments or “instructional experiences directly suited to the learner’s ability to learn” (Wagner, 1994, p. 15). Wagner (1994) contended that interaction is a critical variable within instructional theory and that “within the context of instructional theories, interaction is the most frequently described in terms of feedback efficacy” (Wagner, 1994, p. 15).

By understanding instructional and learning theories, it is apparent that interaction is perceived to be an important component of instruction. However, such an understanding does not focus on the specific learning strategies that are used to promote

interaction. The creation of these learning strategies is done through a systematic process known as instructional design. This process uses techniques such as analysis, design, development, implementation, and evaluation (Wagner, 1994) to create, evaluate, and revise a learning situation. Through the use of instructional design principles, designers focus on creating learning strategies used to solicit interaction in a given environment. In essence, the instructional design process is the link between the learning theory and the instructional theory.

As instructional designers work through the instructional design process, they need to think about how to deliver the strategies they have designed. The areas of instructional delivery systems help generate a focus on the various forms of media and the methods that can be used to disseminate information and instruction. More specifically, these areas are concerned with the technologies, hardware, and software used to enhance interactivity, along with the application and integration strategies used to enhance the interaction process (Wagner, 1994). In the case of online distance education, these delivery systems include, but are not limited to, Internet-based technologies such as the World Wide Web, instant messaging, email, and discussion boards.

It is apparent that interaction can be connected to learning theories, instructional theories, instructional design, and instructional delivery. It is also apparent that there are various methods that are designed and developed to promote interaction within a learning environment. In order for distance and online education to be successful, data needs to be collected to show that interactivity can successfully occur in online distance education and to focus on those learning strategies that are best used to allow for interaction.

Chapter 2

Review of the Literature

This study was one whose ultimate purpose was to determine which of two learning strategies most effectively promotes student-to-student interaction, student-to-teacher interaction, and student satisfaction when conducting discussion activities for Online IST 110 courses. The purpose of this review of related literature was to demonstrate the importance of learner satisfaction within an educational environment, the importance of developing learning environments through the integration of learning strategies, and the importance of interaction in online education. More specifically, interaction in online education was broken down into learning environments and interaction, interaction through the integration of computer-mediated technologies, and student-to-student and student-to-teacher interaction.

Learner Satisfaction

It has long been thought that a student's satisfaction toward learning has been an integral part of an individual's success (Hackman & Walker, 1990; Smith & Ragan, 1999). Hackman and Walker (1990) stated that an individual learner is ultimately responsible for determining whether the trade-offs of a distance learning setting are worthwhile and are satisfying enough for a learner to complete the activity or course. Hackman and Walker (1990) also found that course effectiveness depends on a student's satisfaction. Since each individual learner is ultimately responsible for determining the effectiveness of a learning experience, it is important to understand an individual's level of satisfaction towards a course or activity.

Keller also demonstrated the importance of learner satisfaction as he developed a model that is used to influence a learner through the incorporation of motivational strategies within a learning environment (Smith & Ragan, 1999). The model Keller developed, the ARCS model, incorporates four independent strategies, all of which are used to improve a learner's motivation toward learning (Smith & Ragan, 1999). The four strategies are: attention, relevance, confidence, and satisfaction (Smith & Ragan, 1999). Attention is used to keep a learner focused on the instruction throughout the duration of a course. Relevance is used to show how the course materials are related to the learner's situation and to establish the current value of the instruction. Confidence is used to bolster a learner's self-esteem or confidence throughout the learning process. Satisfaction is used to manage the consequences of student activity and learning.

Furthermore, learner satisfaction is based on Thorndike's Law of Effect, which theorizes that positive consequences occur when learning is successful and is reinforced (Smith & Ragan, 1999). Thorndike's law states that "if a stimulus is followed by a response that is followed by a satisfier, then the stimulus-response connection will be strengthened" (Smith & Ragan, 1999, p. 263), thus improving a learner's satisfaction. In the context of a distance learning setting, such a stimulus or satisfier can be generated in a number of ways. The stimuli or satisfier can be generated through those interactions produced by other students, or the feedback provided by an instructor. As a student interacts with other students and/or the instructor, positive or negative feedback is provided reinforcing or contradicting the student's beliefs.

Based on the understanding of Thorndike's Law of Effect and the assumption that student-to-student and teacher-to-student interaction is a stimulus used to increase a

learner's satisfaction, it could be hypothesized that if interaction levels among students and with the instructor are high, then a learner's satisfaction would also be high.

Concurrently, if the interaction levels among students and with the instructor are low, then a learner's level of satisfaction would also be low. Baker (1995) further supported this theory as he claimed that satisfaction and persistence of distance learners is impacted by the amount of interaction within a distance education setting.

Online Learning Environments

As is in the case with any learning opportunity, there are many advantages and disadvantages to the various methods used in course delivery. Research has traditionally focused on comparing online environments with traditional face-to-face environments. Through the comparison of these two environments, several advantages and disadvantages have appeared. Aase (2000) and Burgstahler (1997) identified several of these advantages to be:

- Eliminating the need to be in the same place at the same time. With Internet-based technologies, students can obtain access to course materials and communication tools wherever they have a connection to the Internet.
- Immediacy of students to be able to receive speedier feedback on assignments.
- Increased instructor/student contact and peer-to-peer contact.
- Providing new learning opportunities. Both students and professors can now construct new knowledge in ways they could not without the technology.
- Facilitating participation by diverse groups by extending educational opportunity to those individuals that may not normally have the opportunity to participate.

- Providing access to a wide range of instructional resources. More and more textbooks, journals, periodicals, and other printed materials are available through the Internet.
- Promoting active engagement by learners. In fact, some students stated that they participated more in class discussions when the course was delivered electronically than they did in a traditional class.
- Providing more time to compose comments and responses thus producing higher quality interaction.

Aase (2000) and Burgstahler (1997) also identified that several of the disadvantages of online education when compared to traditional forms of education are:

- Technological breakdowns that minimize the users' ability to take the course.
- The need for learners to have access to the Internet and the World Wide Web.
- The premise that learners must have the technical ability to use the tools utilized throughout the course.
- Lack of face-to-face communication eliminating the ability for instructors to view verbal and facial cues and read body language.

Through the understanding of the numerous advantages and disadvantages of online education, instructors and designers of online courses can make more informed design decisions about the environments they are about to create. They can look at the advantages and disadvantages and determine which environment is best suited for a course activity. After weighing the numerous advantages and disadvantages, designers may decide that moving to a total online environment is the most appropriate decision. There could be instances where online education would enhance the learning opportunity

if a combined approach and a traditional face-to-face event is combined with an online event creating a blended approach to learning.

One area that is often overlooked when creating online education is the possibility of taking and creating an online experience, which incorporates both traditional face-to-face strategies with online strategies. By incorporating such a blended strategy toward instruction, the designer will be able to overcome many of the negative issues currently identified in online education.

Hybrid or blended learning strategies are educational events that have been created and delivered using a combination of a traditional face-to-face approach and a distance or online approach (Ganzel, 2001; Horton, 2000; Zenger & Uehlein, 2001). Horton (2000) claimed that those web-based training and traditional face-to-face training offer complementary strengths, thus providing a more powerful learning opportunity for an individual.

In a study conducted by Edwards and Fritz (1997), students' perceptions of educational outcomes between three different learning environments were studied. Participants of the study were thirty-four undergraduate students, split up into three classes, with each class being presented a different educational online delivery approach. The first delivery approach, visual communication, used half of the class materials online, a traditional textbook, and traditional lectures based on textbook materials. The second approach, computer graphic design, used online supplemental materials, a traditional textbook, no traditional lecture, and a coaching/hands-on style of face-to-face teaching. The third delivery approach, World Wide Web publishing, used all online class materials and no textbook.

The results of the study showed that students perceived strong learning outcomes from online materials and from mediated modes of education. Furthermore, it was shown that the effectiveness of online learning appeared to be influenced by students' access to materials.

Based on the finding of the study, the results would suggest that a blended approach to instruction, which utilizes both mediated forms of education and face-to-face forms of education, may be an appropriate mode for delivering educational materials. Further investigation of the use of a blended approach was needed to determine if such an approach could be used to increase interaction among students and between teachers and students.

Blended learning environments have often been described as allowing for “the best of both worlds,” meaning that such an approach, if incorporated properly, provides an opportunity to build off of the strengths of online components while utilizing strengths of the traditional face-to-face environment. While these environments seem ideal in creating a mixed or blended approach, they can be ineffective if incorrectly designed. When designing and developing blended learning environments, it is important that all of the activities are designed and developed by incorporating the delivery method best suited for each particular activity. Following sound instructional design principles is one way of insuring the appropriate mix of strategies is incorporated. Zenger and Uehlein (2001) stressed the importance of utilizing instructional design principles when they stated,

A blended solution doesn't occur when you just bolt on some e-learning modules to an instructor-led session. It's only when the pieces fit together logically like finely machined parts of an engine that you create a real blended solution (p. 58).

It is the ability and the challenge of the designers to successfully piece together these components that will determine the overall effectiveness of these blended learning environments. Jansen and Lewis (1996) further supported this challenge as they explained, “one of the challenges and opportunities facing distance education instructors and instructional designers is the creation of new levels of interaction in distance education courses” (p. 8).

Through the use of instructional design, instructional strategies can be created with a specific focus on incorporating the best features of either environment while allowing for high levels of participation and interaction. Given the importance of interactivity in educational settings, when one designs distance or blended education, they must be cognizant of the numerous instructional strategies that can be used to increase interactivity.

King and Doerfert (1996) described the need for designing strategies to allow for interaction to occur when they stated,

interaction is not a phenomena that simply occurs; it needs to be an intentional part of the learning design for the course to be taught. Each element of the learning opportunity (the teacher, content, context and methods) must compliment each other and include flexible opportunities for interaction (p. 1).

Jansen and Lewis (1996) back up King and Doerfert’s statement even further in their statement, “it is important that the level of interaction be carefully considered and designed into the development of all distance education courses” (p. 8). In the case of distance or blended education, “the technology employed for instruction sets parameters on the type of interaction and the conveniences of the interactions in which students are engaged” (Berge, 1999, p. 5).

When designing blended-learning environments, Horton (2000) recommended several methodologies for combining the face-to-face and the online components of a course. These components include using:

- Classroom sessions as an orientation or as a time for questions.
- Online components that prepare learners for face-to-face sessions.
- Online lessons that are completed by individuals in the classroom and are facilitated by the instructor while in the class.
- Online materials as a mode of presentation, where an instructor uses web-based materials for classroom presentations.

Jansen and Lewis (1996) also identified three types of participation that can be incorporated into distance education courses: allowing for participation, encouraging participation, and requiring participation.

By understanding these methodologies and through careful consideration as to the required level of participation required of an individual, sound instructional strategies can be integrated into blended learning environments. Also, based on the findings of King and Doerfert, (1996) “continued study of variables such as interaction can only increase the chance of a successful outcome for consumers of distance learning” (p. 1).

Online Interaction

Interaction has long been thought of as a critical predictor when determining the success of an educational environment (Flanders, 1970). Jackson (1994) described the importance of studying interaction as he claimed that interaction is one of the biggest issues revolving around distance education today. Furthermore, in an article written by King and Doerfert, (1996) Acker and McCain were noted as saying that, “interaction is

central to the social expectations of education in the broadest sense and is in itself a primary goal of the larger educational process and that feedback between learner and teacher is necessary for education to develop and improve" (p.11).

Moore (1989) contended that within a distance education environment, there are three primary types of interaction: learner-content interaction, learner-instructor interaction, and learner-learner interaction. Learner-content interaction is the interaction that occurs "between the learner and the content or subject of study" (Moore, 1989, p. 2). Learner-instructor interaction is the interaction that occurs "between the learner and the expert who prepared the subject material or some other expert acting as an instructor" (Moore, 1989, p. 2). Finally, learner-learner interaction is the interaction that occurs "between one learner and other learners, alone or in group settings, with or without the real-time presence of an instructor" (Moore, 1989, p. 4).

Given the above assumptions that interaction is a critical predictor for determining the success of online education and that there are three major forms of interaction in online education, one of the major questions that could be asked by educators would be, which mode or modes of interaction provide the greatest learning opportunities? In an attempt to answer this question, Soo and Bonk (1998) conducted a study to determine which types of interactions are most important for distance education: synchronous forms of learner-to-learner, teacher-to-learner, learner-to-material, or learner-to-self interaction; or, asynchronous forms of learner-to-learner, teacher-to-learner, learner-to-material, or learner-to-self interaction.

This study was conducted using a Delphi technique consisting of eight experienced distance education instructors. Each of the eight instructors were asked three

questions: what type of interaction is necessary for learning in online distance education; how would you rank the following types of interaction; and considering the averaged rankings, why would you agree or disagree with the rankings given for each category or interaction?

The results of the study conducted by Soo and Bonk (1998) showed that there was a predominant preference for asynchronous modes of interaction. More specifically, asynchronous learner-to-learner interaction and asynchronous teacher-to-learner interaction were selected as the most important forms of interaction for the success of online distance education (Soo & Bonk, 1998). The results of this study would suggest that designers and instructors of online distance education should pay close attention to maximizing learner-to-learner and teacher-to-learner interaction through the use of asynchronous technologies.

Further justification for the need for interaction in an online environment was presented in an article written by Wagner (1998). In this article, Wagner (1998) identified twelve outcomes that learners are to achieve as a result of interaction. These twelve outcomes demonstrate not only the need for successful online interaction but also the importance of using interaction as an outcome for online education.

The twelve outcomes are: interaction for participation where interaction is used to provide a means of engaging learners to meet other fellow learners; interaction for communication where learners are able to share information and opinions with other learners in an attempt to persuade other individuals to subscribe to a particular point of view; interaction for feedback where a learner is given that opportunity to judge the quality of his or her performance; interaction for elaboration where a learner creates an

alternative example to explain a new idea which will help the learner make new information more meaningful; interaction for learner control/self-regulation where learners show their ability to keep themselves on task and demonstrate their ability to become lifelong learners by inquiring for information as needed; interaction for motivation where curiosity, creativity and higher order thinking are stimulated; interaction for negotiation where a learner determines the willingness of another individual to engage in a dialog with another in an attempt to come to a mutual agreement; interaction for team-building where team-building is necessary to ensure that individuals of a team support the goals of the group; interaction for discovery where new discoveries often occur through the sharing of ideas and perspectives with other learners; interaction for exploration where a learner has the ability to define the scope, breadth, and depth of a new idea; interaction for clarification where learners can clarify their understanding by restating their understanding in their own words; and finally, interaction for closure where learners can determine the expectations of an endeavor and also determine when the expectations have been met.

While Soo and Bonk (1998) determined the most important modes of interaction and Wagner (1998) discussed the importance of interaction, they did not describe the instructional methodologies that should be used to ensure that these benefits are met through the various forms of interaction. One way to ensure that the benefits are met is through the careful selection of appropriate instructional strategies.

Learning Environments and Interaction

The design and development of learning environments can have a big impact on a student's ability to successfully interact with other students and with an instructor. In

fact, studies have been shown that a well-structured learning environment is a vital component to an online learning experience.

Mahesh and McIsaac (1999) conducted a qualitative study which looked at learner-teacher interaction and time spent teaching within a distance education environment. In this study, they examined both the structure and interaction that occurs in an online course.

The participants in the study were seventeen teachers and teacher assistants who taught a graduate course in distance education delivered through a computer conferencing medium. The course was comprised of a combination of face-to-face sessions and online sessions utilizing both the World Wide Web and computer conferencing technologies. The first three class sessions and the last class session were the only face-to-face meetings between the class and the students. The rest of the course was taught totally online utilizing both synchronous and asynchronous technologies of FirstClass, a computer conferencing technology.

The qualitative data was collected through the analysis of chat sessions between the teacher and the students and the use of interviews, studying the messages the teacher sent out. Findings from their study suggest that even though the teacher and the teaching assistants spent more time teaching the online course as compared to a traditional face-to-face course, they felt the online teaching experience was worthwhile. Mahesh and McIsaac (1999) also found that teachers felt as if they were more readily available for the students than in a traditional face-to-face setting. Furthermore, they found that students felt a stronger commitment to their work in the online setting because of the close interaction that occurred between the students and the instructor. It was hypothesized

that the closeness of interaction may have offset the lack of control the students may have felt in a highly structured online learning environment. Finally, Mahesh and McIsaac (1999) found that an instructor's personality, emotions, philosophy, and educational background helped determine the amount of time a teacher would spend interacting with the online activities.

The findings of this study suggest that online interaction between teachers and students could be obtained through the proper use of computer conferencing technologies. In order for effective communications to occur and to maximize interaction, an instructor must realize that much more attention needs to be spent on administering and planning for activities. One of the reasons this study may have shown positive results could be that all of the learners, prior to the study, had taught a course using computer conferencing technologies. This prior experience may have made them aware of the importance of interaction within an online environment, which, in turn, may have motivated them to be more proactive in their levels of interaction.

Another study by Brown and Vician (1997) was conducted to examine the characteristics of student interaction when given computer-based communication assignments. The subjects were forty-eight undergraduate students enrolled in two communication courses in different colleges at the same large Midwestern university.

Twenty students in the first course were required to use email to submit answers to essay questions only to the instructor. The twenty-eight students enrolled in the second course were assigned to conversation groups and were required to discuss the questions they posed to the instructor using email. The primary differences between the two classes were as follows: the second class sent their email to a listserver, which

allowed all students to view all responses; students in the first class sent the messages only to the instructor. The first set of respondents returned 207 messages while the second set of respondents returned 158 messages.

Upon collection of each of the students' responses, they were coded and graded based on scheme used to assess communication, content, communication exchange format, and communication exchange timing for each of the messages. This coding was completed by two individuals who were not course instructors.

The results of this exploratory study indicated that communication content was free of destructive comments, and when negative or destructive comments were present, they were directed at the technology, not the communication activities. Furthermore, the study showed that only 6% of the communication was used for social reasons and the use of the computer-based communication tool did not hinder the ability for sharing to occur. This would suggest that the computer-based communication tool was not seen as a mode for building personal relationships but as a tool for building relationships among students and between teachers and students. Finally, based on the results of the study, the authors suggest that if an instructor wishes to increase student-to-student and student-to-teacher interaction through the use of computer-based communications, the activities must be carefully assigned.

One final study in this review conducted by King and Doerfert (1996) was used to determine student differences in interaction needs based upon delivery method used. The researchers collected survey data from 139 students enrolled in distance education courses taught through the Off-Campus Professional Agricultural Program at Iowa State University (King & Doerfert, 1996). Each of the participants in the study completed their

course work following one of three methods: videotape, ICN (Iowa Communication Network), a fiber optic network that allows for voice communication over a network, and face-to-face (King & Doerfert, 1996).

The findings of the study determined that the interaction needs of students varied based on the delivery methods used and that instructors needed personal contact with all students regardless of the delivery method (King & Doerfert, 1996). Furthermore, the study determined that students were satisfied overall with the courses, regardless of the delivery methods (King & Doerfert, 1996).

The findings of this study help reinforce the importance and the need for designing instructional strategies that help foster interaction between an instructor and the students. Even though the study did not look at online or blended education, the study also helps demonstrate that learners can be satisfied within a distance education setting, if designed properly. The success of the study lends support to investigating how courses can be structured to build a more satisfying learning environment.

As can be seen, a well-structured learning environment can have an impact on the ability for interaction to occur among students and between teachers and students. If designers and developers of online instruction are to maximize the benefits of interaction, they will need to pay close attention to developing the environment. This means that both designers and developers should start investigating the use of learning strategies to help build well structured learning environments.

Interaction through Computer-mediated Technologies

Numerous benefits and limitations have been identified dealing with online education. In an attempt to overcome one of the primary limitations of online education,

which was the loss of interaction within distance and online education (Kirby, 1999), a concept known as Computer Mediated Communications (CMC) was formed. CMC is the “communication between different parties separated in space and/or time, mediated by interconnected computers” (Romiszowski & Mason, 1996, p. 439). With regard to distance education, CMC is the communication that occurs via networked computers either between the learners or between the learners and the instructor. This form of communication has certain characteristics that make the communication process different than formerly offered communication media. These characteristics include the ability to provide highly interactive communication, multi-way communication, synchronous communication, and asynchronous communication (Romiszowski & Mason, 1996).

The highly interactive nature of communication supports the complex processes of interaction between participants (Romiszowski & Mason, 1996). In the case of Web-based training, learners have the ability to utilize the power of written communication, along with the speed of the Internet, to interact with other learners and instructors.

Multi-way communication is the ability for a minimum of two learners to communicate electronically (Romiszowski & Mason, 1996). In the case of Web-based instruction, this communication can occur by a learner sending out an email to another learner or by a learner posting a message to a series of learners on a discussion board.

Asynchronous technologies allow for learners to interact on their own time, at their own pace. When using this form of communication, the learners do not need to be online at the same time as other learners (Romiszowski & Mason, 1996). Instead, they have the ability to send and receive information at their own pace and on their own time. Typically, this would require one person to send or post a message to a person or a group

of people, followed by the receiver reading the posting and replying to the message. One of the primary benefits of these technologies is that learners have the ability to read and absorb messages sent through asynchronous technologies, thus, providing an opportunity for deeper, more meaningful responses.

Synchronous communication is “the communication between two or more people in real-time, such as classroom-based, face-to-face discussion, or a telephone conversation” (Romiszowski & Mason, 1996, p. 439). The primary benefit of synchronous technologies is that students and teachers can conduct conversations in a timelier manner than with asynchronous technologies. The primary limitation to this form of online communication is that both participating parties need to be online at the same time, often finding it difficult to determine a time suitable to all participants. Technologies used to produce synchronous forms of communication include chatrooms, video conferencing, and audio conferencing, to name a few.

As society continues to increase the demand for online, it becomes imperative that the learning outcomes of interaction are maximized through the use of online communication tools. One way of maintaining these levels of interaction is through the use of CMC. CMC technologies provide both teachers and students with a way of communicating through the use of both synchronous and asynchronous technologies.

Student-to-Student and Student-to-Teacher Interaction

Student-to-student and student-to-teacher interaction has been shown to be the most important kind of interaction within distance education (Soo & Bonk, 1998). Several studies have been conducted demonstrating the importance of student-to-student and student-to-teacher interaction.

Westbrook (1999) conducted a study to look at adults' perception of attitudinal changes towards a Web-based course. More specifically, the study was used to determine attitudinal changes regarding the level of interaction, satisfaction, technological interference, learning, and time spent on course content.

Participants of the study were thirty-two, part-time adult graduate students enrolled in a Leadership Essentials Web-based class during the 1998 summer term at a private university in the Midwest. Each of the students completed a pre- and post-class assessment, which was used to measure the students' attitudes toward instruction.

The results of Westbrook's (1999) study showed that there was a significant difference found between pre-test means and post-test means of student to instructor interaction, which indicates that students realized there was a greater level of instructor-to-student interaction than originally anticipated. A second finding concerned student-to-student interaction. A significant difference was found in the anticipated versus actual level of student-to-student interaction within the Web-based courses.

Westbrook's (1999) findings dealing with levels of satisfaction showed that there was no significant change in the attitudes of the students with regard to the level of satisfaction with the Web-based course. Also, when looking at technological interference and overall success of the class, no significant change was found over the course of the term (Westbrook, 1999).

Other findings focused on students' feelings about learning, time spent on course content, and the effect of the distance education experience. With regard to learning, students, in the Web-based course, felt as if they learned the same amount of information as those in the face-to-face course. When students were asked about the time spent on

course content, a significant difference was found indicating that more time was spent on course content in the Web-based class than on the traditionally offered face-to-face class. Finally, the study suggests that there was no significant difference in post-term scores between those students who had prior distance education experience and those who did not have prior distance education experience.

This study suggests that graduate students enrolled in their first Web-based class anticipated high levels of interaction, overall satisfaction, and low technological interference (Westbrook, 1999). Furthermore, similarities found in levels of learning and higher course involvement may help convince skeptics that Web-based instruction can offer the same quality of instruction as that found in a traditional face-to-face course. It should be noted that the study was specific to one class offered via Web-based instruction and that future studies should investigate these questions in other Web-based settings.

Another study conducted by Schutte (1997) investigated the effects of face-to-face vs. virtual professor-student interaction and the impact the environments have on test performance of students. It was argued that face-to-face interaction with a professor was fundamental to the learning process, and without this interaction, the students would suffer. It was also contended that the loss of face-to-face interaction with the professor would lead to greater interaction between the students, which, in turn, will result in higher student test results.

The subjects in the study were thirty-three students enrolled in the fall 1996 Social Statistics class at the California State University, Northridge. The subjects were randomly divided into two groups, one taught in a traditional classroom, and the other taught on the World Wide Web. Data were gathered and analyzed based on the

implementation of a pre-test questionnaire, a post-test questionnaire, and students' scores reported on a midterm and final examination.

The results of the study showed that the virtual class scored an average of 20% higher on both examinations than on the scores in both traditional class examinations. Furthermore, data showed that the virtual class had a significantly higher level of peer contact along with an increased amount of time spent on class work. Finally, the highest performing students reported the greatest amount of peer interaction, suggesting that the more interaction that occurs between students, the greater their level of achievement.

One of the major criticisms of this study was that the research design and methodology was so flawed that the results were uninterruptible (Jones, 1999). Based on this criticism, Jones (1999) conducted a follow-up study in an attempt to replicate Schutte's findings. To overcome one of the limitations of Schutte's (1997) study, a larger sample was used to try to gain statistical significance. The study was conducted at Texas A&M University and used 89 students enrolled in two sections of an introductory statistics course. Similar to the Web-based class in Schutte's (1997) study, Jones (1999) used lecture notes, online quizzes, a discussion listserver, email, and bi-weekly chat sessions. Furthermore, Jones (1999) used the same content, had the same assignments, and used the same elementary statistics text as was used in Schutte's (1997) study.

The results of this study conclude that Schutte's study was not reproducible, at least not with the student population used. Additionally, Schutte (1997) claimed that students in a Web-based class would be more likely to solicit others for help and understanding. This was not the case in this study. In fact, interaction within this course was resisted and students complained that one of the reasons for taking this course was

the flexibility of the medium and that the attempt to force interaction defeated the purpose of their taking the course. Finally, even though students were loyal and enthusiastic towards the class, participation in class discussions on the listserver was poor. On average, only 15%-20% of the students attended the live web-classes.

Based on the finding of this study, Jones (1999) was able to make two recommendations regarding Web-based instruction. The first recommendation was that future research needs to be conducted in an attempt to find the best teaching methodology for Web-based instruction. The second recommendation was that “it is unlikely that a simple translation of a course from a traditional classroom format to an all Web-based class will improve or degrade student learning performance” (Jones, 1999, p. 7).

Johnson et al. (2000) conducted a study to compare online vs. face-to-face instruction. The purpose of their study was to compare a graduate online course with an equivalent course taught in a face-to-face format. Their intent was to determine differences and similarities in student ratings of instructors and course quality, assessment of course interaction, structure, support, and learning outcome measures such as grades and student self-assessment of their ability to complete a specified course task.

The study compared the outcomes and data collected from students enrolled in one of two versions of a graduate level instructional design course. Both courses were taught by the same instructor, delivered by the same department, and required the same content, activities, and projects. The sample used for this study was thirty-eight HRD graduate students, nineteen of whom were enrolled in the online course and nineteen who were enrolled in the face-to-face course.

Three modes of data collection were used to answer the research questions. First, an instrument known as CISS (Course Interaction, Structure, and Support) was used and implemented across both treatment groups. The purpose of the instrument was to measure the interaction that occurs in the course, the course structure, and the course support. The instrument was implemented at the end or near the end of the semester.

Second, students of the course were required to create a package including all training materials and instructional aids needed to conduct a training course that they had created. Three doctoral students with instructional design experience then graded the packages for presentation quality, course organization, degree of detail, and overall quality.

The third mode of data collection was done by implementing a self-assessment instrument at the end of the semester. The purpose of this instrument was to determine comfort level of each of the students in performing the various ID tasks required of them.

The result of the study showed that student satisfaction with their learning experience was more positive for students in the traditional format than with the students in the online format. The students of both groups reported positive ratings for the quality of the instructor and the course even though the face-to-face group presented a slightly higher-level instructor quality. This may have been because the instructor was more comfortable and more effective in teaching in a more traditional class setting.

When looking at differences in perceptions of course interaction, structure, and support, findings revealed that students enrolled in the traditional face-to-face class had a more favorable opinion about the amount of interaction with other students. Even though there was no significant difference found in the amount of contact among students, there

was a significant difference found in terms of their ability to communicate with other students in the class when sharing learning experiences, a feeling of a sense of community, and being able to work as a team.

Findings dealing with student and instructor interactions showed that there was a significant difference in the items relating to students being informed about their course progress, student-to-instructor interactions, and the treatment of students in the course. The findings favored the traditional format. For course structure, the findings indicated that there was no significant difference found between the online format and the traditional face-to-face format in the students' abilities to work at their own pace, the quality of a course syllabus, the structure of class activities, and the student assessment. Instructor support revealed that the instructors in the face-to-face course had a higher rating for support than instructors in the online format. Departmental support revealed that support in the online format was significantly higher than that in the traditional face-to-face course.

Finally, the findings dealing with learning outcomes indicated that there was no significant difference found between the projects submitted by the students in the online format and the students in the traditional face-to-face format. Furthermore, there was no significance found between the overall grades of those students in the online class and those in the face-to-face class.

Overall, this study supports the argument that online forms of instruction can be at least as effective as courses taught in a traditional face-to-face mode; but, future studies need to be done in an attempt to determine how a course can be designed to increase and maximize interaction among students and between the instructor and students. The

findings of the study may have been due to a flaw in course design. It was possible that the flaw was in the instructional strategies employed in the online format were not designed to maximize interaction.

Fulford and Zhang (1993) conducted a study to examine the perceptions of student-to-student and teacher-to-student interaction and satisfaction in courses delivered through interactive television. More specifically, Fulford and Zhang (1993) were looking to see if learners' perceived personal level of interaction impacted their perceived level of overall interaction, if learners' perceived level of personal interaction helped predict learner satisfaction, if learners' perceived level of overall interaction helped predict learner satisfaction, and if there was a relationship between learners' perceived levels of both types of interaction and their satisfaction with instruction.

The study examined 123 K-6 instructors enrolled in a Developmental Approaches in Science and Health program, who completed three of the ten sessions used throughout the course (Fulford & Zhang, 1993). After each of the three sessions, each of the participants was instructed to complete a survey regarding their perceptions of the amount of interaction and the quality of the instruction.

The results of the study found that perceptions of personal interaction were a moderate predictor of learner satisfaction (Fulford & Zhang, 1993). The results also determined that an individual's perception of overall interaction was a critical predictor in the level of satisfaction. In other words, a high perceived level of interaction resulted in a high level of satisfaction with the instruction; a low perceived level of interaction resulted in a low level satisfaction with the instruction (Fulford & Zhang, 1993).

While this study was helpful in understanding an individual's perceptions of interaction and satisfaction in an interactive television course, it did not provide any insight into a course taught either in an online or blended format. Furthermore, the study evaluated individual perceptions of the overall course structure instead of looking at the individual instructional strategies used. Since a course is typically constructed of a number of individual instructional strategies and each instructional strategy can be delivered following any number of methods, it would be helpful to investigate an individual's perception of interaction and satisfaction toward each instructional strategy.

Conclusion

The review of literature has determined that interaction and satisfaction are critical components when determining the success of distance education. Currently, research in online education has focused primarily on comparing online education with traditional face-to-face forms of education. While authors have started to recognize the importance of interaction within online learning environments and the importance of incorporating specifically designed instructional strategies into distance courses, few have focused on investigating interaction and satisfaction in blended learning strategies. Given the many advantages of online education and the lack of research focusing on interaction within online or blended learning strategies, it is clear that more research needs to be conducted to determine the most appropriate learning strategies for maximizing student-to-student and student-to-teacher interaction in online learning strategies.

Chapter 3

Methodology

The review of literature revealed that interaction is an integral part of both online and traditional face-to-face educations. More specifically, asynchronous student-to-student and student-to-teacher interaction have been noted as the most important forms of interaction when build in online components to a course (Soo & Bonk, 1998). The review also revealed that interaction is a critical in when maintaining student's level of satisfaction (Fulford & Zhang, 1993). Finally, as identified in the literature, the creating of blended learning strategies can provide an opportunity which utilizes the best of multiple environments (Zenger & Uehlein, 2001) and when designed appropriately can help improve interaction and student satisfaction.

Based on the review of literature, the purpose of this study was to evaluate the effects that a blended learning strategy used to deliver course discussion activities had on student-to-student interaction, student-to-teacher interaction, and student satisfaction. The two strategies used in the study consisted of two possible approaches to completing the course discussion activities, an online asynchronous approach and a blended approach, consisting of both an online asynchronous approach and a traditional face-to-face approach. The results of the study provided the School of Information Sciences and Technology with the data needed to recommend a learning strategy to be used to deliver the online IST course discussion activities. The data collected helped evaluate the impact each of the learning strategies had on the student's perceptions of student-to-student interaction, student-to-teacher interaction, and satisfaction toward discussion activities in the online IST 110 course.

Course Selection

The IST 110 course, an Introduction to Information Sciences and Technology, was selected as the course to use for this study because of several factors. First of all, IST 110 was initially designed and developed to allow for an instructor to customize the experience for the students. Each of the instructional design strategies used within the course were developed with the understanding that an instructor may wish to modify the actual delivery of that activity. For example, an instructor may choose to complete the discussion activities online, in the classroom, or a combination of the two. The second reason for using IST 110 was the accessibility to the course and the ability to be able to modify the course structure to fit the requirements of the study. Finally, the course was selected because it was the first of a series of online IST courses that students had the option to take to enter the School of Information Sciences and Technology, which eliminated any possible exposure to the design model used for any of the other online IST courses.

Course Structure

The primary purpose of the IST 110 was to provide students with an introduction to basic concepts of information, information systems, and the "Information Age." Throughout this four-credit course, students developed an understanding of basic computing and information systems' principles and the social implications of information and information technology. The course also provided an overview of the creation, organization, analysis, storage, retrieval, and communication of information.

The course was developed to present the course information in the form of modules, topics, and lessons. A module was comprised of a series of topics; a topic was

comprised of a series of lessons; and a series of lessons was comprised of a series of instructional pages containing course content, images, animation, and discussion activities. The basic structure of the course provided the foundation for the instructional assessment module used to evaluate the students throughout the semester. For example, the IST 110 assessment model consisted of two module problems, three module quizzes, five lab activities, and thirteen discussion activities.

The module problems were completed in teams and were designed for the students to think critically about the topics that comprised each particular module. Once completed, the teams were then required to turn in a document and present their solution to the class and the instructor. The grades were determined based on a grading rubric presented to each of the students.

The module quizzes were a series of questions tied directly to the topic objectives for all topics in each of the modules. The quizzes were completed individually and were used to demonstrate each student's ability to comprehend each of the topic level objectives. Each of the quizzes had approximately 25 – 50 multiple-choice items.

The purpose of the lab activities was to provide the students with an opportunity to individually demonstrate their ability to utilize technology as a means of information dissemination. Through the lab activities, students demonstrated their knowledge, comprehension, and application of current software tools, specifically, Microsoft Office including Microsoft Word, Microsoft Excel, Microsoft PowerPoint, and Microsoft Access, and an HTML editor of their choice. Throughout the course, the students were expected to complete five lab activities, which made up the one-credit lab portion of the course.

The discussion activity questions were designed to encourage active communication and learning between the student and instructor virtually. By generating discussion (answers and responses) around questions embedded within the online course content, these activities served as a means of demonstrating the students' knowledge, comprehension, application, analysis, synthesis, and evaluation of each of the course topics.

For purposes of this study, only the discussion activities were to be completed following one of two learning strategies. Using the discussion activities was done because of the numerous ways in which they could be presented. They could be conducted in an online asynchronous mode through the use of online discussion boards, or a combination of the online discussion boards followed by a face-to-face discussion.

Course Resources

This online course was made up of three primary resources that were constructed for each of the students as they worked through the IST 110 course. Each of the resources was developed to provide each of the students with the information and technology needed for successful completion. The four course resources are described below.

Course content interface. The course content interface was an HTML-based browser window, which was used to present the course content. The content was accessed by students entering a URL and then by entering their Penn State user-id and password. After they were logged on, they were presented with a “slide out” panel that outlined all course modules, topics, and lessons. Selecting any of these loaded the appropriate content into the right frame of the browser window.

Course Communication Space. The primary purpose of the course communication space was to provide a means for students and instructors to communicate throughout the duration of the course. The course communication space allowed for email correspondence, course calendar presentation, discussion activity deployment, and finally, for delivery of course quizzes. For IST 110, ANGEL was the tool of choice because it allowed for all required forms of communication to occur within one application.

Student Roadmap. The Student Roadmap was a document that provided each student with all the answers and details needed for successful completion. Specifically, this Roadmap included:

- An outline for the course.
- An assignment checklist to keep you on track.
- Directions for completing all assignments.
- Grading rubrics for all assignments.
- Descriptions of all discussion activities.

Procedures

Each of the course sections received two weeks of a learning strategy. Section 1, completed the two weeks of course discussion activities using only the online discussion board, the other course section, section 5, completed the course discussion activities using the online discussion board coupled with a face-to-face session. Upon completion of each of the two-weeks, each individual was instructed to fill out the online survey, which was available from within the Course Communication Space.

To minimize the potential error due to differences in course structure, all courses content was presented to all the students in the same online format. Also, prior to completing each of the Discussion Activities, each of the students was directed to read the online course content associated with each of the week's Discussion Activities and then instructed to complete the course Discussion Activities.

To insure consistency between the course sections, the same instructor was used to facilitate all the discussion activities across both course sections. To try and ensure equal instructor involvement across the two sections, the instructor was asked to make, at a minimum, one instructor posting for every ten of the students postings in the online discussion board. Furthermore, when the instructor facilitated the face-to-face sessions, he was instructed to start the discussion by providing a summary of the online discussion threads in the form of a question. He was then instructed to facilitate the discussion by providing feedback as needed and to allow the discussion to continue as long as deemed appropriate.

To further validate the findings of the survey, structured individual interviews were conducted with a random sample of participants. These five participants were randomly selected from each of the two sections. During the interviews, each individual was asked a series of predetermined questions used to qualitatively gather their perceptions of student-to-student interaction, student-to-teacher interaction, and satisfaction. For tracking purposes, each of the individuals was instructed to state the last four digits of the social security number. Furthermore, each of the interviews was audio taped for further analysis. Refer to Appendix C for a list of question asked to each of the individuals interviewed.

Population and Sampling

Four IST 110 course sections were taught in the fall semester of 2001 at University Park I used in this study. Of those four sections, two of them followed the Online IST 110 model and all of the learning strategies used in this study. The participants of the study were 100 students taking IST 110 in the 2001 Fall Semester and were spread across two IST 110 course sections: section 1 ($N = 50$) and section 5 ($N = 50$). Of the 100 students, 84 could be used for data analysis. Based on the findings of Krefjic and Morgan (1970), of those 100 students, a sample of at least 80 students would be needed to adequately generalize to the larger population.

Research Variables

Based on the research questions and hypothesis identified for this study, several dependent, independent, and control variables have been identified. Further details of the dependent, independent, and control variables are discussed in the following sections of this document.

Dependent Variables

The dependent variables in this study were the perceptions of student-to-student interaction, teacher-to-student interactions, and student satisfaction. Both of the variables, student-to-student and student-to-teacher interaction, were measured independently by summing the responses to each of the questions identified on the perception of interaction. The range of scores for both student-to-student and student-to-teacher interaction was from five, representing the lowest level of interaction, and to twenty, representing the highest level of interaction.

Table 1: Summary, Definition, and Treatment of Data for Dependent Variables

Variable	Definition	Treatment of Data
<i>Student-to-Student Interaction</i>	Student's perceptions of the interaction that occurred between him/herself and the other students during the discussion activity	Individual values were calculated by summing the responses of the four-point Likert-type questions used to measure student-to-student interaction. The individual responses could range from 5 to 20.
<i>Student-to-Teacher Interaction</i>	Student's perceptions of the interaction that occurred between him/herself and the instructor during the discussion activity	Individual values were calculated by summing the responses of the four-point Likert-type questions used to measure student-to-teacher interaction. The individual responses could range from 5 to 20.
<i>Student Satisfaction</i>	Perceived value and quality of completing the discussion activities	Individual values were calculated by summing the responses of the six-point Likert-type question used to measure student satisfaction. The individual responses could range from 6 to 36.

Student satisfaction was used to analyze the students' perceptions of the quality of discussion activities. After each of the students completed each of the strategies for delivering discussion activities, they were asked to provide their perceptions of the

usefulness or quality of each of the strategies for presenting each of the discussion activities. The range of scores for student satisfaction was from six, representing the lowest level of satisfaction, and up to thirty-six, representing the highest level of satisfaction. Refer to Table 1 for a more detailed list of the dependent variables including the variable name, the variable definition, and the treatment of the data.

Independent Variables

The primary independent variables investigated were learning strategies, student-to-student interaction, and student-to-teacher interaction. Learning strategies referred to one of two potential learning environments in which a student performed the discussion activities while taking the IST110 course at the Pennsylvania State University. For purposes of this study, the learning environment variable was measured using nominal data by categorizing the environments into one of two strategies: an online asynchronous strategy, and a blended strategy consisting of both face-to-face and online asynchronous strategy.

Table 2: Summary, Definition, and Treatment of Data for the Dependent Variable

Variable	Definition	Treatment of Data
<i>Learning Strategies</i>	Learning strategies used for course discussion activities	Online = 0 Blended = 1
	Online = Completing the activity using only the online discussion board	
	Blended = A blending of completing the activity using the online discussion board followed by a face-to-face session.	
<i>Student-to-Student Interaction</i>	Student's perceptions of the interaction that occurred between him/herself and the other students during the discussion activity	Individual values were calculated by summing the responses of the four-point Likert-type questions used to measure student-to-student interaction. The individual responses could range from 5 to 20.
<i>Student-to-Teacher Interaction</i>	Student's perceptions of the interaction that occurred between him/herself and the instructor during the discussion activity	Individual values were calculated by summing the responses of the four-point Likert-type questions used to measure student-to-teacher interaction. The individual responses could range from 5 to 20.

Each of the two groups in each of the course sections followed both of the learning strategies for completing the course discussion activities. Each of the instructional strategies had its own set of requirements for how a student was expected to complete the discussion activity. For example, the online group completed its discussion activities in a pre-built discussion board and the blended group completed its discussion activities first in the pre-built discussion board and then continued the discussion in the classroom.

Additionally, both student-to-student and student-to-teacher interaction were also used as independent variables. Again, they were measured independently by summing the responses to each of the questions identified on the perception of interaction. The

range of scores for both student-to-student and student-to-teacher interaction was from five, representing the lowest level of interaction, and up to twenty, representing the highest level of interaction. Refer to Table 2 for a more detailed description of the independent variables used in this study.

Control Variables

Several variables were controlled for in this study. The three control variables, prior Internet experience, prior online discussion boards used, and prior online discussion boards used in a course, were not of theoretical importance in this study, but were included in the analysis because they may have had an impact on a student's ability to interact with other students or with the instructor and needed to be controlled.

Prior Internet experience refers to a student's past experience using or surfing the Internet. Such prior experience may impact a student's ability to use the integrated Internet technologies involved in this study. For example, with no prior Internet experience, a student may have had difficulties using Internet technologies such as email or a discussion board, limiting their ability to interact with other students or with the instructor. During this study, prior Internet experience was measured in the form of a yes or no response— yes, meaning that a student had past experience with Internet-based technologies; no, meaning that a student had no prior experience with using Internet-based technologies.

The variable, prior online discussion boards used, measured a student's past experience with using online discussion boards. For this study, prior online discussion boards used were being measured in the form of a yes or no response— yes, meaning that a student had used an online discussion board; no, meaning that a student had not

previously used an online discussion board. This variable was of importance because a person's use or lack of use with online discussion boards may have had an impact on whether they were successfully able to interact with the teacher or other instructors which, in turn, could have an impact on their level of satisfaction towards the activity.

Finally, the variable, prior online discussion boards used in a course, measured a student's past experience with using online discussion boards within a course setting. For this study, prior online discussion boards used in a course were being measured in the form of a yes or no response– yes meaning that a student had used an online discussion board in a course; no, meaning that a student had not previously used an online discussion board in a course. Obtaining this data was of importance because a person's use or lack of use with online discussion boards in a course could have an impact on whether they were successfully able to interaction with the teacher or other instructors which, in turn, could have an impact on their level of satisfaction towards the activity. Refer to Table 3 for a more detailed a list of the control variables used in this study.

Table 3: Summary, Definition, and Treatment of Data for Control Variables

Variable	Definition	Treatment of Data
<i>Prior Internet Experience</i>	The extent to which a student has used Internet-based technologies in the past	Yes = 0 No = 1
<i>Prior Online Discussion Boards Used</i>	The extent to which a student has taken a course in which an online discussion board was used	Yes = 0 No = 1
<i>Prior Online Discussion Boards Used in a Course</i>	The extent to which a student has taken a course in which an online discussion board was used when taking a course	Yes = 0 No = 1

Instrumentation

Perception of Student-to-Student and Teacher-to-Student Interaction

Interaction among students and between an instructor and a student can occur in multiple ways in online and distance education environments. Individuals can interact through the use of either written or verbal modes of communication, or they can interact in a nonverbal mode through active listening of other individuals. Given the nature of an online environment, students may not always be in the same setting at the same time but are still expected to interact with other students and instructors. While much of these interactions require individuals to send and receive messages to other individuals, it is possible that individuals may interact with other individuals by actively listening or reading messages and/or discussions posted by other individuals.

When trying to measure the interaction that occurred among students and between a teacher and a student, it was important to identify the most effective mode of measurement. Two primary methods for measuring interaction were identified in the literature; they are to measure the actual occurrences of interaction (DeVito & Hecht, 1990) or to measure interaction as perceived by each of the individuals (Fulford & Zhang, 1993). The use of either method has its own advantages and disadvantages.

Actual measures of interaction would investigate or determine the actual numbers or instances of interaction during an event. There are several common methods used for measuring and recording these behaviors; they are through the uses of observations, surveys, coding systems, and field notes (DeVito & Hecht, 1990). Each of these methods was intended to measure the actual occurrences or instances of interaction by measuring verbal and nonverbal behaviors such as questions and statements made during

conversation, occurrences of touch, eye contact, or body orientation (DeVito & Hecht, 1990).

One advantage of measuring actual occurrences of interaction was that patterns and instances of interaction among students and between the students and the instructor were able to be determined when all the individuals were located in the same setting. With the shift to online and distance education, actual occurrences of interaction were much more difficult to measure.

Individuals in online environments may interact differently than those in a traditional online environment. Interaction may not be measurable by looking at actual occurrences, but may be measurable by soliciting the perceptions of those individuals involved. Perception of interactions was used to determine the interaction that occurred from the perspective of an individual for a specific event. In a study conducted by Fulford and Zhang (1993), they found that perception of overall interaction was a critical predictor of learner satisfaction in a distance education course.

If one were to measure the actual amount of interaction that occurred, the measure would not have been able to investigate those students who interacted internally or from a distance. Based on this understanding, it was appropriate to measure a student's perception of interaction instead of attempting to measure the actual instances of interaction.

The instrument developed for this study was modified from two other surveys and was designed to collect the student's perceptions regarding student-to-student, student-to-teacher interaction, and student satisfaction. Since the survey used in this study was modified from two other surveys, construct validity was measured through the use of a

factor analysis. Prior to using the questions from the other instruments, permission was obtained from the initial authors.

The instrument consisted of three sets of questions used to measure each of the constructs, student-to-student interaction, student-to-teacher interaction, and student satisfaction. The first question set consisted of five questions used to measure student-to-student interaction; the second set of questions consisted of five questions used to measure student-to-teacher interaction; and the third set of questions consisted of six questions used to measure student satisfaction.

Student-to-student and student-to-teacher interactions were measured through a four point Likert-type scale ranging from strongly disagree (1) to strongly agree (4) (Appendix A). Student satisfaction was measured using a six-point semantic-differential scale, forcing a choice of either a negative or a positive response. The lowest response on the scale, one, indicated a very negative response, and the highest response, six, indicated a very positive response. To increase the reliability of the measures, redundant parallel questions were asked using several bi-polar adjectives.

The question sets used to measure student-to-student and student-to-teacher interaction were based on an instrument previously developed and tested in a study conducted by Johnson et al. (2000). The purpose of the instrument was to compare online versus face-to-face instruction. More specifically, the Course Interaction, Structure, and Support (CISS) instrument was developed to collect data regarding course interaction, structure, and support within both traditional face-to-face and online learning environments, and therefore was deemed appropriate for this investigation.

The CISS instrument was initially developed from three other validated instruments used to assess student's perceptions of course quality, interaction, structure, and support (Johnson et al., 2000). These three instruments were chosen because they were grounded in research and theory that was consistent with the objective and research questions addressed in this study. From these instruments, content experts in the field of education selected 50 items used to measure dialog, structure, and support. The instrument was then pilot tested in an undergraduate engineering course with 43 students and in two graduate courses with 25 students (Johnson et al., 2000).

Construct validity was established through the use of factor analysis procedures. For further explanation of the factor analysis procedures, refer to Johnson et al. (2000). Based on the analysis, 24 items were then selected from the original 50-item instrument. Eleven of the 24 items were used to measure course dialog, which can be further broken down into student-to-student and student-to-teacher interaction. For purposes of this study, five items were identified as appropriate to measure student-to-student interaction and five were identified as appropriate to measure student-to-teacher interaction, given the nature of the instructional activities used.

Student Satisfaction

The question sets used to measure student satisfaction were adopted from an instrument previously developed and used in a study conducted by Fulford and Zhang (1993). The initial purpose of the instrument was to examine a learner's perception of interaction and satisfaction in a course delivered by interactive television. More specifically, the instrument was developed to collect data regarding a student's personal level of interaction, a student's overall level of interaction, and a student's satisfaction

toward the quality and value of the instruction. Based on the intent of the instrument and its previous use to measure interaction and satisfaction within a distance education course, it was deemed appropriate for this investigation.

The question set used to measure student satisfaction consisted of an average score on a six-point scale that forced a negative or positive response. The lowest value, one, represented an extremely negative response and the highest value, six, represented an extremely positive response. To increase the reliability of the measure, redundant parallel questions were asked.

Since the newly created instrument was being used in a new setting, the internal reliability of the instrument was assessed. This was measured using Cronbach's alpha. To determine the reliability of the instrument, each of the individual constructs had to meet the general expected level of .7 (Nunnally, 1967).

Data collection for this study was done through the use of an online survey. Since all students completing the survey had been equally exposed to the course in an online format, an online survey was viable. The instrument was designed, developed, and implemented through the use of Macromedia Cold Fusion and was accessible only through a link provided through the course communication space. Access to the course communication space was secure; thus, this was a viable method of providing students secure access to the instrument.

Instrument Validation

Since the newly constructed course interaction and satisfaction instrument was developed from two existing surveys, further validation was performed. This was done by sending the survey out to three experts in the area of online courseware design and

development. Based on the feedback from the three experts, one of the questions used to measure student-to-student interaction was eliminated and two others were modified based on the context of the study. Two of the items used to measure student-to-teacher interaction were modified based on the context of the study. Finally, three of the items used to measure student satisfaction were modified.

Based on the validation process, the new instrument consisted of five items used to measure student-to-student interaction, five items used to measure student-to-teacher interaction, and six items used to measure student satisfaction. Additionally, six other control items were added to gather basic demographic data and other factors that may have influenced the student's perception of student-to-student interaction, student-to-teacher interaction, and student satisfaction. Each of the items used to measure student-to-student and student-to-teacher interaction ranged from one to four, one indicates strong disagreement to four indicating strong agreement. Each of the items used to measure student satisfaction ranged from one to six, one being least satisfied to six being most satisfied. See Appendix A to view a list of the items used in this instrument.

To further validate the findings from the survey, structured individual interviews were conducted with a random sample of participants. Ten participants were randomly selected from each of the two sections. Of those ten students, seven agreed to participate in the interviews. During the interviews, each of the individuals was asked a series of predetermined, qualitative questions which were used to gather their perceptions of student-to-student interaction, student-to-teacher interaction, and satisfaction. For tracking purposes, each person was instructed to state the last four digits of his or her

social security number. Furthermore, each of the interviews was audio taped and transcribed for further analysis.

Data Analysis

Student-to-student, student-to-teacher interaction, and student satisfaction were measured based on the data collected through the questionnaire. Data gathered from the survey was exported from the database and imported into SPSS, a research tool used to statistically analyze data.

Questionnaires containing missing or incomplete data were pulled from the study and not used in any of the data analysis. The reason for pulling the incomplete data sets was that, even with a reduced sample size, there were still enough subjects needed to run the desired statistical analysis technique.

Each of the questions and hypotheses identified in this study was developed with a specific data analysis technique in mind. As a result, the remainder of this section was used to outline the hypothesis used to answer each of the research questions and to describe the data analysis techniques used to answer the research hypothesis.

Research Question One

To answer the first research question, “What effect does student-to-student interaction have on learner satisfaction?” the following hypothesis was created:

Hypothesis One

H₀: No significant relationships exist between student-to-student interaction and student satisfaction at the $\alpha = .05$ level.

H₁: A significant relationship exists between student-to-student interaction and the student satisfaction at the $\alpha = .05$ level.

Research Question Two

To answer the second research question, “What effect does student-to-teacher interaction have on learner satisfaction?” the following hypothesis was created:

Hypothesis Two

H₀: No significant relationship exists between student-to-teacher interaction and student satisfaction at the $\alpha = .05$ level.

H₁: A significant relationship exists between student-to-teacher interaction and the student satisfaction at the $\alpha = .05$ level.

Research Question Three

To answer the third research question, “What effect do the learning strategies have on learner satisfaction?” the following hypothesis was created:

Hypothesis Three

H₀: No significant relationship exists in learner satisfaction by learning strategies at the $\alpha = .05$ level.

H₁: A significant relationship exists in learner satisfaction by learning strategies at the $\alpha = .05$ level.

Research Question Four

To answer the fourth research question, “How much do the perceptions of student-to-student interaction differ between learning strategies?” the following hypothesis was created:

Hypothesis Four

H₀: No significant relationship exists in student-to-student interaction by learning strategies at the $\alpha = .05$ level.

H₁: A significant relationship exists in student-to-student interaction by learning strategies at the $\alpha = .05$ level.

Research Question Five

To answer the fifth research question, “How much do the perceptions of student-to-teacher interaction differ between learning strategies?” the following hypothesis was created:

Hypothesis Five

H₀: No significant relationship exists in student-to-teacher interaction by learning strategies at the $\alpha = .05$ level.

H₁: A significant relationship exists in student-to-teacher interaction by learning strategies at the $\alpha = .05$ level.

Analysis Technique

Linear regression analyses were used to determine the impact each independent variable had on the corresponding dependent variable. This analysis was appropriate because it determined how well the independent variable helped predict the dependent variable. The direction and size of the change was evaluated through the examination of each of the *b* values.

Multiple regression analyses were also used to determine the impact the independent variables had on the dependent variable along with the control variables. A multiple regression analysis was the most appropriate technique because of its ability to determine the “effects of more than one independent variable on one dependent variable using principles of correlation and regression” (Kerlinger & Lee, 2000, p.527).

The overall significance for each of the multiple regression models was tested through the evaluation of the calculated F -ratio. When the F -ratio was found to be significant, then the b value for each of the independent variables for each of the equations was evaluated. When a given independent variable or control variable was found to be significant, then the b value was further evaluated to determine the size and direction of the change.

The basic multiple regression models were as follows:

$$\hat{y} = a + b_1 x_1 + b_2 x_2 + \dots + b_k x_k + e$$

Where \hat{y} was the criterion variable, a was the regression constant, bs were the regression coefficients, xs were the predictor variables, k was the number of predictor variables used, and e was the random deviation of an observed y value from the regression line.

Chapter 4

Results

This chapter contains a summary of the data collected for testing the hypotheses stated in Chapter 3. The five hypotheses in this study were designed to test the impact the two learning strategies had on student-to-student interaction, student-to-teacher interaction, and student satisfaction. Furthermore, several of the hypotheses tested the impact student-to-student interaction and student-to-teacher interaction had on student satisfaction.

Survey Reliability

The internal consistency reliability of the instrument used in this study was measured through the use of the Cronbach's α reliability coefficient. The items used to measure student-to-student interaction had a Cronbach's α of .75; the items used to measure student-to-teacher interaction had a Cronbach's α of .80; and the items used to measure student satisfaction had a Cronbach's α of .84.

Demographics

There were 100 students distributed equally between two course sections solicited to participate in this study. Of the 100 students, 84 of them completed the online survey and consented to having their data utilized. Most of the students participating in this study were white males between the ages of 17 and 19 and enrolled in the School of Information Sciences and Technology (see Table 4). A majority of the students participating in this study have used the Internet and an online discussion board prior to this study (see Table 4).

Table 4: Demographic Statistics for Participants Across Course Sections

	Course Section		Total	%
	Online Only	Online and Face-to-Face		
Age				
17-19	35	29	64	76%
Other	7	13	20	24%
Gender				
Male	35	31	66	79%
Female	7	11	18	21%
Ethnic Background				
Caucasian	31	39	70	83%
Other	11	3	14	17%
College of Enrollment				
IST	34	28	62	74%
Other	8	14	22	26%
Use Internet?				
Yes	41	40	81	96%
No	1	2	3	4%
Use Online Discussion Board?				
Yes	25	39	64	76%
No	17	4	21	25%
Used Online Discussion Board in a Course?				
Yes	5	9	14	17%
No	37	33	70	83%

Hypothesis One

H₀: No significant relationship exists between student-to-student interaction and student satisfaction at the $\alpha = .05$ level.

H₁: A significant relationship exists between student-to-student interaction and the student satisfaction at the $\alpha = .05$ level.

Hypothesis one was tested by running two regression analyses. The first equation regressed student-to-student interaction on student satisfaction and the second equation regressed student-to-student interaction and the control variables on student satisfaction.

The first regression equation revealed that there was a positive, significant difference between student-to-student interaction and student satisfaction ($b = 1.27, p < .001$) (See Table 5). The second equation, a multiple regression equation, revealed that there was a significant difference between student-to-student interaction, the control variables, and student satisfaction, $F(8,75) = 9.34, p < .001$ (See Appendix C, Figure 3). Among those variables found to be significant were student-to-student interaction and ethnic background. For every change in student-to-student interaction, there was approximately a positive one-point change in the level of student satisfaction ($b = 1.29, p < .001$) (See Table 5). Non-Caucasian students scored two points higher in their level of satisfaction than Caucasian students ($b = 1.86, p < .05$) (See Appendix C, Figure 2).

Based on the findings, I was able to reject the null hypothesis and accept the alternative hypothesis that there was a significant difference between student-to-student interaction and student satisfaction. See Appendix C, Figures 1, 2, and 3 to view the results of the regression equations.

Hypothesis Two

H₀: No significant relationship exists between student-to-teacher interaction and student satisfaction at the $\alpha = .05$ level.

H₁: A significant relationship exists between student-to-teacher interaction and the student satisfaction at the $\alpha = .05$ level.

Hypothesis two was tested by running two regression analyses. The first equation regressed student-to-teacher interaction on student satisfaction and the second equation regressed student-to-teacher interaction and the control variables on student satisfaction.

The first regression equation revealed that there was a positive, significant difference between student-to-teacher interaction and student satisfaction ($b = .61, p < .01$) (See Table 5). The second equation, a multiple regression equation, revealed that there was a significant difference between student-to-teacher interaction, the control variables, and student satisfaction, $F(8,75) = 3.34, p < .01$ (See Appendix C, Figure 6). Among those variables found to be significant were student-to-teacher interaction, college enrollment, and prior experience with the Internet. For every change in student-to-teacher interaction, there was approximately a positive three quarter of a point change in the level of student satisfaction ($b = .69, p < .001$) (See Table 5). Students enrolled in a major other than IST had a three point lower level of satisfaction than students enrolled in IST ($b = -3.35, p < .05$) (See Appendix C, Figure 5). Students who had not used the Internet before were six points less satisfied than students who had used the Internet ($b = -5.91, p < .05$) (See Appendix C, Figure 5).

Based on the findings, I was able to reject the null hypothesis and accept the alternative hypothesis that there was a significant difference between student-to-teacher interaction and student satisfaction. See Appendix C, Figures 4, 5, and 6 to view the results of the regression equations.

Table 5: Regressions of Student-to-Student and Student-to-Teacher Interaction on Student Satisfaction

	Student-to-Student Interaction	Student-to-Teacher Interaction
Δ Student Satisfaction Unit Δ in Independent Variable (95% Confidence Interval)	1.27 ^{***, a} (.96, 1.58)	.61 ^{** , c} (.25, .97)
Regression Adjusted Mean Difference Student Satisfaction (95% Confidence Interval)	1.29 ^{***, b} (.94, 1.63)	.69 ^{** , d} (.31, .106)

** $p < .01$

*** $p < .001$

^aSee Appendix C, Figure 1

^bSee Appendix C, Figure 2

^cSee Appendix C, Figure 4

^dSee Appendix C, Figure 5

Hypothesis Three

H₀: No significant relationship exists in learner satisfaction by learning strategies at the $\alpha = .05$ level.

H₁: A significant relationship exists in learner satisfaction by learning strategies at the $\alpha = .05$ level.

Hypothesis three was tested by running two regression analyses. The first equation regressed learning strategies on student satisfaction; the second equation regressed learning strategies and the control variables on student satisfaction.

The first regression equation revealed no significant difference (see Appendix C, Figure 7). The second equation, a multiple regression equation, also revealed no significant difference (See Appendix C, Figures 8 and 9).

Based on the findings, I was not able to reject the null hypothesis that there was a significant difference between learning strategies and student satisfaction. See Appendix C, Figures 7, 8, and 9 to view the results of the regression equations.

Hypothesis Four

H₀: No significant relationship exists in student-to-student interaction by learning strategies at the $\alpha = .05$ level.

H₁: A significant relationship exists in student-to-student interaction by learning strategies at the $\alpha = .05$ level.

Hypothesis four was tested by running two regression analyses. The first equation regressed learning strategies on student-to-student interaction and the second equation regressed learning strategies and the control variables on student-to-student interaction.

The first regression equation revealed that there was a positive, significant difference between learning strategies and student-to-student interaction ($b = 1.07, p < .05$) (See Table 6). The second equation, a multiple regression equation, revealed that there was a significant difference between learning strategies and the control variables, $F(8,75) = 2.69, p < .05$ (See Appendix C, Figure 12). Among those variables found to be significant were gender and college of enrollment. Students not enrolled in IST perceived lower levels of interaction than those enrolled in any other major ($b = -2.28, p < .05$) (See Appendix C, Figure 11). Females perceived higher levels of student-to-student interaction than males ($b = 1.22, p < .05$) (See Appendix C, Figure 11).

Based on the first regression equation, I was able to reject the null hypothesis and accept the alternative hypothesis that there was a significant difference between student-

to-student interaction and learning strategies. Based on the multiple regression equation, I was unable to reject the null hypothesis. See Appendix C, Figures 10, 11, and 12 to view the results of the regression equations.

Hypothesis Five

H₀: No significant relationship exists in student-to-teacher interaction by learning strategies at the $\alpha = .05$ level.

H₁: A significant relationship exists in student-to-teacher interaction by learning strategies at the $\alpha = .05$ level.

Hypothesis five was tested by running two regression analyses. The first equation regressed learning strategies on student-to-teacher interaction and the second equation regressed learning strategies and the control variables on student-to-teacher interaction.

The first regression equation revealed that there was a significant difference between learning strategies and student-to-teacher interaction ($b = 1.98, p < .001$) (See Table 6). The second equation, a multiple regression equation, revealed that there was a significant difference between learning strategies, the control variables, and student-to-teacher interaction, $F(8,75) = 3.50, p < .001$ (See Appendix C, Figures 15). Among those variables found to be significant were learning strategies. Students who completed the online and face-to-face learning strategy perceived higher levels of interaction than those students completing the online only learning strategy ($b = 2.00, p < .001$) (See Table 6).

Based on the findings, I was able to reject the null hypothesis and accept the alternative hypothesis that there was a significant difference between student-to-teacher interaction and learning strategies. See Appendix C, Figures 13, 14, and 15 to view the results of the regression equations.

Table 6: Summary of Regression Analyses of Learning Strategies on Student-to-Student Interaction, Student-to-Teacher Interaction, and Student Satisfaction

	<u>Student Satisfaction</u>	<u>Student-to-Student Interaction</u>	<u>Student-to-Teacher Interaction</u>
Learning Strategies			
Online Only			
<i>M</i>	26.86	14.76	15.12
<i>SD</i>	4.39	2.09	1.86
Online and Face-to-Face			
<i>M</i>	27.79	15.83	17.10
<i>SD</i>	3.71	2.07	2.30
Mean Difference by Learning Strategy (95% Confidence Interval)	0.93 ^a (-.84,2.69)	1.07* ^c (.16,1.98)	1.98** ^e (1.07,2.89)
Regression Adjusted Mean Difference by Learning Strategy (95% Confidence Interval)	1.43 ^b (-.51,3.37)	0.83 ^d (-.14,1.81)	2.00** ^f (.97,3.02)

* $p < .05$

** $p < .001$

^aSee Appendix C, Figure 7

^bSee Appendix C, Figure 8

^cSee Appendix C, Figure 10

^dSee Appendix C, Figure 11

^eSee Appendix C, Figure 13

^fSee Appendix C, Figure 14

Chapter 5

Discussion

Summary

The purpose of this study was to evaluate the effects two learning strategies had on student-to-student interaction, student-to-teacher interaction, and student satisfaction. Two sections of the Online IST 110 were used to collect data for this research study. Each of the course sections followed one of the two learning strategies. The one course section completed the discussion activities using only an online discussion board, while the other course section completed the discussion activities using an online discussion board followed by a face-to-face class session. Each course section followed the designated learning strategy for two weeks. Upon completion of the two weeks, all students were asked to complete a survey used to measure their perceptions of student-to-student interaction, student-to-teacher interaction, and student satisfaction. To help control for instructor differences, the same instructor was used to facilitate the activities in both course sections. The remainder of this chapter was used to discuss the findings of this study.

Discussion and Implications

Interaction and Student Satisfaction

Two of the hypotheses in this study examined the impact student-to-student interaction and student-to-teacher interaction had on student satisfaction. The linear regression analysis revealed that both student-to-student interaction and student-to-teacher interaction had a direct, positive relationship with the level of student satisfaction

when completing an online IST course discussion activity. See Figure 2 to view the relationship between the researched variables.



Figure 2: Interaction on Student Satisfaction

When regressing the student-to-student interaction and the control variables on student satisfaction, student-to-student interaction and ethnic background were found to be significant. When regressing student-to-teacher interaction and the control variables on student satisfaction, student-to-teacher interaction, college enrollment, and prior experience with the Internet were found to be significant.

Follow-up interviews revealed that students were expressed that they were satisfied with the level of student-to-student interaction. They reported that they liked having access to the discussion board because they were able to read and react to each other's postings; however, they felt that a majority of the students seemed to post answers for themselves but were uninterested in interacting with other students.

Another interesting finding was the impact the control variables and student-to-teacher interaction had on student satisfaction. Interviews further supported the findings as they revealed that students were satisfied in knowing that the instructor was available, if needed; however, students would have preferred more immediate feedback from the

instructor regarding their individual postings. In addition, non-IST students and students who did not have prior Internet experience were significantly less satisfied than those who were IST students or had prior Internet experience. There are several explanations for these findings. First, it was possible that those students who were not enrolled in IST may have been less motivated throughout the discussion activities. Since these students may have been taking the course as an elective or as a minor, they may not have been as interested in interacting with the IST instructor, thus decreasing their level of satisfaction.

One is cautioned to generalize that students without prior Internet experience would be less satisfied than students with prior Internet experience. Through a more in-depth examination into the data, it was found that two of the respondents reported never having used the Internet prior to taking this class. These same respondents also claimed that they had used an online discussion board. One explanation that may contribute to this contradiction was that the respondents who claimed they had never used the Internet were unaware that online discussion boards were a form of an Internet-based technology.

Another interesting finding was the impact the control variables, along with student-to-student interaction, had on student satisfaction. When the control variables were placed into the regression equation, student-to-student interaction and ethnic background were significantly related to student satisfaction. Caucasians students were significantly more satisfied than non-Caucasian students. Non-Caucasian students may have had a different level of satisfaction due to language or cultural differences. Even though a majority of the class was made up of Caucasians, a majority of the non-Caucasians were comprised of students from non-English speaking countries. Since this was a freshman level course and possibly the first class taken by the non-English

speaking students, they may not have felt confident enough with their ability to communicate with English speaking students, thus decreasing their level of satisfaction. Secondly, it was possible that cultural differences caused a difference in student satisfaction. In some cultures, students are expected to be passive recipients of knowledge and they are discouraged from participating in active dialog.

One should be cautioned before generalizing the ethnic background finding to a larger population. It is possible that the significance of the finding was due to the way the variable ethnic background was coded and placed in the regression equation. The variable was categorized as placing the students as either being a Caucasian student or a non-Caucasian student. This categorization did not account for other differences such as differences in language or culture. Future research should investigate such differences before make generalizations.

The significance of the above findings is that both student-to-student and teacher-to-student interactions are significant contributors to the level of student satisfaction. If an instructor wishes to create a satisfying learning environment, the results of this study suggest building learning environments to promote both student-to-student and teacher-to-student interaction with all students. Building interaction into learning environments may become dependent on the accessibility to technology and the time available for integrating desired learning strategies.

One study that helps support the findings of the current study was a study conducted by Fulford and Zhang (1993). This instructional study examined if a learner's perceived personal level and perceived overall level of interaction impacted learner satisfaction (1993). The authors found that perceptions of personal interaction were a

moderate predictor of learner satisfaction and that an individual's perception of overall interaction was a critical predictor in the level of satisfaction (Fulford & Zhang, 1993).

Both the findings of Fulford and Zhang (1993) and this study support the relationship of interaction to satisfaction: the level of learner satisfaction increases with ones perceived level of interaction. However, one should be cautioned that the design of these two studies differed in two ways. First, the current study primarily used freshmen enrolled in a technology-based course while Fulford and Zhang used K-6 instructors enrolled in a Developmental Approaches in Science and Health program (1993). Secondly, Fulford and Zhang (1993) measured interaction by combining both student-to-student and student-to-teacher interaction rather than looking at the independent effects of the two variables.

Based on the findings described in the aforementioned paragraphs, future studies need to take a deeper look at the impact ethnic background, college of enrollment, and prior Internet experience, combined with student-to-student and student-to-teacher interaction have on student satisfaction. Additionally, future studies need to investigate the relationship of student-to-student and student-to-teacher interaction on student satisfaction where different populations, course offerings, instructors, and course activities are investigated.

Learning Strategies and Student Satisfaction

One of the hypotheses in this study examined the impact two learning strategies had on student satisfaction. The analysis revealed that there was no significant difference between the learning strategies and the level of student satisfaction. See Figure 3 to view the relationship between the researched variables.



Figure 3: Learning Strategies on Student Satisfaction

Contradictory to the statistical analysis, follow-up interviews revealed that while students were satisfied with both learning strategies, they were slightly more satisfied with the addition of the face-to-face session. Some participants reported that one of the most satisfying components of completing the discussion activities using the blended learning strategy was that each student was able to prepare for the discussion prior to attending the face-to-face session. Furthermore, the students felt that by using the blended learning strategy, they were able to be more open in their discussion. They liked having the opportunity to read through other students' postings as well as reading replies from the instructor prior to attending the face-to-face setting. Finally, the students enjoyed using the online discussion board because it gave them an opportunity to compare their postings with those from other students and from the instructor.

There are several explanations as to why there was no significant finding between the learning strategies and the level of student satisfaction. One possible rationale was explained in a study conducted by Hackman and Walker (1990). In this study, Hackman and Walker (1990) suggested that teacher immediacy strongly impacts student satisfaction. Moreover, they looked at the effects of teacher immediacy on student

satisfaction within a televised classroom versus a traditional face-to-face classroom (Hackman & Walker, 1990). Even though their study did not investigate the integration of blended versus non-blended learning strategies, their findings can provide some insight into ways of improving student satisfaction.

Another finding of significance by Hackman and Walker (1990) was that instructors who used strategies to encourage involvement, provide individual feedback, and promote relationships were viewed to be more favorable than those that did not. In particular, “a greater rapport was felt when students were asked questions and encouraged to talk” (p. 205).

A final noteworthy finding by Hackman and Walker (1990) was that audio and video clarity had a positive impact on the level of student satisfaction within a televised course. While this finding has significant importance to courses delivered via televised instruction, it may also have direct implications for building learning strategies into a course activity using computer-mediated technologies. Hackman and Walker (1990) found that student satisfaction was directly related to the transmission of the message. This finding may also explain the lack of difference between the learning strategies and the level of student satisfaction. When the students were completing the activities using the online discussion board, they may have run into technical difficulties as they either tried to read other students’ responses or tried to post a response. The technical difficulties, even though not identified, may have accounted for lower levels of satisfaction towards either of the two environments.

Based on the findings of Hackman and Walker (1990) and the findings in the current study, future studies should look at the impact teacher immediacy has on student

satisfaction. Such a study should investigate how much teacher and student involvement is required to maintain a student's level of satisfaction within a course, what strategies should be used by the instructor to build relationships among students and between teachers and their students, and what level of feedback is required to maximize the student's level of satisfaction. While the current study primarily investigated the impact two learning strategies had on student satisfaction, it did not investigate the impact teacher immediacy had on student satisfaction. Further exploration needs to be conducted to determine the importance of teacher immediacy on student satisfaction between the two learning strategies and to establish which learning strategy produces the lowest level of technical issues.

Based on the aforementioned discussion, one implication of this finding was that students who completed course discussion activities were equally satisfied whether or not the activity included a face-to-face session. Before one can generalize these findings to all types of course activities, one first needs to further investigate the use of the same strategies for other course activities. Furthermore, future studies should examine the impact various technologies have on providing opportunities to interact both with other students and with the instructor and to determine if different technology-based learning strategies provide greater levels of student satisfaction.

Learning Strategies and Interaction

Two of the hypotheses in this study examined the impact two learning strategies had on student-to-student and student-to-teacher interaction. The linear regression analysis revealed that students who followed the blended learning strategy had a higher perception of student-to-student and student-to-teacher interaction than those students

who followed the online only strategy when completing an online IST course discussion activity. See Figure 4 to view the relationship between the researched variables.



Figure 4: Learning Strategies on Interaction

When regressing the learning strategies and the control variables on student-to-teacher interaction, it was found that the control variables had no significant effect on student-to-teacher interaction, but the learning strategies remained significant. When regressing the learning strategies and the control variables on student-to-student interaction, gender and college of enrollment were found to be significant. This finding suggests that gender and college of enrollment may have a greater influence on student-to-student interaction than the learning strategies.

Follow-up interviews supported the data analysis for student-to-teacher interaction. When participants used only the online discussion board, they felt that little student-to-teacher interaction occurred since interaction with the instructor was unnecessary to successfully complete the course activity. However, if the instructor had used the discussion board to its fullest potential, more student-to-teacher interaction would have occurred. Finally, the participants reported that there was a lack of immediate feedback from the instructor, which could potentially be a problem. However,

it was helpful when the instructor posted a response in the discussion board. It was also reported that the students would have liked to have seen the instructor provide more feedback to the postings.

When the participants used the online discussion board followed by the face-to-face session, students expressed that there was a good amount of interaction with the instructor. They felt that the face-to-face component gave the instructor the opportunity to discuss the topics more in depth than when using only the online discussion board and that the instructor was able to provide immediate feedback. Furthermore, it was noted that even when a student did not actively participate in the discussion, the student was able to hear the instructor's response and then compare it to his or her own posting.

The interviews used to look at student-to-student interaction revealed that participants using only the online discussion board felt that there was very little direct interaction with other students. They felt that individuals seemed to post answers for themselves, but did not interact with others through posting to other individual's responses. Even when a student did respond to another student's posting, the thread only occurred for one level. The participants felt that student-to-student interaction occurred by actively reading other student responses. Overall, the impression of the participants was that generating postings using only the online discussion board was still better than if they had to write a response on paper and then submit it.

The blended strategy, on the other hand, was reported to be much more interactive than the online-only strategy. The blended strategy allowed for more immediate feedback from other students and allowed for more spontaneous discussion among students. The participants also liked having the opportunity to view the other students'

perspectives prior to coming to the class discussion. They felt it helped formulate their thoughts and encouraged a greater amount of in-class discussion. In summary, the interviews provided support that the blended learning strategy was the ideal strategy for completing the discussion activities allowing for the greatest amount of student-to-student interaction.

Of particular interest was the impact the control variables had on student-to-student interaction. When the control variables were placed into the regression equation, college of enrollment and gender were found to be significant, while learning strategies were not. This finding was of particular importance because it would suggest that college of enrollment and gender might play a bigger role in producing student-to-student interaction than the learning strategy.

There are several explanations for these findings. First, it was possible that those students who were not enrolled in IST may not have been as motivated to interact with the instructor throughout the discussion activities, thus decreasing their perceptions of student-to-student interaction. Since these students may have been taking the course as an elective or as a minor, they may not have been as interested in interacting with other IST students.

One other possible factor that could have had a direct impact on the students' and the instructor's ability to interact online, which was not identified in this study, was the use of the online discussion board. Through the use of the discussion boards, students and teachers have the ability to create, read, and react to discussion board threads. While this computer-mediated communication technology provides a means for interaction among students and between an instructor and students, this technology does not come

without its limitations. One of the major limitations was that instructors and “students must navigate to one central location where the messages are posted” (Box, 1999).

The online discussion board used within this course may have impacted the level of student-to-student and student-to-teacher interaction. The online discussion board used in this course required the students to login to an application, navigate to the appropriate discussion board, and read through and respond to a given thread, which may have limited the availability and immediacy of receiving responses from other students and the instructor. This need for manual navigation to a thread may have had a negative impact on the student’s ability and interest to interact with other students and the instructor.

One study that helps support the findings of the current study was a study conducted by Johnson et al. (2000). In this study, the authors found that the level of student-to-student and student-to-teacher interaction was perceived to be greater in the face-to-face section than in the online section. While the study conducted by Johnson et al. (2000) revealed significant findings, it differed in two ways from the current study.

First, the study conducted by Johnson et al. (2000) focused on investigating the differences that occurred between two courses; one taught online and the other taught face-to-face. The current study focused on investigating two learning strategies used to complete only one type of course activity. The importance of investigating individual learning activities, instead of overall course designs, was because certain course activities may lend themselves to different learning strategies such as online, face-to-face, or blended, mixing the two strategies.

A second difference between the two studies was that Johnson et al. (2000) used graduate level Instructional Systems Design students. The current study utilized primarily freshmen students taking a 100 level Introduction to Information Sciences and Technology course.

While both the current study and the study by Johnson et al. (2000) provide valuable data to support both the face-to-face and the blended learning strategies, neither of the studies compared the use of an online, face-to-face, or blended learning strategy. Based on these two studies, future research needs to be done to identify the impact face-to-face, online, and blended learning strategies have on both student-to-student and student-to-teacher interaction.

In conclusion, it was possible that different learning strategies needed to be constructed to increase the perception of student-to-student interaction. Further research needs to be done in this area to investigate which learning strategies produce the greatest perceptions of student-to-student interaction based on a student's college of enrollment and gender. Additionally, the integration of technology needs to be further investigated to determine which tools or features best promote both student-to-student and student-to-teacher interaction.

Student Interaction, Learning Strategies, and Student Satisfaction

An interesting phenomenon occurred while analyzing the data. The study found that students completing the course discussion activities using the hybrid learning strategy reported a significantly greater level of student-to-student and student-to-teacher interaction when using a linear regression equation than students who used only the online discussion board strategy. It was also found that student-to-student interaction and

student-to-teacher interaction had a significant positive impact on the level of student satisfaction. Based on these findings, one would expect that the hybrid learning strategy would have produced a greater level of student satisfaction than the online discussion board strategy. Interestingly, this was not the case; no significant difference was found between the learning strategies used and the student's satisfaction.

As reported earlier, no significant difference between student-to-student interaction and learning strategies was found when using a multiple regression equation containing the control variables. This result may suggest that other independent variables may have a stronger influence on a student's perception of student-to-student interaction than the learning strategy. Future research might further examine the impact other independent variables, such as gender and college of enrollment may have on student-to-student interaction.

Conclusion

The findings of this study provide support for the importance of student-to-student and student-to-teacher interaction, especially when one is concerned with improving the level of student satisfaction. The findings also support the need designers to create specially designed learning strategies to increase the student's perception of student-to-student and student-to-teacher interaction.

More specifically, based on the findings from this study, it was recommended that when teaching the Online IST 110 course, if instructors are interested in increasing the level of student-to-teacher interaction, they should be encouraged to conduct the course discussion activities following the blended learning strategy. If instructors are interested in increasing the students' level of satisfaction toward completing the course discussion

activities, they need to integrate strategies to improve both student-to-student interaction and student-to-teacher interaction. Even though the blended learning strategy did not produce the greatest level of student satisfaction and student-to-student interaction, it did produce the greatest level student-to-teacher interaction. Several factors have been identified as potential barriers that could account for the lack of significance between student-to-student and student-to-teacher interaction. Several of these factors include: teacher immediacy, instructor differences, interest in activity, amount of feedback required from an instructor, college of enrollment, and class size.

Also, based on the findings of this study, further investigation needs to be conducted to investigate the use of learning strategies to improve student satisfaction. One recommendation is to investigate other strategies for developing blended learning environments. For example, a blended strategy might be designed to use any combination of face-to-face and computer-mediated communications technologies.

Future studies might look at the use of online discussion boards combined with a variation of chat room or video conferencing technologies. By looking at other technologies, one might be able to determine if there is a combination of communication strategies that build an ideal blended learning environment.

Finally, due to the very narrow sample used in this study, it is recommended that further exploration be conducted with a larger population of students before generalizing the current findings to other online IST courses or other population. It was possible that the nature of the course content and the questions being posed in the discussion activities may have a direct impact on the level of satisfaction and the students' perception of student-to-student and teacher-to-student interaction.

Bibliography

- Aase, S. (2000). Online learning goes the distance. *International Data Corp.*, Retrieved October 2, 2000, from <http://currents.net/articles/1910,1,1,1,1001,00.html>
- Baker, M. H. (1995). Distance teaching with interactive television: Strategies that promote interaction with remote-site students. *Encyclopedia of Distance Education Research in Iowa*. Research Institute for Studies in Education. College of Education. Iowa State University, Ames, Iowa.
- Barron, A. (1998). Designing web-based training. *British Journal of Educational Technology*, 29(4), 355-370.
- Berge, Z. L. (1999). Interaction in post-secondary web-based learning. *Educational Technology*, 39(1), 5-11.
- Box, K. (1999). *Human interaction during teacher training courses delivered via the internet*. San Antonio, TX: Society for Information Technology & Teacher Education Conference. (ERIC Document Reproduction Services No.)
- Brown, S. A., & Vician, C. (1997, December 12-14). *An examination of the characteristics of student interaction in computer-based communication assignments*. Paper presented at the 12th Annual International Academy for Information Management Conference, Atlanta, GA.
- Burgstahler, S. (1997). Teaching on the net: What's the difference? *T.H.E Journal*, 24(9). Retrieved October 9, 2000, from <http://www.thejournal.com/magazine/vault/A1365.cfm>
- DeVito, J. A., & Hecht, M. L. (1990). *The nonverbal communication reader*. Prospect Heights, Ill.: Waveland Press, Inc.
- Edwards, C., & Fritz, J. H. (1997). *Evaluation of three educational online delivery approaches*. Paper presented at the 2nd Mid-South Instructional Technology Conference, Murfreesboro, TN.
- Flanders, N. A. (1970). *Analyzing teaching behavior*. Reading, MA: Addison-Wesley.
- Friedman, T. L. (1999, November 17). Next, it's e-ducation. *The New York Times*, pp. 2.
- Fulford, C. P., & Zhang, S. (1993). Perceptions of interaction: The critical predictor in distance education. *The American Journal of Distance Education*, 7(3), 8-21.
- Ganzel, R. (2001). Associated learning. *Online Learning*, 5(5), 36-41.
- Gilbert, L., & Moore, D. R. (1998). Building interactivity into web courses: Tools for social and instructional interaction. *Educational Technology*, 38(3), 29-35.

- Hackman, M. Z., & Walker, K. B. (1990). Instructional communication in the televised classroom: The effects of system design and teacher immediacy on student learning and satisfaction. *Communication Education, 39*, 196-206.
- Horton, W. (2000). *Designing web-based training*. New York, NY: John Wiley & Sons, Inc.
- Imel, S. (1997). *Web-based training*. Columbus, OH: ERIC Clearinghouse on Adult, Career, and Vocational Education Center on Education and Training for Employment College of Education. (ERIC Document Reproduction Services No. ED414446)
- Jackson, G. B. (1994). *A conceptual model for planning agricultural distance education courses and programs*. Paper presented at the 21st Annual National Agricultural Education Research Meeting, Dallas, Tx.
- Jansen, D. G., & Lewis, W. B. (1996). Creating high levels of interaction in distance education courses. *American Technical Education Association Journal, 24*(1), 8-9.
- Johnson, S. D., Aragon, S. R., Shaik, N., & Palma-Rivas, N. (2000). Comparative analysis of online vs. face-to-face instruction. *Journal of Interactive Learning Research, 11*(1), 29-50.
- Jones, E. R. (1999, February 28-March 4). *A comparison of an all web-based class to a traditional class*. Paper presented at the Society for Information Technology & Teacher Education International Conference, San Antonio, TX.
- Kearsley, G. (1998). *A guide to online education*. Retrieved October 18 from <http://home.sprynet.com/~gkearsley/online.htm>
- Kerlinger, F. N., & Lee, H. B. (2000). *Foundations of behavioral research*. Fort Worth, TX: Harcourt College Publishers.
- King, J. C., & Doerfert, D. L. (1996). *Interaction in the distance education setting*. Retrieved June 22, 2001, from University of Missouri, College of Agriculture, Food, and Natural Resources Web site: <http://www.ssu.missouri.edu/ssu/AgEd/NAERM/s-e-4.htm>
- Kirby, E. (1999, February 28 - March 4,1999). *Building interaction in online and distance education courses*. Paper presented at the Society for Information Technology & Teacher Education Conference, San Antonio, TX.
- Krjfcif, R. V., & Morgan, D. W. (1970). Determining samples size for research activities. *Educational and Psychological Measurement, 30*, 607-630.
- Mahesh, V., & McIsaac, M. S. (1999, February 10-14). *Distance education: Learner-teacher interaction and time spent by teaching*. Paper presented at the the

National Convention of the Association for Educational Communications and Technology, Houston, TX.

- McCroskey, J. C., & Andersen, J. F. (1976). The relationship between communication apprehension and academic achievement among college students. *Human Communication Research, 3*, 73-81.
- McIsaac, M. S., & Gunawarden, C. N. (1996). Distance education. In D. H. Jonassen (Ed.), *Handbook of research for educational communications and technology* (pp. 403-437). New York: Simon & Schuster Macmillan.
- Miller, S. M., & Miller, K. L. (1999). Using instructional theory to facilitate communication in web-based courses. *Educational Technology & Society, 2*(3). Retrieved July 20, 2000, from http://ifets.ieee.org/periodical/vol_3_99/miller.html
- Moore, M. G. (1989). Editorial: Three types of interaction. *The American Journal of Distance Education, 3*(2), 1-6.
- Nunnally, J. C. (1967). *Psychometric theory*. New York: McGraw-Hill.
- Palloff, R. M., & Pratt, K. (1999). *Building learning communities in cyberspace*. San Francisco: Jossey-Bass Publishers.
- Petska, K. (1999). U.S. tops 100 million internet users according to computer industry almanac. *Computer Industry Almanac Inc.*, Retrieved October 6, 2000, from <http://www.c-i-a.com/199911iu.htm>
- Regalbuto, J. (1999). *Teaching at an internet distance Seminar: the pedagogy of online teaching and learning*. Retrieved July 15, 2000, from University of Illinois, Vice President for Academic Affairs Web site: <http://www.vpaa.uillinois.edu/tid/report>
- Romiszowski, A. J., & Mason, R. (1996). Computer-mediated communication. In D. H. Jonassen (Ed.), *Handbook of research for educational communications and technology* (pp. 438-456). New York: Simon & Schuster Macmillan.
- Rosen, M. (2000). A guide to implementing web-based training. *e-Learning, 1*(2), 40-41.
- Schutte, J. G. (1997). *Virtual teaching in higher education: The new intellectual superhighway or just another traffic jam*. Retrieved February 20, 2000, from California State University, Department of Sociology Web site: <http://www.csun.edu/sociology/virexp.htm>
- Smith, P. L., & Ragan, T. J. (1999). *Instructional design* (2nd ed.). New York, NY: John Wiley & Sons, Inc.
- Soo, K.-S., & Bonk, C. J. (1998, June 20-25). *Interaction: What does it mean in online distance education*. Paper presented at the 10th annual ED-MEDIA/ED-

TELECOM 98 World Conference on Educational Multimedia and Hypermedia & World Conference on Educational Telecommunications., Freiburg, Germany.

- Thomas, A. (2000, September). Some beat back-to-college bustle. *The Columbus Dispatch*. Retrieved October 6, 2000, from <http://www.dispatch.com:80/news/newsfea00/sep00/428652.html>
- Wagner, E. D. (1994). In support of a functional definition of interaction. *The American Journal of Distance Education*, 8(2), 6-29.
- Wagner, E. D. (1998, August 5-7). *Interaction strategies for online training designs*. Paper presented at the 14th Annual Conference on Distance Teaching & Learning, Madison, WI.
- Westbrook, T. S. (1999). Changes in student attitudes toward graduate instruction via web-based delivery. *Journal of Continuing Higher Education*, 47(2), 32-38.
- Zenger, J., & Uehlein, C. (2001). Why blended will win. *Training and Development*, 55(8), 54-62.

Appendix A

Course Interaction and Satisfaction Survey

Student-to-Student Interaction

1. I was able to communicate with other students during the discussion activities.
2. I was able to share learning experiences with other students during the discussion activities.
3. Increased contact with fellow students helped me get more out of the discussion activities.
4. A sense of community existed with fellow students during the discussion activities.
5. The discussion activities enabled me to collaborate with other students.

Student-to-Teacher Interaction

1. The instructor encouraged me to become actively involved in class discussions.
2. I was able to interact with the instructor during the discussion activities.
3. The instructor treated me as an individual.
4. The instructor encouraged me to become actively involved in class discussions.
5. I was NOT able to interact with the instructor outside of the regular class time.

Student Satisfaction

1. How did the level of interaction make you feel?
2. How would you rate the value of the question and answer portion of the discussion activities?
3. How would you rate the value of the participant-sharing portion of the discussion activities?
4. How much of the material you learned in these discussion activities do you feel is valuable to you?
5. How would you rate your knowledge of the content after completing the discussion activities?
6. How do you feel about the discussion activities as a whole?

Control Variables

1. Gender
2. Age
3. How would you identify your ethnic background?
4. Are you enrolled full-time or part-time?
5. What degree are you seeking?
6. What is your cumulative GPA at PSU?
7. What is your College of Enrollment?
8. Have you ever used the Internet?
9. Have you ever used Online Discussion Boards or Discussion Forums?
10. Excluding this course, have you ever taken a course that required you to use Discussion Boards or Discussion Forums?

Appendix B

Student Interview Form

The interview questions used to qualitatively look at the students perceptions as to how well they felt they were able to interaction with the instructor and their fellow students and also their level of satisfaction while completing the course discussion activities. The questions have been grouped based on the learning strategy they followed.

Online Only Questions

1. When completing the discussion activities using only the online Discussion Board, how well did you feel you were able to interact with the instructor?
2. When completing the discussion activities using only the online Discussion Board, how well did you feel you were able to interact with your classmates?
3. Could you provide some feedback as to how you felt about completing the discussion activities when using only the online discussion board?

Online Followed by Face-to-face Session Questions

1. When completing the discussion activities using the online discussion board followed by an in class discussion, how well did you feel you were able to interact with the instructor?
2. When completing the discussion activities using the online discussion board followed by an in class discussion, how well did you feel you were able to interact with your classmates?
3. Could you provide some feedback as to how you felt about completing the discussion activities when using the online discussion board followed by an in class discussion?

Appendix C

List of Regression Tables

Figure 1: Regression of Student-to-Student Interaction on Student Satisfaction

Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B		Collinearity Statistics	
	B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1 (Constant)	7.937	2.418		3.282	.002	3.127	12.747		
Student to Student Interaction	1.267	.157	.666	8.094	.000	.956	1.579	1.000	1.000

a. Dependent Variable: Student Satisfaction

Figure 2: Regression of Student-to-Student Interaction and Control Variables on Student Satisfaction

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	6.960	2.936		2.371	.020	1.111	12.809		
	Student to Student Interaction	1.285	.173	.676	7.429	.000	.941	1.630	.807	1.239
	Gender	-.236	.920	-.024	-.257	.798	-2.069	1.597	.766	1.306
	Age of Students	1.159	1.425	.122	.814	.419	-1.680	3.999	.296	3.377
	Ethnic Background	1.856	.898	.171	2.067	.042	.067	3.645	.974	1.026
	College of Enrollment	-1.238	1.378	-.135	-.898	.372	-3.984	1.508	.297	3.366
	Have you ever used the Internet	-2.102	1.854	-.097	-1.134	.261	-5.796	1.592	.922	1.085
	Have you ever used online discussion boards	.801	.829	.086	.966	.337	-.850	2.453	.847	1.181
	Have you ever taken a course the required the use of an online discussion board	.437	1.012	.040	.432	.667	-1.579	2.453	.767	1.303

a. Dependent Variable: Student Satisfaction

Figure 3: Model Summary of Student-to-Student Interaction and Control Variables on Student Satisfaction

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.706 ^a	.499	.446	3.02767	.499	9.338	8	75	.000

a. Predictors: (Constant), Have you ever taken a course the required the use of an online discussion board, Ethnic Background, Have you ever used the Internet, Gender, Student to Student Interaction, Have you ever used online discussion boards, College of Enrollment, Age of Students

Figure 4: Regression of Student-to-Teacher Interaction on Student Satisfaction

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	17.516	2.971		5.896	.000	11.606	23.425		
	Student to Teacher Interaction	.609	.183	.346	3.334	.001	.246	.972	1.000	1.000

a. Dependent Variable: Student Satisfaction

Figure 5: Regression of Student-to-Teacher Interaction and Control Variables on Student Satisfaction

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	16.467	3.234		5.092	.000	10.025	22.910		
	Student to Teacher Interaction	.685	.187	.389	3.668	.000	.313	1.057	.875	1.143
	Gender	1.054	1.086	.107	.970	.335	-1.110	3.218	.808	1.237
	Age of Students	2.141	1.724	.226	1.242	.218	-1.294	5.576	.298	3.358
	Ethnic Background	2.194	1.107	.202	1.982	.051	-.011	4.398	.944	1.059
	College of Enrollment	-3.349	1.618	-.364	-2.070	.042	-6.573	-.126	.317	3.151
	Have you ever used the Internet	-5.909	2.249	-.271	-2.627	.010	-10.391	-1.428	.922	1.085
	Have you ever used online discussion boards	-.482	.984	-.052	-.489	.626	-2.442	1.479	.884	1.131
	Have you ever taken a course the required the use of an online discussion board	-8.62E-02	1.224	-.008	-.070	.944	-2.524	2.352	.772	1.295

a. Dependent Variable: Student Satisfaction

Figure 6: Model Summary of Student-to-Teacher Interaction and Control Variables on Student Satisfaction

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.513 ^a	.263	.184	3.67303	.263	3.340	8	75	.003

a. Predictors: (Constant), Have you ever taken a course the required the use of an online discussion board, Ethnic Background, Have you ever used the Internet, Gender, Student to Teacher Interaction, Have you ever used online discussion boards, College of Enrollment, Age of Students

Figure 7: Regression of Learning Strategies on Student Satisfaction

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	26.857	.627		42.830	.000	25.610	28.105		
	Learning Strategy	.929	.887	.115	1.047	.298	-.836	2.693	1.000	1.000

a. Dependent Variable: Student Satisfaction

Figure 8: Regression of Learning Strategies and Control Variables on Student Satisfaction

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	26.688	1.406		18.985	.000	23.888	29.489		
	Learning Strategy	1.429	.973	.177	1.469	.146	-.509	3.366	.778	1.285
	Gender	1.276	1.167	.130	1.094	.277	-1.047	3.600	.804	1.244
	Age of Students	3.255	1.812	.343	1.797	.076	-.354	6.865	.309	3.235
	Ethnic Background	1.901	1.206	.175	1.577	.119	-.501	4.303	.912	1.097
	College of Enrollment	-4.175	1.717	-.454	-2.431	.017	-7.596	-.754	.323	3.096
	Have you ever used the Internet	-4.770	2.380	-.219	-2.004	.049	-9.511	-.028	.944	1.060
	Have you ever used online discussion boards	.126	1.128	.014	.112	.911	-2.121	2.373	.772	1.295
	Have you ever taken a course the required the use of an online discussion board	-.257	1.311	-.024	-.196	.845	-2.869	2.355	.771	1.297

a. Dependent Variable: Student Satisfaction

Figure 9: Model Summary of Learning Strategies and Control Variables on Student Satisfaction

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.393 ^a	.155	.065	3.93276	.155	1.716	8	75	.109

a. Predictors: (Constant), Have you ever taken a course the required the use of an online discussion board, Ethnic Background, Have you ever used the Internet, Gender, Learning Strategy, College of Enrollment, Have you ever used online discussion boards, Age of Students

Figure 10: Regression of Learning Strategies on Student-to-Student Interaction

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	14.762	.321		45.950	.000	14.123	15.401		
	Learning Strategy	1.071	.454	.252	2.358	.021	.168	1.975	1.000	1.000

a. Dependent Variable: Student to Student Interaction

Figure 11: Regression of Learning Strategies and Control Variables on Student-to-Student Interaction

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	15.499	.709		21.867	.000	14.087	16.910		
	Learning Strategy	.833	.490	.196	1.699	.093	-.144	1.810	.778	1.285
	Gender	1.223	.588	.236	2.079	.041	.051	2.395	.804	1.244
	Age of Students	1.658	.914	.332	1.814	.074	-.162	3.478	.309	3.235
	Ethnic Background	-5.46E-02	.608	-.010	-.090	.929	-1.266	1.157	.912	1.097
	College of Enrollment	-2.278	.866	-.471	-2.631	.010	-4.003	-.553	.323	3.096
	Have you ever used the Internet	-2.020	1.200	-.176	-1.683	.096	-4.411	.370	.944	1.060
	Have you ever used online discussion boards	-.640	.569	-.130	-1.126	.264	-1.773	.493	.772	1.295
	Have you ever taken a course the required the use of an online discussion board	-.524	.661	-.092	-.792	.431	-1.841	.794	.771	1.297

a. Dependent Variable: Student to Student Interaction

Figure 12: Model Summary of Learning Strategies and Control Variables on Student-to-Student Interaction

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.472 ^a	.223	.140	1.98284	.223	2.692	8	75	.012

a. Predictors: (Constant), Have you ever taken a course the required the use of an online discussion board, Ethnic Background, Have you ever used the Internet, Gender, Learning Strategy, College of Enrollment, Have you ever used online discussion boards, Age of Students

Figure 13: Regression of Learning Strategies on Student-to-Teacher Interaction

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	15.119	.323		46.762	.000	14.476	15.762	1.000	1.000
	Learning Strategy	1.976	.457	.431	4.322	.000	1.067	2.886	1.000	1.000

a. Dependent Variable: Student to Teacher Interaction

Figure 14: Regression of Learning Strategies and Control Variables on Student-to-Teacher Interaction

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	14.970	.740		20.217	.000	13.495	16.445		
	Learning Strategy	1.995	.512	.435	3.893	.000	.974	3.015	.778	1.285
	Gender	.340	.614	.061	.553	.582	-.884	1.564	.804	1.244
	Age of Students	1.636	.954	.304	1.714	.091	-.265	3.537	.309	3.235
	Ethnic Background	-.457	.635	-.074	-.719	.474	-1.722	.809	.912	1.097
	College of Enrollment	-1.203	.905	-.231	-1.330	.188	-3.005	.599	.323	3.096
	Have you ever used the Internet	1.682	1.254	.136	1.342	.184	-.815	4.180	.944	1.060
	Have you ever used online discussion boards	.850	.594	.160	1.430	.157	-.334	2.033	.772	1.295
	Have you ever taken a course the required the use of an online discussion board	-.244	.691	-.040	-.353	.725	-1.620	1.132	.771	1.297

a. Dependent Variable: Student to Teacher Interaction

Figure 15: Model Summary of Learning Strategies and Control Variables on Student-to-Teacher Interaction

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.521 ^a	.272	.194	2.07146	.272	3.502	8	75	.002

a. Predictors: (Constant), Have you ever taken a course the required the use of an online discussion board, Ethnic Background, Have you ever used the Internet, Gender, Learning Strategy, College of Enrollment, Have you ever used online discussion boards, Age of Students

Keith D. Bailey Vitae

Education

The Pennsylvania State University
University Park, PA
Ph.D. Candidate, Workforce Education, Training and Development
Expected Graduation Date, May 2002

Bloomsburg University of Pennsylvania
Bloomsburg, PA
M.S., Instructional Technology
August 1996

Bloomsburg University of Pennsylvania
Bloomsburg, PA
B.S., Adult Health and Fitness
December 1994

Research Interests

My research interests revolve around investigating the impact various instructional learning strategies have on the effectiveness of on-line education.

Professional Presentations

The State of IST 210 – Database Fundamentals. Presented at the 2001 School of Information Sciences and Technology's Faculty Retreat. The Pennsylvania State University. University Park, May 2001

Implementing Problem-based Learning Into an Online Environment. Presented with Kristin Camplese. Presented at the 2000 School of Information Sciences and Technology's Faculty Academy at The Pennsylvania State University. University Park, PA, August 2000.

Teaching Experience

Professor of Record, IST 110 – An Introduction to Information Sciences and Technology. Summer and Fall Semesters 2001. Online course in The School of Information Sciences and Technology, The Pennsylvania State University, PA. (Summer and Fall 2001)

Co-Instructor, Director Course. Fall 1998, seminar in Instructional Systems, The College of Education, The Pennsylvania State University, PA.

Professional Experience

Instructional Designer (September 2000 – Present)
The Pennsylvania State University, University Park, PA
The School of Information Sciences and Technology

- Lead the integration of learning management systems into online courses, including WebCT and ANGEL
- Utilize instructional design methodologies to develop a training program to prepare faculty and staff members for teaching online courses
- Manage a team that is designing and developing an online database course
- Work with faculty across the university to create online course content
- Conduct faculty development workshops for the delivery of online courses
- Work with IST administration to develop online curriculum
- Design, develop, and publish student course roadmaps for online courses
- Assist in the creation of standards for methodological design and instructional strategies used in all online courses for IST