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The assessment of student performance and satisfaction outcomes with synchronous and asynchronous interaction methods in a student -centered distributed learning environment

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THE ASSESSMENT OF STUDENT PERFORMANCE AND SATISFACTION OUTCOMES WITH SYNCHRONOUS AND ASYNCHRONOUS INTERACTION METHODS IN A STUDENT-CENTERED DISTRIBUTED LEARNING ENVIRONMENT

by:

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MBA, The University of Montana, 1990

Presented in partial fulfillment of the requirements

For the degree of

Doctor of Education

The University of Montana

May 2001

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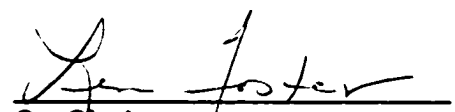

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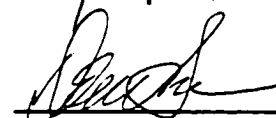

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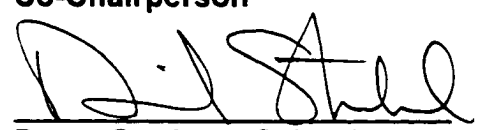

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Abstract

Clouse, Shawn F., Ed.D, May 2001 Education

The Assessment of Student Performance and Satisfaction Outcomes with Synchronous and Asynchronous Interaction Methods in a Student-Centered Distributed Learning Environment

Co-Directors: Len Foster, Ed.D.
Dean Sorenson, Ph.D.

The purpose of this research was to investigate which instructional methods for interaction facilitated student satisfaction and performance for on-campus and off-campus MBA students. A two-phased mixed methodology was used to investigate the differences between synchronous and asynchronous methods. Phase I gathered information from 57 students (37 on-campus and 20 off-campus) and had a total response of 98.25%. Phase II included post-hoc interviews with 12 students.

The quantitative performance and satisfaction data was analyzed using ANCOVA and MANOVA. This study found that (a) performance was improved on the essay questions by having a mix between synchronous and asynchronous lectures and discussions, (b) on-campus students performed best on objective and off-campus students performed best on essay questions, (c) students were most satisfied with traditional synchronous methods, (d) off-campus students preferred asynchronous lectures, and (e) students needed to interact with content and the instructor to gain understanding of the subject matter.

The qualitative analysis found that (a) students resist learning with asynchronous methods because of their traditional paradigm for learning, (b) threaded discussions should be guided by asking probing questions, providing frequent feedback, and enabling students to ask questions, (c) students felt "disconnected" from asynchronous discussions, (d) chats should be guided by providing structure and focus to the discussion, (e) students should learn to use new technologies prior to the learning activities, (f) students preferred to participate with people they already knew, and (g) technology discussions provided more opportunity for student participation.

The transactional distance was low for the chat and high for the threaded discussion. The chat needed increased transactional distance by providing more structure to the dialog. The threaded discussion needed reduced transactional distance by increasing the amount of dialog.

This research project determined that synchronous and asynchronous interaction methods have application for both face-to-face and distance learning. Future studies should concentrate on the development of innovative learning techniques to help students learn regardless of the location of instruction. Learning environments should incorporate a mixed instructional design approach to create a rich student-centered distributed learning environment with the appropriate amount of synchronous and asynchronous interaction methods to stimulate student learning.

Acknowledgements

The journey to complete the doctorate in Higher Education and Technology Leadership has taken me three-years. I owe much gratitude to many people that have helped me along the way to accomplish something that I never even dreamed I would be doing. First, I would like to thank my committee for helping me navigate through the dissertation process in record time. The quality of this dissertation is largely due to the probing questions and guidance from them.

Dr. Dean Sorenson has been my advisor, dissertation co-chair, and constant mentor throughout my Educational Leadership program. I want to thank him for the intellectual discussions that we have had which shaped this dissertation and for the encouragement when it appeared to me that I would not be able to complete it on time.

I met Dr. Len Foster while serving on a campus committee that looked at the role of distance learning at The University of Montana. We quickly became friends because of our common beliefs, and he encouraged and prodded me to apply to the doctorate program in the School of Education. I will never forget the moment when he was trying to help me with Chapter 5 and I said, "I can see why some people don't finish their dissertation." I learned there is not much distance between success and failure, and I want to thank him for prodding me one more time to get the thing done.

I want to thank both Dr. Bobbie Evans and Dr. Jerry Evans for teaching me everything that I currently know about research. I admire Bobbie's energy and enthusiasm, as well as, the unique ability that she has for helping students to develop their ideas. I want to thank Jerry for giving me my first job teaching information systems in the School of Business that has helped shape my professional career. I could not have completed this dissertation without his willingness to let me study his courses and help with the statistics. I will forever remember his words of wisdom prior to the defense when he said, "Shawn, remember when you go into that room that you are the expert on this material!"

I want to thank Dr. Roberto Bamberger for enabling me to study learning with technology at Microsoft and for taking time out of his very busy schedule to participate on this dissertation committee. I enjoyed sharing an office with him at Microsoft in December of 1999 and he is truly a "champion" for learning with technology.

Lastly, I want to thank my family for being my source of strength and for making many personal sacrifices so that I could succeed in life. My parents, Ferris and Anna Marie Clouse, instilled the love of learning in me. They were both teachers by profession and even though I said after high school that I would never be a teacher, I finally saw the light and am proud to follow in their footsteps. My seven siblings: Lynne, Sarris, Shannon, Daniel, Brookie, Clint, and Shane all provided me with encouragement. I want to thank my wife Nancy and our 8-month old son Daynen for the support during this intense process. I love you both more than I can express in words. Nancy has made many personal and professional sacrifices so that I could finish this degree and was a constant source of support. It was amazing how one of Daynen's hugs or funny sounds helped reduce the tremendous stress that I was feeling throughout the entire process. I will forever be indebted to all of these wonderful people for the personal success that this doctorate degree may bring me.

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CHAPTER ONE: INTRODUCTION

Introduction

Higher education leaders are faced with making difficult decisions on how to allocate resources to support teaching and learning, both on-campus and at a distance. These decisions are part of the new paradigm of the use of technology in post-secondary education. Bork (2000) described the old paradigm in higher education to be the information transfer paradigm where faculty lecture for students to acquire information, knowledge, or wisdom. Barker (1993) described a paradigm as a set of rules and regulations that establishes boundaries, and defines how to behave inside the boundaries in order to be successful. He defined a paradigm shift as a change in the fundamental rules of the business, organization, or industry. Higher education is in the beginning stages of a new paradigm on how to best utilize new emerging technologies in the learning process. This paradigm can be described by the rapid growth in investment in technology, the rapid growth in the number of distance learning students, and the amount of quality research available to guide the use of technology for learning.

The first defining aspect of the teaching and learning with technology paradigm is the rapid growth in investment over the last decade. The Clinton-Gore Administration has invested over $8 billion in educational technology in the United States from 1995 to 2000 (Office of Educational Technology, 2000). The state of Montana received $29.8 million during that same time frame. The Campus Computing Project's 1998 National Survey of Information Technology in American Higher Education found that

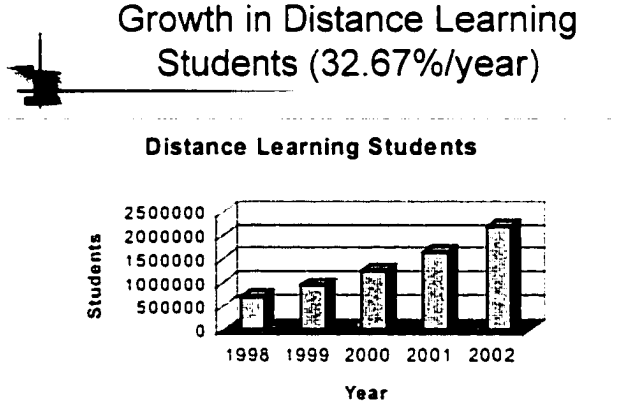
approximately 60% of all post-secondary institutions had increases in their academic computing budgets (Educause, 2000). At the same time, 33.2% of the higher education institutions indicated that integrating information technology with instruction was the single most important issue confronting the campus.

The second defining aspect of this paradigm is the growth in the number of college students taking courses via distance learning. In 1997, there were approximately 14.5 million students at 4,064 institutions of higher education in the United States (Educause, 2000). The Institute of Higher Education Policy (1999) projected market growth for higher education distance learning to reach 2.2 million students by 2002. The growth rate anticipated is 32.7% per year (see figure 1). They expect the number of institutions offering distance learning programs to grow to 84% from 62% in 1998. In 1997, approximately 5% of students in higher education were distant learners. This percentage, as well as the size of the distance learning market, is growing rapidly. The growth reflects the current emphasis on distance learning by both public and private institutions.

The final defining aspect of the teaching and learning with technology paradigm is the amount of quality research to guide the appropriate use of technology for learning. Many research studies have been conducted comparing traditional classroom instruction to instruction at a distance utilizing technology to facilitate the delivery. There are two sides of the technology research issue, one side calls for a moratorium on further study and the other calls for more quality studies to be conducted. Russell (1999) published an annotated bibliography about the effectiveness of distance learning titled The No

Significant Difference Phenomenon. Most of the citations state that learning outcomes of students using technology at a distance are similar to the outcomes of students who participate in traditional classroom instruction. What's the Difference: A Review of Contemporary Research on the Effectiveness of Distance Learning in Higher Education, by Phipps & Merisotis (1999), is a publication that reviewed a broad range of research on distance learning. They found that the overall quality of research was questionable; therefore, the findings are inconclusive. Phipps and Merisotis (1999) stated that the higher education community has a lot to learn about how distance technology affects the teaching and learning process. Higher educational leaders need quality research on appropriate uses of technology for learning in order to effectively allocate resources to meet the demand for programs.

Figure 1: Distance Learning Growth Rate[1]



1 From Online Distance Learning in Higher Education, 1998-2002. Report #W17827 - January 1999, by J. Rochester, R. Boggs, and S. Lau. Copyright 1999 by International Data Corporation.

Statement of the Problem

Montana is the fourth largest state in the United States with a rural and geographically dispersed population. The University of Montana (UM) School of Business Administration (SOBA) is the sole provider of graduate MBA business education in the Montana University System. The MBA degree has been offered by SOBA since 1965 to on-campus students as well as to off-campus working professionals across Montana in Billings, Bozeman, Butte, Great Falls, Helena, Kalispell, and Missoula.

The curriculum for the MBA program includes both a foundation and professional program. The foundation program looks at the theories and practices in the fundamentals of business administration. The professional program looks at advanced theories and practices of business administration as well as interpersonal applications, technology, and strategic management.

The MBA curriculum is offered to students in three delivery modalities. The daytime students take courses in a traditional classroom setting for both the foundation and professional programs. The off-campus students take classes over the Internet for the foundation program and through two-way interactive videoconferences for the professional program.

The University of Montana (UM) School of Business Administration (SOBA) has experienced the same trends as seen nationally with rapid growth in student interest in graduate business distance learning as well as considerable investments in technology to deliver educational programs both on-campus and off-campus. The main problem facing

SOBA is how to use three delivery modalities (traditional classroom courses, interactive videoconference courses, or online Internet courses) or a combination of the three to effectively deliver a quality graduate education experience to students both on-campus and at a distance. Working professionals in Montana that are off-campus students want access to quality graduate business education at a time and at a place that is convenient for their busy schedules. On-campus students want access to quality graduate business education to maximize their knowledge of business for future employment opportunities. Both groups of students want to sharpen face-to-face and technology driven communication skills through opportunities to interact, network, and collaborate with faculty and other students in order to work successfully in the rapidly changing business world of the information age. Faculty and students stress the importance of communication and interaction to the learning process for the graduate business education program. This research project investigated the relationships inherent to the interaction process between students, content, and faculty in order to provide valuable information for the development and delivery of graduate business education courses for both on-campus and off-campus MBA students.

Research Questions and Objectives

The purpose of this research was to investigate which instructional methods for interaction are best to facilitate student satisfaction and learning for both on-campus and off-campus MBA students. This study sought to answer several questions that require further investigation to advance the knowledge base in the area of distance and distributed learning.

The first charge was to determine which technology-based interactive methods facilitate learning best for learner characteristics. The second area was which methods for interaction are more suitable for the learning style and personality type of individual students. The third area was which interactive methods are more appropriate for the different technology delivery media used for instruction. The final area was which methods are best for the level of the learner's skill with technology. These areas lead to the following research questions:

- What impact does interaction have on the satisfaction and learning outcomes of the students in the graduate business courses?
- What relationships do the instructional methods for interactions have with student learning styles and student skill level with technology?
- What student characteristics facilitate success with synchronous and asynchronous delivery methods for interaction?

Significance of the Study

With this rapid growth in distance learning demand, the increased use of different distance delivery technologies, and the national technology-based goals, there is a need to conduct empirical research to better understand how to effectively educate students in distance and distributed learning environments. The need is not to say that one delivery modality is better than the other, but to learn as much as possible about how to use each delivery modality in the best way. Learning environments of the future will most likely incorporate more of a mixed instructional design approach by taking the best methods from each of the delivery modalities to create a rich distributed learning environment

with the appropriate interactive methods to stimulate student learning. Educational leaders need to understand these methods in order to allocate resources to meet the demand for distance learning programs in the future.

There are several studies that have looked at the effect of interaction in distance learning environments. Webster and Hackley (1997) examined video-based delivery of instruction outcomes related to student involvement and participation, cognitive engagement, technology self-efficacy, attitudes toward the technology employed, the usefulness of the technology, attitudes toward technology-mediated distance learning, and the relative advantage or disadvantage of such distance learning. They asserted: (a) the reliability of the technology related positively to learning outcomes, (b) the quality of the technology used related positively to learning outcomes, (c) students perceived the technology to be less rich than face-to-face instruction and reported higher learning outcomes for rich environments, (d) students experienced more positive learning outcomes when more interactive methods are used, and (e) students that had more positive attitudes toward the technology experienced more positive learning outcomes.

Everett (1998) looked at (a) how students make sense of distance learning technology, (b) what mechanisms students employed to adapt to media-rich learning environments, (c) what internal and external motivations allowed students to succeed, and (d) what social interactions were employed to help students master and use the technology in the distance learning classroom. Schutte (1996) found that collaboration helped students perform better in a virtual classroom than with that of face-to-face interaction. He attributed the improved performance to collaboration rather than the

technology itself. Learner characteristics are a major factor in the achievement and satisfaction levels of distance learning (Phipps & Merisotis, 1999).

Distance learning and online learning are rapidly growing delivery modalities for Higher education. These delivery methods will continue to grow in the future. The International Data Corporation released a report in January 1999, titled Online Distance Learning in Higher Education, 1998-2002 (as cited in Institute for Higher Education Policy, CHEA Update, 1999). The report states that 710,000 students were enrolled in distance education in 1998, and the number is expected to grow to 2.2 million students by 2002. Sixty-two percent of four-year colleges and universities offered distance education courses in 1998, and the number is expected to jump to 84-percent by 2002.

The study released by US Department of Education titled Distance Education at Postsecondary Education Institutions: 1997-98 presents findings from the second nationally representative survey of distance education (Lewis, Snow, Farris, & Levin, 1999). The top four types of distance learning technology used in 2-year and 4-year postsecondary institutions between 1997 and 1998 were asynchronous Internet instruction (58%), synchronous two-way interactive videoconference (54%), asynchronous one-way pre-recorded video tapes (47%), and synchronous Internet instruction (19%). This study provided insight into how to use interaction methods for asynchronous Internet delivery, synchronous interactive videoconference delivery, and synchronous Internet delivery.

The National Educational Technology Plan from the Office of Educational Technology (2000) has five goals. This research addresses two of those five goals. The

two goals are (Goal 4) research and evaluation will improve the next generation of technology applications for teaching and learning and (Goal 5) digital content and networked applications will transform teaching and learning. Higher education must understand the role of interaction, methods, and media in teaching and learning in order to achieve these goals. This study advanced the present body of knowledge in the area of interaction in order to achieve these national technology related goals.

This research provides educational leaders with valuable information and increases the distance learning body of knowledge to address the rapidly growing distance learning market, the national technology goals, and how to effectively use different delivery modalities to facilitate interaction in the learning environment. Ehrmann (1997) encouraged research agendas that study which teaching-learning strategies are best as well as studying which technologies are best for supporting those strategies. Hall (1999) noted that that research on web-based training is in its infancy and that there are few systematic, controlled studies of the specific aspects of web site design as it applies to instruction or training. Diaz (2000) noted the need to shift away from focusing on comparing modalities by the following quote:

> As constructivist researchers begin to understand the implications of constructivist assumptions, they will see that the role of modality in facilitating learning is not as important as the quality of the relationships. If students assume a critical role in the learning process, the research focus should be on individual students and the characteristics that make them successful in different modalities (p. 3).

Higher education leaders can use this information to become better consumers of the technology used to facilitate interaction.

Definitions of Terms

The following definitions are used in the study:

Interaction. The interaction in a learning environment is communication between student and content, student and instructor, and student and student (Moore, 1993).

Synchronous Interaction. Synchronous interaction occurs when participants interact at the same time or in real time (McIsaac & Gunawardena, 1996).

Asynchronous Interaction. Interaction that occurs with participants contributing at different times is asynchronous or time-delayed (McIsaac & Gunawardena, 1996).

Threaded Discussion. Threaded discussions are an asynchronous interaction method where the conversation topics are organized in threads of discussion. A thread is a group of related comments that are organized with each comment indented below the previous comment. Student and instructor responses are organized into categories or threads simulating classroom discussion.

Distance Learning. Distance learning is a learning activity where time and/or place separate students and teachers (Lever-Duffy, 1996).

Distributed Learning. Distributed learning includes distance education, but reaches further to integrate the networked delivery of learning through asynchronous and synchronous conversations within learning communities of students (Graves, 1997). It is based on learner needs and allows students and faculty to enter the learning environment at different times and from different locations (Oblinger & Maruyama, 1996).

Distributed learning involves educational activities in classrooms, workplaces, homes, and in community settings (Dede, 1996).

Mediated Learning. Baker, Hale, and Gifford (1997) define mediated learning as a method using technology to create a communications-rich instructional environment that provides the instructor with more teaching options and provides students with more opportunities for learning and to secure instructional assistance.

Student Centered Instruction. Felder & Brent (1996) define student-centered instruction to include techniques such as substituting active learning experiences for lectures, assigning open-ended problems requiring critical or creative thinking to solve, involving students in simulations or role-playing, assigning a variety of unconventional writing exercises, and using other cooperative learning techniques.

Cooperative Learning. Cooperative learning is an activity that uses small groups in instructional environments where students work together to maximize their own and each other's learning (Johnson and Johnson, 1996). Cooperative learning creates a culture for learning in which students are responsible for their own learning as well as for the learning of their peers (Panitz, 1999).

Collaboration. Collaboration is a type of activity that extends communication and cooperation toward highly productive relationships among participants (Tiessen & Ward, 1997). Collaboration occurs when a group of autonomous students engage in an interactive process, using shared rules, norms, and structures, to act or decide on issues related to the area of study (Wood and Gray, 1991).

Learning Styles. Learning styles emphasize the different ways people think and feel as they solve problems, interact, and create products (Silver, Strong, & Perini, 1997).

Adult Learners. The adult learner is a type of learner that is self-directed and desires an active learning environment, which includes actual experience as much as possible (Boettcher, 1999).

Virtual Classroom. The virtual classroom is a place for learning that is made possible by electronic teaching, learning, and research environments created by the use of information and instructional technologies (Van Dusen, 1997).

Assumptions Inherent in the Study

It was assumed for the purposes of this study that:

1. The students in the graduate business courses are motivated learners, regardless of being enrolled in the on or off-campus MBA program. The descriptive portion of the study may find that the on-campus students might have different demographics characteristics than the off-campus students.
2. All of the students are motivated adult learners.
3. The student skill level with technology can be measured.
4. The learning styles of students can be measured.
5. The personality characteristics of students can be measured.
6. The instructor was the best person to measure the degree to which students have mastered the material presented in a learning module.

Delimitations

This study was delimited to graduate business students in the School of Business Administration at The University of Montana located in the state of Montana. The intent of this research was to look at the effectiveness of the interaction methods (asynchronous and synchronous) used within each of the different delivery modalities. This study did not look at comparing the effectiveness of the different delivery modalities.

Limitations

The limitations of the study are that it is only generalizable to graduate business education. The Association to Advance Collegiate Schools of Business (AACSB) accredits the University of Montana School of Business Administration. This accreditation ensures standards for faculty, curriculum, and student admissions. This study should be generalizable to graduate business students across the accredited institutions. Controlling all of the extraneous or moderator variables in a learning environment is difficult. This research held the content and instructor constant for a specific graduate business course and did not study all students or all courses in the SOBA MBA program. The analysis used Likert-type ordinal data as one of the factors in the factorial analysis of variance statistical procedure. Traditionally, this statistical procedure was designed to use with interval/ratio data.

CHAPTER TWO: REVIEW OF RELATED LITERATURE

Introduction

Technology has been used for many years to support the teaching and learning process. It has been used for distance learning, as a presentation medium, and to facilitate interaction in the learning environment. Students in the search for skills and knowledge, create the need for a learning environment. There is no single best method of education because students have different learning styles, needs, and preferences (Oblinger & Maruyama, 1996). The challenge for using information technology is to preserve the important aspects of human interaction between students and faculty, while transforming the environment to a student-centered model (Dede, 1996; Felder & Brent, 1996; Graves, 1997; Oblinger & Maruyama, 1996).

This literature review discusses theories and practices for using technology in the learning process that are grounded in the literature on distance and distributed learning environments. These areas have a rich history, theoretical basis, and have progressed through several generations and improvements of technology used to create and deliver a course. The students in higher education distance learning courses are adult learners that have many different learning styles. Faculty are impacted by the use of technology in the areas of teaching, research, and service. Creating a distance or distributed learning course requires careful consideration in the instructional design process as well as in the selection of instructional methods. These design and methods decisions can be further guided by the research on interaction and communication between the participants of the

course. The final area of consideration is a discussion of the research on the effectiveness for using technology in distance and distributed learning.

Distance and Distributed Learning

This section defines distance and distribute learning, provides a historical and theoretical basis for distance learning, discusses the student and faculty related issues, look at instructional design and methods considerations, and provides a foundation for the importance of interaction to learning.

Distance Learning Defined

Distance learning has been traditionally thought of as the delivery of instruction to students who are at a distance and do not come to campus. Distance learning occurs when time and/or place separate students and teachers and has a long history of serving isolated and geographically dispersed learners by providing learning opportunities that are flexible and responsive to student needs (Lever-Duffy, 1996, and Sullivan & Rocco, 1996). This type of distance education replicates traditional classroom teaching across barriers of distance and time (Dede, 1996b).

Moore and Kearsley (1996) defined distance education as "planned learning that normally occurs in a different place from teaching and as a result requires special techniques of course design, special instructional techniques, special methods of communication by electronic and other technology, as well as special organizational and administrative arrangements" (p. 2). Distance education provides instruction in the place and time convenient to the learners rather than instructors or teaching institutions.

According to Moore and Kearsley (1996) a systems model for distance education has the elements of resources, design, delivery, interaction, and the learning environment. The institutional history and philosophy about distance learning are part of the systems model along with the attributes of teaching, learning, communication, design, and management. This model emphasizes how the attributes are interconnected. Moore and Kearsley's (1996) model has a series of inputs and outputs shown in Table 1. They stressed that distance learning should be conceived and developed as a total system with interacting components.

Table 1: Distance Learning Systems Model

Inputs	Outputs
Student characteristics	Student satisfaction ratings
Instructor experience	Student achievement scores
Competence of administrative staff	Student completion rates
Efficiency of course development	Total enrollments
Student access to resources	Quality assessments
Response time	Cost and revenue
Local site coordination	Staff turnover
Institutional cooperation/support	
Reliability of evaluation	

Note. From Moore, M. G. and Kearsley, G. (1996). Distance Education: A Systems View. Belmont, CA: Wadsworth Publishing Company. Page 15.

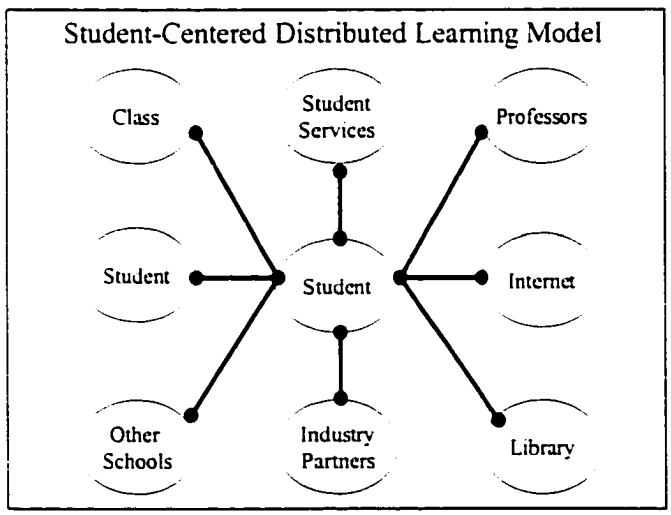
Distributed Learning Defined

Distributed learning is based on learner needs and allows students and faculty to enter the learning environment at different times and from different locations (Oblinger & Maruyama, 1996). The instructional events that traditionally occur in classrooms are distributed to learners (Dede, 1996b). Distributed learning involves educational activities in classrooms, workplaces, homes, and in community settings (Dede, 1996b). Learning can occur at the same time in different places, at different times in the same place, or at

different times in different places (Locatis & Weisberg, 1997). Graves (1997) described distributed education to encompass distance education, but reaches further to integrate the networked delivery of learning through asynchronous and synchronous conversations within learning communities of students. He noted that the promise of distributed education is to increase access to instruction and to enhance the quality of students' learning. Distributed learning blends the use of appropriate technologies to enable opportunities for learning. These descriptions of distributed learning allow for the possibility of distributed learning approaches to help all types of learning environments, whether they are on-campus, off-campus, or online.

The distributed learning model is a synthesis of the works by many authors that have written in the area (Dede, 1996a; Dede, 1996b; Graves 1997; Locatis & Weisberg, 1997; Oblinger & Maruyama, 1996; and Reil, 2000). Distributed learning changes the traditional instructional paradigm of place and instructor-centered learning environments to a student-centered environment (see Figure 2).

Figure 2: Distribute Learning Model



The student in the center utilizes the resources in the environment to be responsible for his or her own learning. The resources can include the instructor, other students, libraries, the Internet, industry partners, other schools, student services, and the classroom. The instructor facilitates the learning process and other students help and support peers through the experience. Libraries, publishers, and the Internet provide resources to help the student explore the subject matter of the course. Industry partners can provide instructional resources and give a sense of realism to the process by describing how the course topics impact their industry or business. Other schools provide the opportunity for students to collaborate with students in different geographic regions to provide diversity to the learning experience. Student services support the needs of the student outside the classroom. The classroom (physical or virtual) provides the time and place for learning as well as the learning tools that make up the distributed learning environment. This learning system, with the student in the center, is the foundation of the student-centered distributed learning model.

Dede (1996a) claimed that forms of distributed learning are emerging based on shifts in what learners need to prepare for the future and on new capabilities in the pedagogical styles of teachers. He stated that this includes learning through doing that involves active participation in experiences that demand real world problem solving skills. Dede (1996a) pointed out that most learners prefer face-to-face interaction, but find the convenience of just-in-time access to learning outweighs the disadvantage of distributed sharing of ideas and experiences.

Reil (2000) described learning as a basic human function and encourages learner-centered environments where learners have their own goals and are willing to construct

new knowledge. This learning environment should be guided by Chickering and Ehrmann's (1996) seven principles of good practice in education. The principles include the methods that encourage contact between students and faculty, the development of reciprocity and cooperation among students, the use active learning techniques, the process of providing prompt feedback, the emphasis of time-on-task, the communication of high expectations, and the respect student differences in terms of talent and ways of learning. Student-centered distributed learning environments incorporate these instructional strategies to help prepare students for future employment.

Distance learning is a type of distributed learning with learners separated from instructors by distance. Distributed learning techniques are not limited to only environments that have distance in the equation. Distributed learning can be used to augment on-campus as well as off-campus learning environments. On-campus distributed learning experiences can include an asynchronous discussion facilitated on the Internet, collaborative discussions between students from different campuses studying similar subjects, and bringing outside experts into the learning environment through the Internet or with interactive videoconferencing technology.

History of Distance Learning

Moore and Kearsley (1996) described the history of distance learning in their book Distance Education: A Systems View. The roots of distance learning in the United States began with correspondence and home study. The first institution to authorize degrees through correspondence study was the Chautauqua Institute in the state of New York in 1883. The International Correspondence School (ICS) started in 1891 and has

become one of the largest commercial providers of home study programs in the United States. Otto Peters coined the term distance learning that is a translation of the German term *fernunterricht* (Peters, 1965). The history of distance learning has progressed with the developments of new technologies that have been used as the delivery mechanism for courses.

The first types of technology used to deliver distance educational programs were radio, telephone, television, and microwave networks (Moore & Kearsley, 1996). Radio was used to deliver educational programs between 1911 and 1922 by the State University of Iowa, Pennsylvania State College, Ohio State University, and the University of Wisconsin. Moore and Kearsley (1996) reported that this technology failed due to "lukewarm interest shown by university faculty and administration" (p. 27). The University of Wisconsin started using telephone technology in 1965 with the Educational Telephone Network created to provide continuing education to physicians. The Corporation for Public Broadcasting (CPB) was created in 1967 and it solidified the use of television networks to deliver educational programming. This led to telecourses being delivered by the Adult Learning Service (ALS) of the Public Broadcasting System (PBS). The Stanford Instructional Television Network started in 1969 and used microwave to broadcast engineering courses.

Several organizations have worked cooperatively to use technology to develop and deliver distance education (Moore & Kearsley, 1996). The National University Teleconferencing Network (NUTN) started in 1982 with 66 member universities and the Smithsonian Institute as members at Oklahoma State University. The National Technological University (NTU) was established in 1985 at Fort Collins, Colorado, to

provide instruction utilizing satellite uplink technology. The NTU and NUTN organizations utilized one-way-video and two-way audio communications. In the 1990's, two-way videoconferencing technology began to be used because it facilitated two-way interaction for both audio and video between participants in a distance learning course. Many states in the United States have systems in place to support videoconference delivery of education materials. One such system in Montana is called the Montana Educational Telecommunications Network (MetNet). Congress passed the Federal Star Schools Program Assistance Act in 1987 to promote the use of telecommunication for instruction in math, science, and foreign languages at the K-12 level. The Star Schools provided valuable data for the research on effectiveness of distance delivery.

Computers and networks are last delivery technology described by Moore and Kearsley (1996). These two technologies began to be used during the late 1980's and early 1990's and have followed the rapid growth of the Internet since 1995. Computers and networks can be used to deliver multimedia course materials that include text, graphic, animation, and video as well as to facilitate discussions between students and teachers.

Theories of Distance Learning

Distance learning has been shaped by the theories of independence, industrialization, interaction, transactional distance, systems theory, and the equivalency theory. These theories have been developed over time and provide the foundation for the development of research questions that can be empirically tested in the area of distance learning.

Theory of Independence

Wedemeyer (1971) laid the foundation for the development of American theories of distance education by describing independence in terms of learners being self-directed and free to control the pace, time, and place of learning. His work was funded by a grant from the Carnegie Corporation at the University of Wisconsin called the Articulated Instructional Media Project (AIM) from 1964-1968. This project looked at various media that could be used for teaching off-campus students. In 1969, the British government established an autonomous degree granting institution called British Open University based on the AIM model. Western Governors University and others have developed in a similar format to the British Open University.

Theory of Industrialization

Otto Peters coined the term *distance learning* and developed the theory of industrialization of distance learning that stems from his 1965 work entitled Distance Education: Sources for the Analysis of a New Form of Teaching that was translated from German to English by Keegan (1994). This theory of distance education was based on industrial methods that should be applied to the design and delivery of instruction for distance learning to be successful (Peters, 1983). His theory is based on the economic and industrial techniques of planning, division of labor, mass production, automation, standardization, and quality control. This theory has the teaching process restructured through increased mechanization and automation. Decisions about the process of distance learning should be made by taking into account the industrial structures and characteristics of distance learning.

Theory of Interaction and Communication

Holmberg (1989) developed the interaction and communication theory that described the impact of the feelings of belonging and cooperation as well as the actual exchange of questions, answers, and arguments on the education process. He believed that dialog or interaction between student and teacher were the critical defining aspects of distance education. Emotional involvement, personal relationships, and empathy between teachers and students are the core of the theory. According to Holmberg (1989), the theory is open to the behaviorist, cognitive, and constructivist modes of learning.

Theory of Transactional Distance

Moore (1994) developed a theory of transactional distance to classify distance learning that combines the perspectives of Wedemeyer, Peters, and Holmberg. The theory looks at the dimensions of dialog and structure to describe the distance between students and instructors. The transactional distance between students and instructors is pedagogical, not geographic, and should be dealt with by changing interaction methods for dialog or instructional design for structure.

Dialog is two-way communication or interaction between students and instructors. According to Moore and Kearsley (1996), "dialog is determined by the educational philosophy of the individual or group responsible for the design of the course, by personalities of the teacher and the learner, by the subject matter of the course, and by environmental factors" (p. 201).

The environmental variables that influence the amount and type of dialog are the learning group size, the communication language, and the communication medium.

Structure is the second variable for the theory that includes learning objectives, teaching strategies, content themes, information presentations, case studies, illustrations, exercises, projects, and evaluation methods. Moore and Kearsley (1996) pointed out that structure is determined by the philosophy of the teaching organization, the philosophy of the teachers themselves, the academic level and autonomy of the learners, the nature of the course content, and the communications medium used. Distance learning courses are structured in different ways to take into account the need to produce, deliver, and control mediated messages.

Moore and Kearsley (1996) observed that, "as long as there is a teacher, learner and a means of communication there is transactional distance" (p. 200). Programs with little transactional distance provide direction and guidance to learners through ongoing dialog with the instructor. Courses with high transactional distance have little dialog between the teacher and students and require high structure to provide learners with guidance. In a course with little dialog or structure, the learners must make their own decisions about how, what, when, where, and in what ways to study. Moore and Kearsley (1996) argue that learner autonomy is where "learners have different capacities for making decisions regarding their own learning" (p. 205). The theory of transactional distance is a teaching-learning relationship model with learner variables, course variables, and instructional variables.

Systems Theory of Distance Education

The systems theory of distance learning was articulated by Saba (1999) to describe the interrelationships of the variables that make up the distance learning

environment. This theory builds on Moore's elements of structure and dialog from the theory of transactional distance. According to Saba (1999) the distance learning environment is best described using systems theory because it is difficult to reduce the complexity of a distance learning environment to its individual elements. The distance learning system is made up of both the elements and the interrelationship among the elements. This theory explains how distance learning systems are non-linear in nature and the fact that the learning environment is dynamic and constantly changing.

Equivalency Theory

The equivalency theory was developed and described by Simonson, Schlosser, and Hanson (1999). The foundation of this theory is that the learning experiences of distant learners should be equivalent to those of on-campus learners and that the objective of instructional design should be to provide appropriate and equivalent learning experiences for all students. The elements of this theory include the concept of equivalency, the learning experiences, the appropriate application, and the learning outcomes. It is the responsibility of the educator to design learning activities or events that provide experiences with equivalent value to learners regardless of their location. The learning experiences are the activities that promote student learning and the goal in planning these experiences is to make them equivalent for all learners. The appropriate application implies that the learning experiences should be appropriate for the needs of the learners and the learning situation. The outcomes are the measurable changes that occur in the students as a result of participation in the course. The instructor-determined outcomes are usually stated as the goals and objectives of the course and are what the

students should master after completing the course. The learner-determined outcomes are related to what the learner hopes to accomplish as a result of participating in the course.

Student Issues

Distance learning environments are complex and require attention to the issues that affect students. Felder and Brent (1996) defined student-centered instruction to include techniques like substituting active learning experiences for lectures, assigning open-ended problems requiring critical or creative thinking to solve, involving students in simulations or role-plays, assigning a variety of unconventional writing exercises, and using other cooperative learning techniques. They point out that using these techniques with students accustomed to traditional methods may be a painful process. Woods (1994) observed that students forced to go through this process experience many of the steps psychologists associate with trauma and grief. The steps are shock, denial, strong emotion, resistance and withdrawal, surrender and acceptance, struggle and exploration, return of confidence, and integration and success. According to Felder and Brent (1996), some students have a more difficult time than others with student-centered instruction. The resistance is a natural part of their journey from dependence to independence. If sufficient structure and guidance are provided, most students reach satisfactory levels of performance and acceptance of responsibility for their own learning. Adult learning theory and the identification of the learning styles of students are important to consider when developing instruction for distance and distributed learning environments.

Adult Learning

Knowles (1980) articulated the andragogical model for adult learning. He contrasted andragogy, the art of helping adults learn, with pedagogy, the art and science of helping children learn. His assumptions include: (a) mature learners are self-directed; (b) adults have a broad range of experiences that are a rich resource for learning; (c) an adults readiness to learn is related to their social role; (d) adults are more problem centered than subject centered; and (e) adults are motivated to learn by internal factors. Everett (1998) stated that adult learners bring many life experiences to the learning environment and are motivated learners because of having the self-concept of being responsible for their own learning.

Cross (1981) developed a model for adult learning based on her analysis of lifelong learning programs. The model has variables of personal characteristics and situational characteristics. The personal characteristics are aging, life phases, and developmental stages. The situational characteristics include part-time versus full-time learning as well as voluntary versus compulsory learning. The dimensions of the model are intended to provide guidelines for designing adult learning programs.

Adult distance learners are self-directed and active in the learning environment, which should include actual experiences as much as possible (Boettcher, 1999). Moore (1994) also described the adult student learning through distance learning to be autonomous and accepting a high degree of responsibility for his or her own learning. Moore and Kearsley (1996) stated, "most distance education students are adults between the ages of 25 and 50" (p. 153). Garrison's (1997) model of a self-directed learner integrates self-management, self-monitoring, and self-motivation. Guglielmino (1977)

developed the Self-Directed Learning Readiness Scale (SDLRS) to measure the degree that an adult is self-directed in his or her learning. She identified psychological qualities as initiative, independence, and persistence in learning; acceptance of responsibility for one's own learning; a high degree of curiosity; ability to learn independently; joy of learning; goal oriented; and the tendency to view problems as a challenge rather than an obstacle. The characteristics of adult learners need to be combined with the learning styles of the students to develop instruction for distance and distributed learning environments.

Learning Styles

There have been many researchers that have worked in the area of learning styles. Carl Jung (1921) was one of the first researchers to work with learning preferences and learning styles. His model of learning styles included the thinker, intuitor, feeler, and the sensor learners. Dunn and Dunn's learning style model is based on Jung's work and identifies major stimuli that students respond to in learning situations to include environmental, emotional, sociological, physical, and psychological (Dunn, Dunn, & Price, 1996). The Myers-Briggs Type Indicator is also based on Jung's theory and was developed by Isabel Myers and Katherine Briggs to understand the differences and similarities in human personalities (Briggs-Myers & McCaulley, 1985). Myers and Briggs develop a list of four ranges of personality traits that include introvert-extrovert, sensing-intuitive, thinking-feeling, and perceiving-judging.

Silver, Strong, and Perini (1997) state that learning styles emphasize the different ways people think and feel as they solve problems, interact, and create products. They

look at the styles of the mastery learner, understanding learner, self-expressive learner, and the interpersonal learner. The mastery style absorbs and processes information sequentially and judges the value of learning based on clarity and practicality. The understanding style focuses on ideas and learns through questioning and reasoning. The self-expressive style uses emotion to construct new ideas and products based on originality and aesthetics. The interpersonal style focuses on concrete information, but prefers to learn socially.

Kolb (1984) outlined four basic learning styles: converger, diverger, assimilator, and accommodator. The convergent learning style depends on active experimentation and abstract conceptualization. The diverger depends on concrete experience and reflective observation. The assimilator depends on abstract conceptualization and reflective observation. The accommodator depends on active experimentation and concrete experience. To match instructional methods to Kolb's learning styles, teachers should provide concrete information and examples in liberal arts and humanities to divergers, provide abstract information and examples in physical sciences to convergers, provide examples in research and planning work to assimilators, and provide marketing and sales work to accommodators (Liu & Ginther, 1999).

The Felder-Silverman Learning Style Model includes five dichotomous learning style dimensions: sensing to intuitive learners; visual to verbal learners; inductive to deductive learners; active to reflective learners; and sequential to global learners (Felder, 1996). Felder (1993) describes the learner preferences for the dichotomous learning style dimensions. Sensing learners favor information that comes through their senses and intuitive learners favor information that comes from memory, reflection, and imagination.

Visual learners prefer information from visual images of charts, diagrams, pictures, or demonstrations. Verbal learners prefer written words, spoken words, and mathematical formulas. Inductive learners prefer to learn by seeing specific observations or results to learn principles through inference. Deductive learners begin with general principles and deduce consequences and application. Active learners learn while doing or working in groups; and reflective learners prefer to think things through and to work alone or in pairs. Sequential learners absorb information in small logically connected chunks, while global learners take information in unconnected fragments and achieve understanding in large holistic leaps.

There are many other models and instruments that have been developed to identify learning styles. Merriam and Cafferella (1999) sum up the value of using one of the methods as follows: "despite the lack of uniform agreement about which elements constitute a learning style, it seems apparent that learning-style inventories have proved useful in helping both learners and instructors alike become aware of their personal learning styles and their strengths and weaknesses as learners and teachers" (p. 210).

Faculty Issues

Developing and delivering distance and distributed learning courses create new stresses and issues for faculty members. Baldwin (1998) analyzed how technology impacts teaching, research, and service. He said, "technology is gradually transforming higher education and the work of the academic profession" (p. 7). Baldwin (1998) described the traditional model of instruction as professor-centered with students in a passive role. Technology and distance learning require the instructor to shift to play a

supportive role as adult learners take responsibility for their learning. The instructor must be the subject matter expert as well as have skills with instructional technology, counseling, and knowledge of group dynamics. Technology has opened up new possibilities for research with access to electronic databases to search for scholarly work and new avenues for publications in electronic journals. Service and outreach is enhanced by the ability of technology to break down barriers between campus and community for the transfer of information, expertise, and resources.

Gumport and Chun (1999) looked at faculty issues as they relate to technology and how the role of the faculty member in distance learning is different than in a traditional instructional setting. Faculty need to guide students through information resources to obtain content knowledge and help students learn how to learn. Universities need to provide faculty members with access to state-of-the-art learning technologies, and training on how to use the equipment, as well as training on new techniques for developing distance learning courses. Training and support help faculty to break out of the traditional instructional paradigm to look for creative ways to achieve learning objectives using the technology.

Power pedagogy through the use of instructional technology can increase faculty productivity and can accommodate more students with existing facilities (Juliano, 1997). There is a new trend of teachers becoming technologically literate for themselves and for their students (Plotnick, 1996). The use of instructional technology to develop distance learning materials takes more time than traditional methods (Juliano, 1997). Developing a distance learning course and learning about new methods to deliver a course are time-

consuming and the faculty rewards system at most universities do not reward working with technology to the same extent as publishing and research.

When creating a distance learning exercise, it is important to plan in advance. The lesson plan matrix developed by Reed and Woodruff (1995) shown in Table 2 is an example of what should be done to prepare for a distributed learning experience. These strategies and preparation techniques help an instructor to develop courses for distance and distributed learning environments.

Table 2: Lesson Plan Matrix

Learner Outcomes	Methods and Activities	Materials	Time	Equipment Cues	Notes
What do you expect learners to accomplish?	How will you convey the topic (lecture, discussion, hands-on activity)?	What audio/visual aids, handouts, etc. will you use to support instruction?	How long will the exercise take?	Cues for the different distributed technologies used	Do you need to prepare a visual or get handouts to learners?

Note. From "An Introduction To Using Videoconferencing Technology For Teaching" by Reed, J. and Woodruff, M. (1995). The Distance Educator Newsletter. Retrieved July 14, 1999 from the World Wide Web: http://www.kn.pacbell.com/wired/vidconf/Using.html.

Instructional Design and Methods

There has been considerable debate on whether media or methods influence learning. Clark (1994) stated that instructional media influence the cost, speed, and efficiency of learning, while instructional design and methods make it possible to influence student learning and achievement. He defined methods as cognitive strategies that are necessary for learning, which students cannot or will not provide for themselves. There are many different media types that can be used to accomplish the same learning goal. According to Clark (1994), learning that occurs as the result of exposure to media

is caused by the instructional methods embedded in the media presentation. Media does not drive the learning environment, but is the vehicle for the delivery of the instructional strategies that lead to learning.

Gagne developed a model for instructional design that includes analysis of requirements, selection of media, design of instruction, formative evaluation, and summative evaluation (Gagne, Briggs, & Wager, 1992). This model is the foundation of most instructional design activities. He also described nine instructional events to include gaining attention, describing learning objectives, stimulating recall of prior learning, presenting a learning stimulus, providing learning guidance, eliciting performance, providing feedback, assessing performance, and enhancing retention and transfer of knowledge to other contexts. The model is designed to guide the process of developing the content for a course as well as selecting the presentation media. Distance and distributed learning environments are guided by Gagne's instructional design model, along with knowledge gained in the areas of cooperative and collaborative learning to design instruction and presentations to be delivered with computers and other information technologies.

Cooperative and Collaborative Learning

Distance and distributed learning environments should incorporate communication, cooperation, and collaboration along with the delivery of content. These techniques help students achieve higher levels of thinking described by Bloom's (1956) cognitive domain. His hierarchy of learning has the elements of knowledge, comprehension, application, analysis, synthesis, and evaluation. The aim of most

graduate programs is to help student to progress through these building blocks of learning in order to achieve the higher levels of analysis, synthesis, and evaluation.

Communication is the process where information is exchanged between individuals; cooperation is the range of processes where individuals work together; and collaboration extends the activities of communication and cooperation toward highly productive relationships among participants (Tiessen & Ward, 1997). The focus on learner-oriented instruction emphasizes interaction, collaboration, and learner control (Merrill, 1997). To truly achieve a student-centered model of education, the student must be a motivated learner and teachers must be open to new techniques of instruction. This requires students to be actively involved in the structuring of their learning, and the teacher's role changes to that of a coach, mentor, or guide (Kozma & Quellmalz, 1996).

Riel (2000) stated that learning should be an active and exciting process that can be difficult, frustrating, and challenging. She also described a learning community to have a shared interest in a problem, respect for the diversity of perspectives, a range of skills and abilities, the opportunity and commitment to work as a team, tools for sharing multiple perspectives, and knowledge production as a shared goal.

Johnson and Johnson (1996) articulated cooperative learning as the use of small groups in instructional environments where students work together to maximize their own and each other's learning. Cooperative learning creates a culture for learning where students are responsible for their own learning as well as for the learning of their peers (Panitz, 1999). This community of learners works together to teach each other new skills and explore new concepts. By working with others, students experience greater long-term retention of information, increased motivation to achieve, higher levels of cognitive

thinking, and enhanced learning (Johnson, Johnson, Holubec, & Roy 1984). Technology-based exploratory tools offer opportunities for students to work together cooperatively, which was otherwise impossible in a lecture format (Rickard, 1999; Dede, 1998).

According to Rimmershaw (1999), collaborative study emphasizes knowledge making as the aim of study and is a common academic practice that is good for learning. The benefit to learning from collaboration is the sharing of information and ideas with others. Wood and Gray (1991) claimed collaboration occurs when a group of autonomous stakeholders of a problem domain engage in an interactive process using shared rules, norms, and structures, to act or decide on issues related to that domain. Stated in terms for education, collaboration occurs when a group of autonomous students engage in an interactive process, using shared rules, norms, and structures, to act or decide on issues related to the area of study.

Collaboration in education necessitates instructors coming together with their own expertise, experiences, and teaching style for a common goal of providing coherent instruction to a group of students (Gary, 1999). Peer collaboration encourages maximum student participation at the idea level, resulting in more flexible thinking, multiple solutions, and greater understanding of solutions (Kewley, 1998). Research by Thiessen and Ward (1997) found that students are able to learn more through collaboration than on their own. Harasim (1999) stated that in contrast to traditional, lecture-based learning, collaborative learning is an interactive, group knowledge building process. He defined knowledge building as "the process of progressive problem solving, which encourages students to be innovative, create intellectual property, and develop and acquire expertise"

(p. 44). Distance learning methods should develop patterns that allow students to collaborate with other students, with students at other schools, and with students in other communities (Kozma & Quellmalz, 1996).

Learning with Computers and Multimedia

Howard Gardner (1999), in his book The Disciplined Mind, points out that one of the most important technological events of our time is the development of the computer. He stated that technology is simply a tool for education and skilled educators must examine goals to determine which technologies can help them meet those goals. According to Gardner (1999):

> For the first time, it is possible via technology to teach individual students in ways that they learn best, to fashion future instruction based on the record of earlier successes and failures with those students, and to allow them to show what they have learned in ways both comfortable for them and susceptible to external evaluation...The challenge is to create pedagogical and curricular interfaces that mobilize the genius of the technology and the curiosity of children in the service of deeper understanding (p. 238-239).

Presentation technologies that include a variety of media may be able to help more students form rich representations of an event and cultivate deeper understandings (Veenema and Gardner, 1996). Multimedia is an interactive computer-mediated presentation that includes text, sound, graphics, video, and animation (Tannenbaum, 1998). Sousa (1998) described the impact that multimedia has on students as:

> The rapidly changing multimedia-based culture and the stresses that result from an ever-increasing pace of living are changing what the developing brain learns from the world. Children are accustomed to rapid sensory and emotional changes and respond by engaging in all types of activities of short duration (p. 22).

Sousa (1998) pointed out that research has shown that schools must provide technology and materials to make the environment engaging and interesting. Further, Sousa (1998) argued that students do not learn best by sitting for long stretches listening to teachers talk.

Multimedia impacts learning by the way the brain processes the different types of media. According to Mayer and Moreno (1998), the dual processing theory of working memory, students learn better in multimedia environments when words and pictures are presented in separate modalities than when they are presented in the same modality. They point out that using visual media to present both graphic and verbal information (text) can create an overload situation for the learner. Visual information and auditory information are processed in different parts of the brain. Therefore, students learn better when presented with the combination of visual information and the corresponding narration presented verbally rather than with text.

According to Mayer, Moreno, Boire, and Vagge (1999), "constructivist learning occurs when learners actively construct meaningful mental representation from presented information" (p. 638). Bruner (1966), the father of cognitive psychology, defined constructivism as learners build or construct their own knowledge by adapting previous knowledge or experiences to construct their own meaning. Mayer et. al (1999) encouraged designers of multimedia to stay away from situations where large amounts of

visual information are presented without corresponding verbal information and vise versa. The implications for classroom presentations are that students need to see and hear to learn best and that too much of either stimulation may cause problems.

King (1997) encouraged instructors to provide opportunities for students to subconsciously preview information by hanging posters and other graphic materials to be covered in future weeks as input for students' peripheral awareness. This can be accomplished through the use of multimedia or materials on the Internet that provide students with a graphical look at all of the materials for a course. Students can access these materials any place with connectivity to the Internet, rather than having to wait to enter the physical classroom. The technology provides an extension to the physical classroom that is the virtual classroom that can be entered via the Internet. Van Dusen (1997) discussed combining virtual classes to create a virtual campus for electronic teaching, learning, and research environments created by the use of information and instructional technologies.

Interaction

Communication, discussion and interaction are vital to the learning process. Caine and Caine (1997) claimed that learning is influenced by the nature of the social relationships between the participants. They stated that students and teachers need superior communication skills to reflect and understand concepts as a result from participating in genuine interactions. Moore (1993) defined interaction in a learning environment to include communication between students and content, students and instructors, and students with other students. Fulford and Zhang (1993) found that

student perception of the level of interaction is a critical predictor of learner satisfaction. Weston and Cranton (1986) suggested that interactive learning strategies promote higher-order learning such as analysis, synthesis, and problem solving. Interaction can occur synchronously, as in interactive systems, or asynchronously, as with independent systems like online education (Smith & Dillon, 1999). Distance and distributed learning have been shaped by the types of student interaction, the ability to use computers as the medium for interaction, and by the different generations of distance learning technologies.

Types of Student Interaction

The three types of student interaction methods used in a distance and distributed learning courses are student-to-content, student-to-instructor, and student-to-student interaction. Moore and Kearsley (1996) describe technology to include the machines that distribute messages and the organizations and people that make the technology work. Media, on the other hand, carry the instructional messages that are distributed via the technology. The media are typically text, graphics, audio, and video found in books, study guides, audiotapes, videotapes, audioconferences, or videoconferences. According to Moore and Kearsley (1996), "selection of a particular delivery technology or combination of technologies should be determined by the content to be taught, who is to be taught, and where the learning will take place" (p. 13).

Student-to-content interaction is the interaction between the students and the subject matter of the course that enables students to engage in knowledge construction. Moore and Kearsley (1996) described this interaction as:

> This interaction of student with content is a defining characteristic of education. Education is a process of planned learning assisted by a teacher or teaching institution. Every learner has to construct knowledge through a process of personally accommodating information into previously existing cognitive structures. It is interacting with content that results in these changes in the learner's understanding, what we sometimes call a change in perspective, when the learners construct their own knowledge (p. 128).

Student-to-instructor interactions are the instructor's efforts to stimulate learner interest and motivation, to assists students in organizing information in order to apply what they have learned, and to provide evaluation and feedback to the learner on progress (Moore & Kearsley, 1996). This type of interaction is important in responding to the learners' application of new knowledge.

Student-to-student interaction is the communication between peers that are going through the learning experience together and is necessary for the development of social and group process skills (Smith & Dillon, 1999). Moore and Kearsley (1996) described student-to-student interaction as interaction between students either "alone or in group settings, with or without the real-time presence of an instructor" (p. 131).

According to Moore and Kearsley (1996) the secret to good teaching is activity and participation.

> The single most important skill that all distance educators must develop is to make their students active participants in their educational program. It is not too difficult to present information over a distance, but getting people to participate and making learning active at a distance is much harder (p. 133).

The art of developing and teaching a distance or distributed learning course is using the interactive nature of computers and media by asking questions, encouraging student presentations, getting student to talk to each other, and using other techniques of involving students fully in the teaching and learning process.

Computers and Interaction

Walther (1996) reviewed the literature on computer mediated communication (CMC) versus face-to-face (FtF) communication and stated the following:

> The key difference between ...CMC and FtF communication has to do not with the amount of social information exchanged but with the rate of social information exchange. This framework acknowledges that there is less social information per message in CMC because of the absence of nonverbal cues (p. 10).

CMC is interpersonal when users have time to exchange information, build impressions, and compare values. The longer that individuals use CMC the more interpersonal the communication becomes. There are times to foster impersonal interaction to facilitate brainstorming, to encourage equal participation, or for criticism blind to status.

There are many types of technologies that can facilitate synchronous and asynchronous interaction. Synchronous interaction occurs when participants interact at the same time. Interaction that occurs with participants contributing at different times is asynchronous. The key is to make the technology transparent and instantly available to the learner. Examples of asynchronous collaboration tools include email and threaded discussions. A threaded discussion area is where the conversation topics are organized in

threads, which are groups of related comments that are organized with each comment indented below the previous comment. Synchronous collaboration tools include chat, instant messaging, and desktop videoconferencing.

Interaction with technology can be as deeply relational as face-to-face interactions, if sufficient time and messages are exchanged (Walther, 1992). Technology-based discussions give students a greater opportunity for reflection and thoughtful composition (Walther, 1996). Harasim and Winkelmans (1990) found that active discussion and interaction in an online discussion was related to the level of activity and presence of the moderator. The construction of the communication and interaction experience for an online course may become as important as developing the content (Irani, 1998). Online discussions can be synchronous or asynchronous and involve one-to-one, one-to-many, or many-to-many relationships between students and instructors (Morris & Ogan, 1996).

Online discussion areas enable students to read other students' answers and comments, while having time to reflect prior to reacting and responding (Mory, Gambill, & Browning, 1998). In face-to-face classes, instructors speak for approximately 80-percent of the time, while online students send about 85-percent of the messages (Harasim, 1999). Asynchronous interaction may have the capacity to be more socially desirable and effective as composers are able to concentrate on message construction to satisfy multiple or single concerns at their own pace (Walther, 1996).

Technology that enables asynchronous and synchronous has improved considerably in the last decade. Sherron and Boettcher (1997) describe a unique benefit to the advancement of technology; "the primary differentiating feature between the

distance learning technologies of today and those of previous generations is the capability for timely and personal interaction, the basis of most satisfying relationships" (p. 9). This level of interaction is a key ingredient for both distance and distributed learning.

Generations of Distance Learning & Interactive Technologies

Moore and Kearsley (1996) described four generations of distance learning technologies. The first generation was characterized by correspondence and independent study learning with the principle media being printed material delivered by mail. The second generation consisted of the Open Universities that began in the 1970s that utilized broadcast and recorded media distributed by radio, television, and audiotapes. The third generation was the delivery of materials by broadcast television or videotapes and interaction by telephone or both delivery and interaction by a videoconference. The fourth generation distance learning technologies is the delivery and interaction of a course through computers connected to networks or the Internet.

Moore and Kearsley (1996) compare the four generations of distance learning with the approaches for interaction, flexibility, level of learning, and the primary media (see Table 3). This table helps describe the progression of distance learning through the generations. The designer of distance learning can use this chart along with the dimensions of the transactional distance model to create learning activities with different amounts of dialog and structure. Learning modules that require a high amount of structure and low interaction are more suited to print, video, or delivery of Internet

presentations. Lessons that require high interaction are more suited for online technologies or interactive videoconferences.

Table 3: Comparison of Distance Education Approaches

	Degree of Interaction	Degree of Flexibility	Level of Learning	Primary Media
Correspondence				
Home Study	Minimal	Moderate	Vocational	Print, video
Independent Study	Moderate	High	Secondary and postsecondary	Print, audio, or computer
Open Universities	Moderate	High	Postsecondary	Print, audio, or visual
Satellite Television	Low-High	Low	K-12 or postsecondary	TV or Teleconferences
Networks	High	High	K-12 or postsecondary	Computers or Videoconferences

Note. From Distance Education: A Systems View, by Moore, M. G. and Kearsley, G. (1996). Belmont, CA: Wadsworth Publishing Company, p. 57.

Research on Effectiveness

Many research studies have been conducted comparing traditional classroom instruction to instruction at a distance utilizing technology to facilitate the delivery. In general, distance education is effective when measured by student achievement, attitudes of students and teachers, and by cost effectiveness (Moore, 1989). Russell (1999) published an annotated bibliography about the effectiveness of distance learning titled The No Significant Difference Phenomenon. Most of the citations state that learning outcomes of students using technology at a distance are similar to the outcomes of students that participate in traditional classroom instruction. Moore and Kearsley (1996) would agree with Russell because "much of the research over the past 50 years has focused on comparing the achievement of learners (as measured by grades, test scores,

retention, job performance) who are taught at a distance and those taught in face-to-face classes" (p. 61). There is no significant difference between learning in the two different environments and no further investigation needs to be conducted comparing the environments. That does not mean that no further research on distance learning needs to be conducted.

What's the Difference: A Review of Contemporary Research on the Effectiveness of Distance Learning in Higher Education by Phipps & Merisotis (1999) is a publication that has reviewed a broad range of research on distance learning. They pointed out that there is considerable research stating that the learning outcomes for distance learning are similar to traditional instruction. They also found that the overall quality of research is questionable and therefore the findings are inconclusive. The problems with the research analysis include failure to control extraneous variables, not using random sampling techniques, not validating testing instruments, and failure to control reactive effects. This shows an opportunity for further research to validate the different technologies used for distance learning. They state that the higher education community has a lot to learn about how distance technology affects the teaching and learning process.

Moore and Thompson (1991) agree that rigorous research is required to measure the fundamental dynamics of learning and teaching at a distance. They claim:

> It seems more reasonable to conclude that (a) there is insufficient evidence to support the idea that classroom instruction is the optimum delivery method; (b) instruction at a distance can be as effective in bringing about learning as classroom instruction; (c) the absence of face-to-face contact is not in itself detrimental to the learning process; and (d) what makes any course good or poor

is a consequence of how well it is designed, delivered, and conducted, not whether the students are face-to-face or at a distance" (p. 65).

Summary of Literature Review

Distance learning is a type of distributed learning with learners separated from instructors by distance. Moore and Kearsley (1996) defined distance education as planned learning that occurs in a different place from teaching. Graves (1997) described distributed education to encompass distance education, but reaches further to integrate learning through asynchronous and synchronous conversations within learning communities of students.

Distance learning has been shaped by the theories of independence, industrialization, interaction, transactional distance, systems theory, and the equivalency theory. Wedemeyer (1971) developed the distance learning theory of independence that has learners being self-directed and free to control the pace, time, and place of learning. Otto Peters coined the term distance learning and developed the theory of industrialization of distance learning based on industrial methods for the design and delivery of distant learning instruction (Peters, 1983). Holmberg (1989) developed the interaction and communication theory that is based on two-way dialog or interaction between students and teachers. Moore (1994) developed the theory of transactional distance that looks at the dimensions of dialog and structure to describe the distance between students and instructors. Saba (1999) developed the systems theory of distance learning to describe the interrelationships of the variables that make up the elements of structure and dialog from the theory of transactional distance. Simonson, Schlosser, and

Hanson (1999) developed the equivalency theory asserting that learning experiences of distant learners should be equivalent to those of on-campus learners.

Adult distance learners are self-directed and active in the learning environment, which should include actual experiences as much as possible (Boettcher, 1999). Knowles (1980) articulated the andragogical model for adult learning that contrasted andragogy, the art of helping adults learn, with pedagogy, the art and science of helping children learn. Everett (1998) stated that adult learners bring many life experiences to the learning environment and are motivated learners because they take responsibility for their own learning.

Carl Jung (1921) was one of the first researchers to work with learning preferences and learning styles. His model of learning styles included the thinker, intuitor, feeler, and the sensor learners. The Myers-Briggs Type Indicator is based on Jung's theory and was developed to understand the differences and similarities in human personalities (Briggs-Myers & McCaulley, 1985). The Felder-Silverman Learning Style Model includes five dichotomous learning style dimensions which include sensing to intuitive learners; visual to verbal learners; inductive to deductive learners; active to reflective learners; and sequential to global learners (Felder, 1996).

Baldwin (1998) looked at how technology impacts teaching, research, and service as well as how the traditional model of instruction is professor-centered with students in a passive role. Gumport and Chun (1999) stated that faculty need to play a supportive role as adult learners take responsibility for student-centered learning. Universities need to provide faculty members with access to state-of-the-art learning technologies and training on how to develop distance learning courses.

According to Clark (1994), learning that occurs as the result of exposure to media is caused by the instructional methods embedded in the media presentation. Gagne developed a model for instructional design that includes analysis of requirements, selection of media, design of instruction, formative evaluation, and summative evaluation (Gagne, Briggs, & Wager, 1992). Johnson and Johnson (1996) articulated cooperative learning as the use of small groups in instructional environments where students work together to maximize their own and each other's learning. Harasim (1999) stated that in contrast to traditional, lecture-based learning, collaborative learning is an interactive, group knowledge building process. According to Mayer and Moreno (1998), students learn better in multimedia environments when words and pictures are presented in separate modalities than when they are presented in the same modality.

Moore (1993) defined interaction in a learning environment to include communication between students and content, students and instructors, and students with other students. Weston and Cranton (1986) suggested that interactive learning strategies promote higher-order learning such as analysis, synthesis, and problem solving. Interaction with technology can be as deeply relational as face-to-face interactions, if sufficient time and messages are exchanged (Walther, 1992). Technology-based discussions give students the opportunity for reflection and thoughtful composition of messages (Walther, 1996).

Educators must leverage new technologies to help traditional and distance students learn. Networking is one of the fastest growing applications of technology in education due to the rapid growth of the Internet (Plotnick, 1996). Distributed learning environments leverage networking to provide a useful tool to help place- and time-bound

students continue to learn. Gumport and Chun (1999) noted that few faculty, students, and administrators are aware of the full range of possibilities of how to use information technology for education. They stated that the resistance to jumping on the bandwagon is the lack of evidence of sustained improvement in student performance as a result of using new information technology.

Russell (1999) described the "no significant difference problem" where the learning outcomes of students using technology at a distance are similar to the outcomes of students that participate in traditional classroom instruction. Phipps and Merisotis (1999) reviewed a broad range of research on distance learning and found that the overall quality of research is questionable and, therefore, the findings are inconclusive.

CHAPTER THREE: METHODS

Introduction

The purpose of this research was to investigate which instructional methods for interaction were best to facilitate student satisfaction and learning for both on-campus and off-campus MBA students. This research looked specifically at student satisfaction and outcomes with synchronous and asynchronous interaction methods.

Research Design

This study used a mixed methodology with both quantitative (Phase I) and qualitative (Phase II) procedures to assess student performance and satisfaction with both synchronous and asynchronous interaction methods. Heinecke, Blasi, Milman, and Washington (1999) recommended using both qualitative and quantitative measures in order to assess the complexities of how technology impacts teaching and learning. Saba (2000) calls for analysis in educational research that includes both qualitative and quantitative methods that are empirical and data-driven and that "cast a wider net for capturing data generated by the interaction between the teacher and the learner" (p. 4).

Quantitative Design

Kozma (1991) described the components of a course to include methods, media, and context. This research worked with the model that includes methods, media, content, and learning participants. Phipps and Merisotis (1999) argued that technology and media delivery modes are not as important as other factors like learning tasks, learner characteristics, student motivation, and the instructional methods. Phase I was a quasi-

experimental study that examined the relationship between student's learning outcomes and the instructional methods used to facilitate synchronous and asynchronous interaction. The student learning outcomes were measured through assessments of satisfaction and performance. The study compared the interaction methods for three groups of adult students: (a) traditional daytime on-campus MBA professional course, (b) an off-campus MBA professional course, and (c) an off-campus foundation MBA course delivered online over the Internet. The instructor was held constant for all three courses, and the content was held constant for the on-campus and off-campus MBA course, but content was different for the online course. All of the courses had matched groups that received alternating treatments of asynchronous and synchronous interaction methods for two learning modules. The learning modules included methods to look at student-to-content, student-to-instructor, and student-to-student interaction. The following describes the detail of the study's groups, observations, and treatments:

On-Campus Group 1 $O_1—X_1—O_2—X_2—O_3$

On-Campus Group 2 $O_1—X_1—O_2—X_2—O_3$

Off-Campus Group 1 $O_1—X_1—O_2—X_2—O_3$

Off-Campus Group 2 $O_1—X_1—O_2—X_2—O_3$

Online Class 1 $O_1—X_1—O_2—X_2—O_3$

Online Class 2 $O_1—X_1—O_2—X_2—O_3$

Qualitative Design

Phipps and Merisotis (1999) pointed out the problems with most distance learning research and the opportunity for further research to validate the different technologies

used for distance learning. They asserted that one of the problems with past studies were that the relationships to test with quantitative procedures need to be identified through qualitative methods. Kozma (1994) pointed out that "if there is no relationship between media and learning it may be because we have not yet made one" (p. 7). He also noted that research must reflect on the capabilities of media and the complexities of the social situations where media are used. The social setting for a distance learning class is complex and includes both physical and virtual elements. Qualitative procedures enabled the researcher to explore these complex relationships from a student's perspective on the synchronous and asynchronous interaction methods.

The qualitative portion of the study was guided by the principles of qualitative inquiry described by Creswell (1994). This research gathered qualitative data with open-ended questions on the post-treatment surveys as well as conducted post-hoc qualitative interviews using the case study method to gather information about student preferences with synchronous and asynchronous interaction methods. The case study method explores a single entity or phenomenon bounded by time and activity (Creswell, 1994). Phase II explored the phenomenon of synchronous and asynchronous interaction methods with the single entity being students in three types of graduate business courses. The qualitative methods helped to further highlight and explain the relationships and phenomena found with the quantitative methods.

Sample, Population, and Subjects

The sample for this study was from registered students in graduate business courses at the University of Montana offered by the School of Business Administration.

All students in the study were graduate students seeking an MBA. The first two groups of subjects were from one professional MBA course that was offered to both on-campus and off-campus students. The last group was from an online MBA foundation course. The same instructor taught the courses for the three groups. It was anticipated that the on-campus group would have 40 students, the off-campus group would have 20 students, and online group would have 15 students enrolled. The students in each class were randomly assigned to two different groups to receive alternating interactive treatments of synchronous and asynchronous methods for two instructional. The sample size and random assignment to groups met the assumption of normality for the on-campus group.

The sample for the Phase II qualitative portion of this research would be around ten students representing the on-campus and off-campus courses. These students were selected using a purposeful sampling method seeking students who represented the main findings from the Phase I quantitative portion of the study. Purposeful sampling selects information rich cases for in depth study based on the purpose of the study (Patton, 1990). The types of purposeful sampling include: extreme or deviant case sampling; typical case sampling; maximum variation sampling; snowball or chain sampling; confirming or disconfirming case sampling; politically important case sampling; and convenience sampling. According to Lincoln and Guba (1985), the most useful strategy for the naturalistic approach is maximum variation sampling. The ten students were selected to represent the maximum variation groups that were identified in the quantitative portion of the study. Post-hoc interviews were conducted with these students

to look for further relationships and findings about the effectiveness of synchronous and asynchronous interaction methods.

Null Hypotheses

The purpose of this research was to investigate which instructional methods for interaction were best to facilitate student satisfaction and learning for both on-campus and off-campus MBA students. This study investigated the following research questions:

- What impact does interaction have on the satisfaction and learning outcomes of the students in the graduate business courses?
- What relationships do the instructional methods for interactions have with student learning styles and student skill level with technology?
- What student characteristics facilitate success with synchronous and asynchronous delivery methods for interaction?

The following null hypotheses were developed to answer the research questions:

1. There is no statistically significant difference between synchronous and asynchronous communication; $H_o: \mu_{Synchronous} = \mu_{Asynchronous}$ $\alpha=.05$
2. There is no statistically significant difference between the on-campus, off-campus, and online course delivery methods; $H_o: \mu_{On-campus} = \mu_{Off-Camp} = \mu_{Online}$ $\alpha=.05$
3. There is no statistically significant difference between student-to-content, student-to-instructor, and student-to-student interaction; and $H_o: \mu_{StoC} = \mu_{StoI} = \mu_{StoS}$ $\alpha=.05$

4. There is no statistically significant difference between the three factors for time of interaction, method of delivery, and type of interaction.

H_o: $\mu_{Time} = \mu_{Method} = \mu_{Type}$

α=.05

Statistical significance was tested with an alpha level less than or equal to .05. The experimental difference of a five-percent increase or decrease in performance for time, method, or type of interaction was considered to make a practical difference.

Instrumentation and Materials

All students taking the courses completed pre-course questionnaires that were administered online. These surveys gathered information about student characteristics, learning styles, skill levels with technology, and demographics. Learning style was measured using the Felder-Silverman Learning Style Model (see Appendix B) with five dichotomous learning style dimensions that included: sensing to intuitive learners; visual to verbal learners; inductive to deductive learners; active to reflective learners; and sequential to global learners (Felder, 1996). The Meyer-Briggs was used to assess learning and personality characteristics for the students in the courses (Briggs-Myers & McCaulley, 1985). The modified Keirsey Temperament Sorter version of the Meyers-Briggs test was administered online (see Appendix B). The Computer and Technology Assessment survey was designed according to the guidelines for survey research described by Fink (1995). This survey measured the different proficiencies that the students had with using computers and other information technology, as well as gathered demographic information (see Appendix B).

The study tested satisfaction and performance with synchronous and asynchronous interaction methods using both pre and post test instruments (see Appendix B). The Pre-Learning Module Assessment measured the student's understanding of the content area prior to the module and their experience with the synchronous or asynchronous methods used for interaction. The Post Learning Module Assessment survey measured the student's satisfaction with the learning experience, their own assessment of how well they mastered the content, and their qualitative assessment of the experience with open-ended questions.

The instructor for the course measured student performance on each module. Since there were no standardized tests developed to measure graduate business student knowledge in both professional and foundation areas, it was assumed that the instructor was the best person to measure the degree to which students have mastered the material. This assessment was gathered from the final exam for the course with several questions for the two learning modules. These questions were designed to measure how well the students mastered the content from the learning modules. The instructor for the course administered the test and provided this information to the researcher for analysis.

The questions in the pretest survey were tested for face validity by a group of 16 students. Both the Myers-Briggs and the Felder-Silverman instruments have been used extensively in other research, which points to both validity and reliability of the instruments.

The qualitative portion of the study used a standard interview protocol (Janesick, 1998). This procedure included a common set of questions about how students perceived the synchronous and asynchronous interaction methods. The interviews were conducted

post-hoc and in a semi-structured manner to enable the researcher to ask the prepared questions and to enable the students to provide information that they deem important about interaction with synchronous and asynchronous methods (see Appendix B).

Procedures

The research used quasi-experimental methods to look for relationships between the independent and dependent variables. The procedures included pre-course surveys, pre-test surveys prior to each learning module, and post-test surveys after each learning module. All of these instruments were administered online over the World Wide Web.

The online course was taught first and used as a pilot to test the validity of the survey instruments and the research procedure. The on-campus and off-campus courses were taught simultaneously. The following list describes the step-by-step procedures used for the study and a detailed chart for the research design can be found in Appendix C:

1. Worked with the instructor to select the two different learning modules and the synchronous and asynchronous interaction methods that were used in the experiment.
2. Created the online survey instruments to gather learner characteristic, learning style, technology skill, demographic information, experience with the synchronous and asynchronous interaction methods, and knowledge of the content area prior to the delivery of the modules.
3. Utilized the course roster to randomly assign the student in the classes into two groups. The groups alternatively received asynchronous and synchronous

interaction methods for each module. The alternating process enabled each group to function as both experimental and control groups.

4. Administered the online pre-course surveys.
5. Created the online pre and post-test surveys to measure satisfaction for the modules.
6. Worked with the instructors to coordinate the delivery of the learning modules and administration of the surveys.
7. After each learning module, worked with the instructor to obtain the student performance grade.
8. Compiled the data and ran the statistical procedures to obtain descriptive statistics and to test the research questions.
9. Selected ten students that represent the major finding areas and the on-campus and off-campus classes.
10. Conducted and recorded the qualitative semi-structured interviews either face-to-face or over the phone.
11. Transcribed the interviews.
12. Analyzed the qualitative interview data for common themes.

Variables in the Study

The dependent variables in this research were student outcomes measured by student satisfaction and the grade received for the specific learning module. The independent variables were the different methods used for synchronous and asynchronous interaction for student-to-content, student-to-instructor, and student-to-student

interaction. The modifying or covariant variables were the student characteristics, learning styles, and technology skill. Diaz (2000) recommended these variables to focus research on individual student characteristics (computer expertise and learning styles) that make them successful in different delivery modalities.

Anticipated Treatment of the Data

The descriptive statistics from the pre-test survey were compiled to describe the characteristics of the students in the different treatment groups. The Likert scale information was analyzed and displayed using frequency distributions. The student outcome data was measured by the grade (interval/ratio data) received as well as using satisfaction data gathered from Likert scales (ordinal data). This analysis used the Likert ordinal data as one of the factors in the statistical analysis. Traditionally, these statistical procedures were designed to use with interval/ratio data. The student outcome data (dependent variable), the interaction methods (independent variables), and the learning style, characteristic, and technology skill (covariates) were analyzed using analysis of covariance (ANCOVA). This statistical procedure helped to remove the potential problems to validity of the study of not holding the type of students constant for all of the groups. Homogeneity of regression was tested at an alpha level of .05. The adjusted student performance information from the factors showing statistical significance with the ANCOVA was further analyzed with factorial analysis of variance (ANOVA).

The qualitative data was analyzed to search for common themes. Strauss and Corbin (1990) defined open coding as the process to identify concepts or themes by breaking data down into discrete parts to discover the properties and dimensions of the

data. They defined axial coding as a process for reassembling the themes from the open coding process into categories to continue to explain the phenomena. The transcriptions from the post-hoc interviews along with the open-ended answers from the post-treatment surveys were analyzed with open and axial coding using the software package NUD*IST. This enabled the researcher to reduce the qualitative data to the specific findings.

The findings were displayed in a conditional matrix showing the themes for synchronous and asynchronous interaction. The matrix also compared the quantitative and qualitative results. The matrix helped to triangulate with the quantitative analysis to seek convergence of results. Triangulation means to look at the data from different vantage points to increase validity by removing bias inherent in the data sources, investigator, or method (Creswell, 1994). This research used a sequential triangulation procedure where the results from the quantitative Phase I helped plan the qualitative Phase II. This qualitative procedure was used to further describe student preferences for synchronous and asynchronous interaction methods.

CHAPTER FOUR: RESULTS AND FINDINGS

Introduction

The purpose of this study was to investigate the different times, methods, and types of interaction in a graduate business course. More specifically, this investigation sought to answer the following research questions:

- What impact does interaction have on the satisfaction and learning outcomes of the students in the graduate business courses?
- What relationships do the instructional methods for interactions have with student learning styles and student skill level with technology?
- What student characteristics facilitate success with synchronous and asynchronous delivery methods for interaction?

The focus of this study was to answer the research questions with a mixed methodology that included gathering both quantitative and qualitative data. Phase I of the study gathered performance and satisfaction information from 57 students in the graduate business course with 37 on-campus and 20 off-campus students. All 57 students submitted the pre-course surveys to describe their learning styles, Meyers-Briggs type characteristics (MBTI), skill with technology, and demographic information (all instruments are in Appendix B). There were 56 students that completed the pre and post-treatment surveys for a total response rate of 98.25%. There were qualitative questions on the post-treatment survey that were used in the qualitative analysis along with the Phase II post-hoc interviews with 12 students. The results and findings are reported in the descriptive, quantitative, and qualitative sections that follow.

Descriptive Statistics

This section looks at the descriptive statistics to describe the type of students enrolled in the on-campus and off-campus sections of the graduate business course. The data were analyzed based on means, percentages, frequency distributions, cross tabulations, and Chi Square Goodness-of-fit tests. The areas reported include the Felder-Silverman Index of Learning Styles (ILS), Meyers-Briggs Modified Keirsey Temperament Sorter (MBTI), computer and technology skill, and demographic information.

Felder-Silverman Index of Learning Styles

The Felder-Silverman Index of Learning Styles (ILS) instrument can be found in Appendix B and was administered prior to the learning module treatments. The learning style dimensions for the ILS include active to reflective (A/R) learners, sensing to intuitive learners (S/I), visual to verbal learners (V/V), and sequential to global learners (S/G) (Felder, 1996). The distribution and strengths of the learning styles can be found in Table 4, which includes the number and percentage of students exhibiting the dimensions of the four different learning styles. The two classes only differed on the active/reflective style with the on-campus class having more active learners and the off-campus class having more reflective learners (40% compared to 32.4%). The difference was measured by a Chi Square (9, N=57) of 18.57 and a p-value of .029. The overall distribution for the learning styles for the students in the course was 64.9% active and 35% reflective learners, 64.9% sensing and 35% intuitive learners, 73.7% visual and 26.3% verbal

learners, and 59.7% sequential and 40.3% global learners. The majority of the students exhibited balanced to moderate strength for the different learning styles.

Table 4: Distribution and Strength for the Felder-Silverman Index of Learning Styles

Styles	Learning Style Distribution			Strength of Learning Style			
Active/Reflective	ACT	REF	Totals	Balanced	Moderate	Strong	Totals
Counts	37	20	57	30	20	7	57
Percent	64.91%	35.09%	100.00%	52.63%	35.09%	12.28%	100.00%
Sensing/Intuitive	SEN	INT					
Counts	37	20	57	19	22	16	57
Percent	64.91%	35.09%	100.00%	33.33%	38.60%	28.07%	100.00%
Visual/Verbal	VIS	VRB					
Counts	42	15	57	28	17	12	57
Percent	73.68%	26.32%	100.00%	49.12%	29.82%	21.05%	100.00%
Sequential/Global	SEQ	GLO					
Counts	34	23	57	31	17	9	57
Percent	59.65%	40.35%	100.00%	54.39%	29.82%	15.79%	100.00%

Meyers-Briggs Modified Keirsey Temperament Sorter

The Meyers-Briggs Modified Keirsey Temperament Sorter instrument can be found in Appendix B. The Myers-Briggs Type Indicator (MBTI) was developed by Isabel Myers and Katherine Briggs to understand the differences and similarities in human personalities (Briggs-Myers and McCaulley, 1985). The four ranges of personality traits include extrovert/introvert (E/I), sensing/intuitive (S/N), thinking/feeling (T/F), and judging/perceiving (J/P). The types did not differ significantly between the on-campus and off-campus students. Table 5 summarizes the distribution and strengths for the personality types.

The distribution for E/I type was 57.9% extraverts, 33.3% introverts, and 8.8% neutral. The distribution for S/N type was 52.6% sensors, 40.4% intuitors, and 7% neutral. The distribution for the T/F type was 73.7% thinkers, 22.8% feelers, and 3.5% neutral. The distribution for the J/P type was 77.2% judgers, 14% perceivers, and 8.8%

neutral. The majority of the students were in the balanced to moderate strengths for the type preferences.

Table 5: Distribution and Strength for the Meyers-Briggs Keirsey Temperament Sorter

	Type Indicator				Strength of Type Preference			
E/I Type	Extraverts	Introverts	Neutral	Totals	Balanced	Moderate	Strong	Totals
Counts	33	19	5	57	5	39	13	57
Percent	57.89%	33.33%	8.77%	100.00%	8.77%	68.42%	22.81%	100.00%
S/N Type	Sensors	Intuitors						
Counts	30	23	4	57	4	45	8	57
Percent	52.63%	40.35%	7.02%	100.00%	7.02%	78.95%	14.04%	100.00%
T/F Type	Thinkers	Feelers						
Counts	42	13	2	57	2	43	12	57
Percent	73.68%	22.81%	3.51%	100.00%	3.51%	75.44%	21.05%	100.00%
J/P Type	Judgers	Perceivers						
Counts	44	8	5	57	5	38	14	57
Percent	77.19%	14.04%	8.77%	100.00%	8.77%	66.67%	24.56%	100.00%

Table 6: Class Distribution for Meyers-Briggs Personality Types

Titles	Unique Ability	Type	% of Population	Counts	Percent of Students
Architect	Logical	INTP	1.00%	1	2.50%
Scientist, Builder	Independent	INTJ	1.00%	1	2.50%
Inventor	Inventive	ENTP	5.00%	3	7.50%
Fieldmarshal	Commandeering	ENTJ	5.00%	6	15.00%
Crusader	Non-directive	INFP	1.00%	0	0.00%
Author	Empathic	INFJ	1.00%	0	0.00%
Journalist	Optimistic	ENFP	5.00%	3	7.50%
Teacher, Catalyst	Persuasive	ENFJ	5.00%	2	5.00%
Entertainer	Generous	ESFP	13.00%	0	0.00%
Promoter	Unpredictable	ESTP	13.00%	0	0.00%
Disestablishment	Artistic	ISFP	6.00%	0	0.00%
Artisan	Skillful with tools	ISTP	6.00%	1	2.50%
Seller	Harmonizing	ESFJ	13.00%	1	2.50%
Administrator	Hard-charging	ESTJ	13.00%	11	27.50%
Loyal	Loyal	ISFJ	6.00%	1	2.50%
Trustee	Strong & silent	ISTJ	6.00%	10	25.00%
		Totals	100.00%	40	100.00%

Note. $t=2.97$, $p=.01$, & $df=15$

Table 6 compared the type preference for the students in the course to the type preference expected in the population. Forty of the students had type preferences directly in the sixteen different type categories. Seventeen students had mixed types that were excluded from the analysis. The majority of the students were in the type title categories of 15% field marshal, 27.5% administrator, and 25% trustee. The students were distributed in the type categories that one would expect for graduate business students that either strive to be or currently are managers and/or leaders in organizations. The class differs significantly from the general population based on a paired sample t-test with a t-value (15, N=40) of 2.97 and a p-value of .01.

Computer and Technology Assessment

The student skill with computers and learning technologies were measured with the Computer and Technology Assessment survey found in Appendix B. Table 7 summarized the findings for the differing skills with computers and technology for the on-campus and off-campus students. There was a significant difference in the computer use proficiency between the classes, with 55% advanced users in the off-campus class compared to 27% advanced users in the on-campus class. This difference was represented by a Chi Square (2, N=57) value of 6.9 and a p-value of .032. The students have been using computers for quite some time with 43.2% of the on-campus and 70% of the off-campus students reporting using computers for over ten years. The on-campus students reported an average use in hours per day for computers of 4.79 hours for work, 3.19 hours for graduate school, and 1.6 hours for personal use. The off-campus students reported 5.4 hours for work, 1.74 hours for graduate school, and 1.37 hours for personal

use. The graduate school use was statistically significant with a Chi Square (9, N=57) of 20.969 and a p-value of .001. The off-campus students spent less time using computers for graduate work (1.74 hours compared to 3.19 hours) that shows they had balanced their time and really focused on activities when it came to studying and preparing for the class.

Table 7: Student Computer and Technology Usage and Proficiency

Description	On-campus Day	Off-campus Night	Total	Chi Square	df	p-value
Computer use proficiency				6.906	2	0.032
Beginner		5.00%	1.80%			
Intermediate	73.00%	40.00%	61.40%			
Advanced	27.00%	55.00%	36.80%			
Computer use in hours per day						
Work	4.79	5.4	5.02			
Graduate School	3.19	1.74	2.7	20.969	9	0.001
Home	1.6	1.37	1.52			
Internet Use Proficiency						
Beginner		10.00%	36.00%			
Intermediate	55.60%	55.00%	55.40%			
Advanced	44.40%	35.00%	41.10%			
Used computer more than 10 yrs.	43.20%	70.00%	52.60%			
Used Internet more than 5 yrs.	62.20%	55.00%	59.60%			
Use Internet every day	67.60%	65.00%	66.70%			
Prior experience with synchronous chat	56.80%	60.00%	57.90%			
Prior experience with asynchronous threaded discussion	32.40%	65.00%	43.90%	5.592	1	0.018
Prior experience with streaming video	24.30%	35.00%	28.10%			
Prior experience with online communities	18.90%	10.00%	15.80%			
Prior experience with online class	16.20%	40.00%	24.60%	3.963	1	0.046
Moderate to high apprehension for learning with technology	5.40%	20.00%	10.60%	9.894	4	0.042
Moderate to high excitement for learning with technology	54.00%	70.00%	59.70%	9.894	4	0.042

The students in the course reported high Internet use and proficiency with 95.5% of all students rating proficiency as intermediate or advanced and 59.6% of the students reported using the Internet for more than 5 years. The on-campus students access the

Internet everyday 67.6% of the time compared to 65% of the off-campus students. The classes have various degrees of experience taking online courses and using online interaction technologies. Forty percent of the off-campus students have taken an online course compared to 16.2% of the on-campus students, which was significant with a Chi Square (1, N=57) of 3.963 and a p-value of .046.

The students had various amounts of experience with interactive technologies. Prior experience with synchronous chats was reported by 57.9% of the students. Only 28.1% of the students had prior experience with watching streaming video on the Internet, which was the technology used to deliver the asynchronous online PowerPoint presentations. Participation in online communities was reported by 15.8% of the students, which points out that most of the students are not using the Internet for highly interactive activities and that the experience with the interactive technologies in this study was a new experience for 84.2% of the students. The two groups differed significantly on experience with asynchronous threaded discussions measured by a Chi Square (1, N=57) of 5.592 and a p-value of .018. The percent of on-campus students reporting prior use of a threaded discussion was 32.4% compared to 65% of the off-campus students.

The last area for describing the differences between the two groups was their receptiveness to learning with technology. This was measure with a 5-point Likert scale and compared using a Chi Square test, which resulted in a Chi Square (4, N=57) of 9.894 and a p-value of .042. The on-campus students reported that 5.4% were moderate to highly apprehensive to learning with technology compared to 20% for the off-campus students. The on-campus students reported that 54% of them were moderate to highly excited about learning with technology compared to 70% of the off-campus students.

This validates that the group that has selected to learn via distance learning was more receptive to that method than the group that selected to learn in a traditional face-to-face mode.

Demographic Information

The demographic information supplied by the 57 students is summarized in Table 8 and included age, sex, income level, percent employed, undergraduate degree area, race, and population for their residence community. There were 37 students in the on-campus class and 20 students in the off-campus class. The mean age for the on-campus group was 26.05 and 36.75 for the off-campus group. This difference in age was statistically significant with a t-value of 6.241, a p-value of less than .001, and 28.27 degrees of freedom. There was not homogeneity of variance between the two groups ($F=3.967$ and $p=.051$) and the t-value for not equal variances was used. The female to male distribution for the on-campus group was 43.2% females to 56.8% males compared to the off-campus group with 55% females and 45% males. The off-campus had a significantly higher number of students that worked with 95% reporting currently being employed compared to 73% of the on-campus students. This was measured with a Chi Square (1, N=57) of 4.045 and a p-value of .004.

The income level for the off-campus group was significantly (Chi Square (4, N=57) = 27.9 and $p < .001$) higher with 78.9% of the students reporting salaries of over $30,000 per year. The majority of the students in both groups have undergraduate degrees in business reported by 75.7% of the on-campus students and 70% of the off-campus students. The off-campus group had a race and ethnicity distribution of 100%

white, while the on-campus group had 5.4% American Indians, 2.7% Hispanic, 86.5% white, and 5.4% other. The two groups differed significantly according to the size of the towns or cities where they live measured by a Chi Square (6, N=57) of 24.03 and a p-value of .001. The percent of students living in rural communities of fewer than 5000 people was 30% for the off-campus group. The on-campus group has 10.8% of the students that are commuting from rural areas. The percent of students living in larger cities of over 40,000 people was reported as 78.4% for the on-campus group and 20% for the off-campus group. This reflects the rural nature of the State of Montana and that the off-campus program serves students that live in rural areas.

Table 8: On-Campus and Off-Campus Student Demographic Information

Description	On-campus Day	Off-campus Night	Total	Test Statistic	df	p-value
N	37	20	57			
Age	26.05	36.75	29.81	t=6.241	28.27	0.000
Females	43.20%	55.00%	47.40%			
Males	56.80%	45.00%	52.60%			
Income over $30,000	10.80%	78.90%	33.90%	Chi=27.9	4	0.000
Percent employed	73.00%	95.00%	80.70%	Chi=4.045	1	0.044
Bachelors degree in Business	75.70%	70.00%	73.70%			
Percent from towns under 5000	10.80%	30.00%	17.50%	Chi=24.03	6	0.001
Percent from cities over 40,000	78.40%	20.00%	57.90%	Chi=24.03	6	0.001
Race						
American Indian	5.40%		3.50%			
Hispanic	2.70%		1.80%			
White	86.50%	100.00%	91.20%			
Other	5.40%		3.50%			

Quantitative Results

The quantitative data from the pre and post-treatment surveys was analyzed using analysis of covariance and factorial analysis of variance. Statistical significance was tested with an alpha level of .05. The experimental difference of a five-percent increase or decrease in performance for time, method, or type of interaction was considered to

make a practical difference. The students received four different treatments during two instructional modules with the instructor and content variables held constant. The four treatments were: (1) synchronous face-to-face or videoconference lecture and a synchronous face-to-face discussion (F2F Lecture/F2F Discussion); (2) synchronous face-to-face or videoconference lecture and an asynchronous threaded discussion (F2F Lecture/Thread); (3) asynchronous online PowerPoint lecture and a synchronous chat discussion (Online PowerPoint/Chat); and (4) asynchronous online PowerPoint lecture and an asynchronous threaded discussion (Online PowerPoint/ Thread). The data were analyzed with four multiple measures for the 57 students giving a total multiple measure N of 228. The following sections look at the results for the statistical tests to compare synchronous and asynchronous interaction methods; on-campus and off-campus courses; student-to-content, student-to-instructor, and student-to-student interaction; as well as the time, method, and type of interaction.

Synchronous to Asynchronous Interaction

The data for this analysis came from the pre and post-treatment instruments. This area looked at synchronous and asynchronous methods for the lecture and discussion treatments. The following sections address the dependent variable measures for performance and satisfaction.

Performance.

The performance data for the study was analyzed with analysis of covariance (ANCOVA) and multivariate analysis of variance (MANOVA) for the two dependent performance measures—the objective and essay exams. ANCOVA was used to evaluate

the covariates for personality type, learning style, technology skill, as well as performance covariates for the Graduate Management Admission Test (GMAT), undergraduate grade point average (GPA), and graduate grade point average (GRADGPA). The GRADGPA covariate factor was significant in the model with a multivariate F-value (1, 222) of 6.486 and a p-value of .002. The GRADGPA covariate was used with the independent variables for the synchronous and asynchronous lecture (L) and discussion (I) treatments to look at student performance on the objective and essay exam questions. The interaction between the lecture (L) and discussion (I) variables for the essay exam was statistically significant with an F-value (1, 223) of 3.806 and a p-value of .051. The adjusted means on the essay exam for the interaction affect are shown in Table 9 and were adjusted for a GRADGPA mean of 3.46. Students had the lowest performance on the essay exam with an adjusted mean of 3.95 for the synchronous lecture (L) by synchronous discussion (I) treatment. The experimental difference between the synchronous lecture and asynchronous discussion treatment (4.35) was 8% and the difference between the asynchronous lecture and the synchronous discussion treatment (4.40) was 9%. This difference represents almost a complete grade level of improvement by using an asynchronous method combined with a synchronous method.

Table 9: Performance on Essay Exam with Synchronous and Asynchronous Methods

	Lecture Format			
Interaction Format	Synchronous	Asynchronous	Difference	Percent of total (5)
Synchronous	3.95	4.40	-0.45	-9.00%
Asynchronous	4.35	4.16	0.19	3.80%
Difference	-0.40	0.24		
Percent of total (5)	-8.00%	4.80%		

Note. F=3.86 & p=.051

Satisfaction.

The satisfaction data for the study was analyzed with MANOVA for the two dependent satisfaction measures for satisfaction with the lecture (SAT-L) method and satisfaction with the interaction (SAT-I) method. The MANOVA between subjects effects are shown in Table 8. The model has an adjusted R-Squared of .029 and shows significance for the lecture (L) by satisfaction with the lecture (SAT-L) factor ($F(1,196) = 6.13$ & $p = .011$), the discussion (I) by the satisfaction with the discussion (SAT-I) factor ($F(1,196) = 12.244$ & $p = .001$), and interaction between the lecture (L) and discussion (I) factors with the satisfaction with the discussion (SAT-I) factor ($F(1,196) = 4.670$ & $p = .032$).

Table 10 shows the means for the satisfaction areas of significance. Students are clearly more satisfied with the synchronous lecture (L) and discussion (I) methods and are the most satisfied with the interaction that occurs in a traditional classroom experience. The experimental difference on the lecture treatment was 7% and 11.2% on the discussion treatment. This demonstrated that students are most comfortable with synchronous interaction. The lecture (L) by discussion (I) interaction illustrated that students prefer the synchronous face-to-face lecture and synchronous face-to-face discussion to the three other treatments. The experimental difference for the synchronous lecture with the synchronous discussion (3.54) showed that students were 18% more satisfied when compared to the synchronous lecture and asynchronous discussion treatment (2.64).

Table 10: Student Satisfaction with Synchronous and Asynchronous Methods

	L X I Interaction for Satisfaction with Interaction			
Delivery Type	Synchronous	Asynchronous	Difference	Percent of total (5)
Synchronous	3.54	2.92	0.62	12.40%
Asynchronous	2.64	2.71	-0.07	-1.40%
Difference	0.90	0.21		
Percent of total (5)	18.00%	4.20%		
p-value	0.032			

	L-Differences	I-Differences
Delivery Type	Satisfaction with Lecture	Satisfaction with Interaction
Synchronous	3.61	3.23
Asynchronous	3.26	2.67
Difference	0.35	0.56
Percent of total (5)	7.00%	11.20%
p-value	0.011	0.001

On-Campus and Off-Campus Delivery Methods

The data for this analysis came from the pre and post-treatment instruments and was analyzed with using analysis of covariance (ANCOVA) and multivariate analysis of variance (MANOVA). This area looked at differences in the on-campus and off-campus student groups for the synchronous and asynchronous methods for the lecture (L) and discussion (I) treatments. The following sections address the dependent variable measures for performance and satisfaction.

Performance.

The performance data for the study was analyzed with ANCOVA and MANOVA for the objective exam and essay exam dependent variables. ANCOVA was used to evaluate the covariates for personality type, learning style, technology skill, and as well as performance covariates of GMAT, undergraduate grade point average, and graduate grade point average (GRADGPA). The covariate factors that were used in the model

were GRADGPA, GMAT score, and the Meyer-Briggs extrovert/introvert type (MBTI-E/I). The GRADGPA had a multivariate F-value (1, 218) of 6.222 and a p-value of .002. The GMAT had a multivariate F-value (1, 218) of 6.308 and a p-value of .002. The MBTI-E/I type had a multivariate F-value (1, 218) of 5.260 and a p-value of .006.

The covariates were used with the independent variable for the on-campus and off-campus students to see the effect on student performance on objective and essay exam questions. There was a statistically significant difference for the class independent variable and the objective and essay exams (see Table 11). The objective exam by class had a F-value (1, 219) of 6.741 and a p-value of .010. The essay exam had an F-value (1, 219) of 4.666 and a p-value of .032. The exam means were adjusted for a GRADGPA of 3.46, a GMAT of 546.07, and MBTI-E/I of 59.06 for the model that had an adjusted R-Squared of .087 for the objective exam and .055 for the essay exam. The on-campus group scored significantly higher on the objective exam (4.19) compared to the off-campus group (3.72). The experimental difference was 9.4% or almost a complete grade level. The off-campus group scored significantly higher on the essay exam (4.49) compared to the on-campus group (4.11). The experimental difference was 7.6% or about three-quarters of a grade level.

Table 11: On-Campus and Off-Campus Student Performance on Exams

	Class				
	On-campus	Off-campus		Percent of	
Exam Type	Day	Night	Difference	total (5)	p-value
Objective	4.19	3.72	0.47	9.40%	0.010
Essay	4.11	4.49	-0.38	-7.60%	0.032

Satisfaction.

The satisfaction data for the on-campus and off-campus groups was first analyzed with ANCOVA to evaluate the covariates for personality type, learning style, technology skill, and as well as performance covariates of GMAT, undergraduate grade point average, and graduate grade point average (GRADGPA). The covariate factors that were used in the model were GMAT, Meyer-Briggs extrovert/introvert type (MBTI-E/I), the sequential/global learning style (ILS-S/G), and the general computer proficiency (GENCOMP). The GMAT had a multivariate F-value (1, 187) of 4.512 and a p-value of .012. The MBTI-E/I had a multivariate F-value (1, 187) of 4.291 and a p-value of .015. The ILS-S/G style had a multivariate F-value (1, 187) of 5.871 and a p-value of .003. The GENCOMP had a multivariate F-value (1, 187) of 8.951 and a p-value of less than .001. The model had an adjusted R-Squared of .170.

The covariates were used with the on-campus and off-campus groups of students (CLASS) and the two dependent satisfaction measures for satisfaction with the lecture (SAT-L) method and satisfaction with the interaction (SAT-I) method. This MANOVA showed a significant difference between classes for the satisfaction with the lecture method (SAT-L). The F-value (1, 188) was 6.772 and a p-value of .005. A second MANOVA was analyzed with the lecture (L) independent variable to see where the differences were located. There was a statistically significant difference between the lecture (L) factor and the satisfaction with the lecture (SAT-L) factor (F (1, 188) = 4.678 & p = .032) and the CLASS by the satisfaction with the lecture (SAT-L) factor (F (1, 188) = 8.106 & p = .005). The means for the satisfaction areas of significance are shown in Table 12. Students are more satisfied with the synchronous lecture method (3.62)

compared to the asynchronous (3.33) lecture delivery. The off-campus students are more satisfied with the lecture method (3.68) compared to the on-campus students (3.27). This difference was primarily due to the satisfaction with the asynchronous PowerPoint presentation (3.61) for the off-campus students compared to the on-campus students (3.05).

Table 12: On-Campus and Off-Campus Student Satisfaction with Lecture Methods

Class	Satisfaction with Lecture	Satisfaction with Synchronous Lecture	Satisfaction with Asynchronous Lecture
On-campus	3.27	3.49	3.05
Off-campus	3.68	3.76	3.61
Difference	-0.41	-0.27	-0.56
Percent of total (5)	-8.20%	-5.40%	-11.20%
p-value	0.005		
Delivery Type			
Synchronous	3.62		
Asynchronous	3.33		
Difference	0.29		
Percent of total (5)	5.80%		
p-value	0.032		

Student-Content, Student-Instructor, and Student-Student Interaction

The data for this section came from the pre and post-treatment instruments and were analyzed using analysis of covariance (ANCOVA) and multivariate analysis of variance (MANOVA). This area looked at differences in student-to-content (S-C), student-to-instructor (S-I), and student-to-student (S-S) interaction. It was impossible to separate out the effect of the three interaction types based on performance for the objective and essay exams because the students received a mix of student-to-content (S-C), student-to-instructor (S-I), and student-to-student (S-S) interaction for each of the four treatments. The results in this area are only for student satisfaction.

The satisfaction with student-to-content (S-C), student-to-instructor (S-I), and student-to-student (S-S) interaction was tested using the satisfaction data for the different types of interaction that came from the post-treatment surveys. There were four measures available for this test. The first measure was the overall satisfaction with the lecture experience that was used to measure student-to-content interaction satisfaction (S-C/SAT). There were two measures for student-to-instructor interaction—one for the lecture (S-I/LEC) experience and one for the discussion (S-I/DIS) experience. The fourth measure was the student satisfaction with the student-to-student interaction from the discussion (S-S/DIS) experience. These four factors were compared using MANOVA and the means for the four measures of satisfaction were 3.42 for satisfaction with the lecture (S-C/SAT) method, 3.54 for satisfaction with the interaction with the instructor (S-I/LEC) during the lecture, 3.06 for satisfaction with the interaction with the instructor (S-I/DIS) during the discussion, and 3.07 for satisfaction with the interaction with other students (S-S/DIS) during the discussion. The four means differed statistically measured by the within subjects effects with an F-value (3, 196) of 17.416 and a p-value of less than .001. Follow-up paired sample t-tests were used to determine the differences between the means and the results are in Table 13. Student-to-instructor interaction satisfaction (3.54) measured by the lecture treatment (S-I/LEC=3.54) was statistically significant over all of the other interaction types. The satisfaction of student-to-content interaction (S-C/SAT=3.42) was statistically significant over the means for student-to-instructor interaction (S-I/DIS=3.06) during the discussion treatment and student-to-student (S-S/DIS=3.07) interaction.

Table 13: Student Satisfaction with Interaction between Content, the Instructor, and Other

	S-C	S-I-Lecture	S-I-Discussion	S-S-Discussion
Means	3.42	3.54	3.06	3.07
Experimental Differences and Significance				
	S-C	S-I-Lecture	S-I-Discussion	S-S-Discussion
S-C	0	0.12*	-0.36**	-0.35**
S-I-Lecture	-0.12*	0	-0.48**	-0.47**
S-I-Discussion	0.36**	0.48**	0	0.01
S-S-Discussion	0.35**	0.47**	-0.01	0
Percentage Differences				
	S-C	S-I-Lecture	S-I-Discussion	S-S-Discussion
S-C	0.00%	2.40%	-7.20%	-7.00%
S-I-Lecture	-2.40%	0.00%	-9.60%	-9.40%
S-I-Discussion	7.20%	9.60%	0.00%	0.20%
S-S-Discussion	7.00%	9.40%	-0.20%	0.00%

Students

Note.*p<.05 & **p<.001

Time, Method, and Type of Interaction

The data for this analysis came from the pre and post-treatment instruments. The performance and satisfaction data was analyzed using analysis of covariance (ANCOVA) and multivariate analysis of variance (MANOVA). The time factor was represented by the synchronous and asynchronous nature of the treatments, method factor is for the on-campus and off-campus courses (CLASS), and the type of interaction are represented by the different lecture (L) and discussion (I) treatments. The following sections address the dependent variable measures for performance and satisfaction.

Performance.

The performance data for the study was analyzed with ANCOVA and MANOVA for the objective exam and essay exam dependent variables. ANCOVA was used to evaluate the covariates for personality type, learning style, technology skill, as well as performance covariates of GMAT, undergraduate GPA, and graduate GPA. The

covariate factors that were used in the model with an adjusted R-Squared of .110 were GRADGPA, GMAT, and the Meyer-Briggs extrovert/introvert type (MBTI-E/I). The GRADGPA had a multivariate F-value (1, 212) of 6.275 and p-value of .002. The GMAT had a multivariate F-value (1, 212) of 6.428 and a p-value of .002. The MBTI-E/I type had a multivariate F-value (1, 212) of 5.410 and a p-value of .005.

The covariates were used with the independent variables for the different CLASS, lecture (L) method, and discussion (I) method to see the effect on student performance on objective and essay exam questions. The means and differences for the time, method, and class factors are shown in Table 14. Time was the first factor tested using the CLASS by discussion (I) method interaction effect that showed a statistically significant difference for the objective exam with an F-value (1, 213) of 6.312 and a p-value of .041. The on-campus students performed better with asynchronous interaction (4.42) than synchronous interaction (3.97) on the objective exam questions. The experimental difference was 9% or almost a complete letter grade.

The second factor was the method of interaction. The researcher predicted that the asynchronous threaded discussion would have a positive impact on performance, so a one-tailed test was used with an F-value (1, 213) of 4.862 and a p-value of .036. When the lecture method was an asynchronous online PowerPoint presentation, students performed better with an asynchronous threaded (4.02) discussion than with a synchronous chat discussion (3.62) on the objective exam questions. This experimental difference of 8% was due to the ability of the asynchronous threaded discussion method to promote reflection and enable students to review the materials. When the discussion method was synchronous interaction either face-to-face or a chat session, students

performed better when combined with a synchronous lecture (4.20) compared to an asynchronous (3.62) lecture on the objective exam questions. This difference required a two-tailed test and the results were not statistically significant (F (1, 213) = 3.268 and p = .072), but made a practical difference based on the experimental difference stated a priori of greater than 5% effect on grades. The synchronous lecture with the synchronous face-to-face discussion had an experimental difference of 11.6% or more than one grade level. This was due to the opportunity to interact with the instructor during the synchronous lecture to ask clarification questions compared to the asynchronous online PowerPoint presentation.

Table 14: Student Performance Based on Time, Method, & Class

	Class				
Exams	On-campus Day	Off-campus Night	Difference	Percent of total (5)	p-value
Objective	4.19	3.72	0.47	9.40%	0.009
Essay	4.11	4.49	-0.38	-7.60%	0.032
Difference	0.08	-0.77			
Percent of total (5)	1.60%	-15.40%			
Interaction Format	Interaction by Class on Objective Exam				
Synchronous	3.97	3.85	0.12	2.40%	
Asynchronous	4.42	3.59	0.83	16.60%	0.041
Difference	-0.45	0.26			
Percent of total (5)	-9.00%	5.20%			
	Interaction by Lecture Format on Objective Exam				
Interaction Format	Synchronous	Asynchronous			
Synchronous	4.20	3.62	0.58	11.60%	0.072
Asynchronous	3.98	4.02	-0.04	-0.80%	
Difference	0.22	-0.40			
Percent of total (5)	4.40%	-8.00%			
p-value 1-tailed		0.036			

The last factor was the difference based on the on-campus and off-campus students. The performance on both exams was statistically significant for the CLASS variable. The objective exam had an F-value (1, 213) of 10.293 and a p-value of .009. The on-campus students scored better on the objective exam (4.19) compared to the off-

campus group (3.72) for an experimental difference of 9.4%. The essay exam had an F-value (1, 213) of 6.62 and a p-value of .032. The off-campus group scored significantly higher on the essay exam (4.49) compared to the on-campus group (4.11) for an experimental difference of 7.6%.

Satisfaction.

The satisfaction data for this test served as the dependent variable with lecture (L) format, discussion (I) format, and CLASS format serving as the independent variables. The covariate for sequential/global learning style (LSI-SG) was found significant with ANCOVA with a F-value (1, 190) of 4.877 and a p-value of .009. The adjusted means were analyzed with MANOVA for the satisfaction with the lecture (SAT-L) method and satisfaction with the discussion (SAT-I) method. The model has an adjusted R-Squared of .061 and shows significance for the lecture (L) by satisfaction with the lecture (SAT-L) factor ($F(1, 191) = 5.747$ & $p = .017$), the discussion (I) by the satisfaction with the discussion (SAT-I) factor ($F(1, 191) = 13.887$ & $p < .001$), CLASS with satisfaction with the lecture (SAT-L) method ($F(1, 191) = 4.978$ & $p = .027$), and interaction between the lecture (L) and discussion (I) factors with the satisfaction with the discussion (SAT-I) factor ($F(1, 191) = 5.712$ & $p = .018$). Table 15 shows the means for the satisfaction areas of significance.

For the time factor, students prefer synchronous (3.65) over asynchronous lectures (3.31) with an experimental difference of 6.8%. Students also prefer synchronous (3.27) over asynchronous (2.65) discussions with an experimental difference of 12.4%. The second factor was the method of interaction. Students strongly prefer the traditional

synchronous lecture by synchronous discussion (F2F Lecture/F2F Discussion, 3.63) to all other delivery treatments for lecture and discussion. The largest experimental differences are between the asynchronous PowerPoint presentation with the synchronous chat discussion (Online PowerPoint/Chat) of 14.4% and the synchronous lecture with the asynchronous threaded discussion (F2F Lecture/Thread) of 20.4%. The last factor was the differences based on the on-campus or off-campus students. The off-campus students prefer lectures (3.64) to on-campus students (3.20) with an experimental difference of 8.8%. This was primarily due to their satisfaction with the online PowerPoint presentations.

Table 15: Student Satisfaction Based on Time, Method, and Class

Class Type	Satisfaction with Lecture	Satisfaction with Synchronous Lecture	Satisfaction with Asynchronous Lecture
On-campus	3.20	3.49	3.05
Off-campus	3.64	3.76	3.61
Difference	-0.44	-0.27	-0.56
Percent of total (5)	-8.80%	-5.40%	-11.20%
p-value	0.027		
Delivery Type	**Satisfaction with Lecture**	**Satisfaction with Discussion**	
Synchronous	3.65	3.27	
Asynchronous	3.31	2.65	
Difference	0.34	0.62	
Percent of total (5)	6.80%	12.40%	
p-value	0.017	0.000	

Qualitative Results

The qualitative data was gathered by open-ended questions on the pre and post-treatment surveys as well as follow-up interviews with 12 of the participating students. The students were selected for the follow-up interviews to represent both the on-campus and off-campus groups and to have moderate to strong type preference for the Meyers-

Briggs extrovert/introvert (MBTI-E/I) and the ILS learning style type of sequential/global (ILS-S/G). These were the covariates that were found to be significant in the quantitative analysis. The interview subjects were distributed equally between the MBTI-E/I type and ILS-S/G style. There were seven males and five females and seven on-campus and five off-campus students in the follow-up sample.

The qualitative interviews had questions in three areas and are in Appendix B. The first area asked questions about student preferences for the interaction methods of the synchronous chat, the asynchronous threaded discussion, and the asynchronous online PowerPoint lecture. The students were asked what they liked, disliked, and how they thought that method impacted their learning. The second area asked questions about the impact that student-to-content, student-to-instructor, and student-to-student interaction had on their learning. The last area had questions about the student's thoughts about learning with technology.

The interviews were transcribed and the software package NUD*IST was used to analyze the data from the surveys and follow-up interviews for themes with open and axial coding. Strauss and Corbin (1990) defined open coding as the process to identify concepts or themes by breaking data down into discrete parts to discover the properties and dimensions of the data. They defined axial coding as a process for reassembling the themes from the open coding process into categories to continue to explain the phenomena. A conditional matrix was created to compare the quantitative and qualitative results. Excel spreadsheets were used to cross-reference the qualitative comments and themes by the student characteristic, performance, and satisfaction data to develop the conditional matrix.

The initial thought was that students with strong type or learning style preference would provide the best insight on what facilitates success for performance and satisfaction with synchronous and asynchronous interaction methods. After conducting a few interviews and reviewing the open-ended questions from the post-treatment surveys, it became apparent that the students with strong types were the least receptive to synchronous and asynchronous interaction methods. The students with moderate to weak preference for extravert/introvert personality type and sequential/global learning style provided some of the most unique insight into the phenomena.

The main theme categories that emerged from the qualitative analysis centered on the issues facing students, instructors, technology, interaction, and a learning community. The following sections look at the themes developed from the open and axial coding process, as well as present the conditional matrix that helps describe the phenomena of interaction in the learning process.

Student Related Issues

The subcategories that make up the student related themes include reflection, the self-concept of students, and student preference for the traditional learning paradigm. Each of these subcategories is explored for their meaning and dimension based on the information provided by students in the study.

Reflection.

The reflection subcategory includes comments about the student's ability to reflect on the topic area before responding in the discussion activity. The comments pertained to the use of the synchronous chat and asynchronous threaded discussion

methods. The dimensions of this subcategory ranged from "time to ponder" for the threaded discussion to "promotes immediate thought" for the synchronous chat. One student described the immediate thought provoking ability of the synchronous chat as, "This was my favorite learning method. I think it promotes thought and sparks questions both asked and answered." The threaded discussion enables students to take their time thinking about the questions and was described as, "I can see a value in the threaded discussion—it gives me the time I need to ponder." Another student said, "You had time to think about your response so you didn't sound silly." This last comment summarizes both dimensions; "Some people have strengths in different areas. Some think on the fly and are great in the classroom, others take time to think about things before they go out on a limb with their ideas. The thread allows these students to take the time to answer questions and jump when they are good and ready." The need and the ability to be reflective were stimulated in different ways between the synchronous and asynchronous discussion methods.

Self-concept.

This subcategory centered around the student's personal self concept and comfort level participating with the synchronous and asynchronous interaction methods. The threaded discussion seemed to promote self-concept comfort for students. One student described the threaded discussion as, "I really liked this method because I felt more confident about commenting on the questions and responding to classmates because I'm fairly shy and get anxious about talking in class." The synchronous chat had both positive and negative dimensions ranging from it was "horrible" to it was the "best

discussion of the year." The negative side of the chat was described as, "This was a lesson in how to put down other students. This was a horrible experience. Under no circumstances would I ever recommend this to any student." The positive side was described as, "I really liked the chat, and it was the best discussion this class has had throughout the semester. Perhaps because of no self consciousness."

Traditional learning paradigm.

The traditional learning paradigm subcategory was described mostly by the on-campus students that have selected to learn primarily in a traditional face-to-face environment. This was described as, "I prefer real class, since online is not necessary and we do have the opportunity to do it live." Another student described an uneasy comfort level with the new interaction methods as, "No one wants to say anything daring because it is in print and is somehow less retractable." One of the off-campus students provided a global comment that looks at capitalizing on the strengths of the different paradigms. "Let's use the WHOLE three hours of class time for discussion, and do the PowerPoint at home." Most of these students seemed comfortable with the learning paradigm that they have experience with and were resistant to trying the new interaction methods with technology.

Instructor Related Issues

The instructor related issues were the importance of the instructor to serve as a facilitator, guide, and moderator as well as providing timely feedback to students. The comments came from the synchronous chat and asynchronous threaded discussion experiences. One student described the guide role of the instructor, as the instructor's job

is to "lead students on a journey of self discovery." The asynchronous discussion needs "thought provoking" questions and steady "guidance" to move the discussion along. One student described the "thought provoking" concept as, "I think it would be beneficial if you were in a threaded discussion where the subject matter was more conducive to a variety of conflicting positions." The need for guidance was described as, "I enjoyed the threaded discussion, however the moderator needs to constantly monitor and continue to ask questions based on responses to the initial questions."

The synchronous chat had the dynamic of moving fast without much structure, but the comments presented the same dimensions for needing "guidance" and "thought provoking" questions. The guidance concept was illustrated by "Need more guidelines. It was easy to get the discussion off track or to get confused with who was responding to what comment." The need for thought provoking questions was described as, "An open chat session doesn't allow for any thought provoking interaction. It goes too fast and it is impossible to have a question answered or keep track of several conversations at once."

Technology Related Issues

The technology related issues looked at the access and convenience of using technology for learning, the learning curve for using technology, and the ability to archive and store information for repeated viewing. This theme emerged from the comments in both the lecture and discussion treatments of the study.

Access and convenient.

The access and convenience of using technology subcategory was generated from the comments on the delivery of lectures. One end of the dimension of using technology

in this area is the willingness to put up with technological problems because of the "access" to learning opportunities. This was illustrated by one student learning on the MetNet interactive videoconference system as, "MetNet is not as good as a live in-person classroom, but it more than makes up for the difficulties in interacting by offering courses that would not otherwise be available." Another student described access for watching an asynchronous PowerPoint lecture as "It does lose some of the 'extra' class discussion that I find valuable, but it makes up for some of that through convenience." It was important that the technology not be difficult for the students to master as described related to access as "I do not have the greatest PC but had no problems with the presentation." Some students are not willing to let go of the traditional paradigm regardless of convenience or access, which was illustrated by "I didn't find it convenient to have access to the material at any time, as I accessed the lectures during regular class time. I already have that time blocked out on my schedule, and I would have found it difficult to access the material at any other time." Receptive students thrived on access to the technology and negative students did not see the point in trying something different.

Learning curve.

The learning curve subcategory builds on the access and convenience area. The comments came from the chat, threaded discussion, and online PowerPoint treatments. Students that were farther down the learning curve for technology seemed to be more receptive to using the technology to learn. The less experienced students required strong justification for why to try using the technology in the first place. Here is a comment given by a frustrated student about the online PowerPoint presentation "I spent so much

time trying to utilize the technology that I didn't see the whole presentation." A student that is farther down the learning curve with technology commented on the same presentation with "Pretty cool—streamed in just fine, even at 56K. The convenience and the ability to stop, start, go back, etc., was great!" The less experienced student seemed disengaged from both learning the technology and the content of the online lecture. This comment shows a less experienced student that was still engaged in watching the online PowerPoint presentation, "I would have like to have known how to stop the audio and come back to it at a later time. There probably is a way to do that but I wasn't sure so I listened to it all in one sitting, rather than have to go back over parts I had already heard if I couldn't access it from the middle."

One student explained a need for both improvements in technology and the skills of users for the asynchronous threaded discussion by, "It is confusing. Threads disappeared, messages didn't appear to post, then posted twice, and then not all threads could be seen. I think the idea is good, but there needs to be some improvement in either the technology, or the degree of experience of the users." Another student made a similar comment about the chat session, "It goes far too fast and depends on erratic technology that I haven't mastered." Learning with technology has dimensions of both the advancement of the technology and where the users are on the learning curve.

Stored and archived materials.

The last technology related subcategory was the ability to store, archive, and rewind presentations. This was mentioned for both the lecture and discussion treatments. Students liked the ability to archive materials for repeated access to aid in the review of

materials for learning. One student liked the asynchronous threaded discussion and mentioned, "The threaded discussion provides a written history of the interaction that can be used for future use." Another said the downside to live presentations was "You can't replay a part you want to focus on." This student mentioned the value as "Having a hard copy of class presentations makes up for the lack of interaction." The technology based treatments for discussion and lecture provided students with the ability to review content and discussions that was not available with the synchronous lecture or the synchronous face-to-face discussion.

Interaction & delivery Methods

This theme has the subcategories of the structure and organization of the interaction experience, the focus of the discussion, and the importance of immediate feedback. The comments were from both the lecture and discussion treatments. The synchronous methods had more of a problem with focus and structure and the asynchronous methods had the problem of a disconnect between the students and the topic of the conversation.

Structure, organization, and currency.

The structure, organization, and currency subcategory comments came from the chat and threaded discussion treatments. The dimensions were that the synchronous chats had less structure and organization and the asynchronous discussion had more structure and organization. One student described the threaded discussion as "This works similar to email but we all get to see the entire discussion unfold." Students liked that comments were organized in threads of discussion for easy access to the different

conversation topics. The chats were generally thought to be "fun" by most students, but unorganized. This was illustrated by this comment "I thought the chat was fun, but because answers and thoughts are so random, there is no logical sequence to the responses."

The dimension of the currency was that the synchronous methods have high connection and currency, while the asynchronous methods have low currency or a disconnection from the conversation topic. The main drawback to the threaded discussion was the disconnect over time with the conversation topic. Students felt that some of the freshness of the discussion topic was lost by having to return to the conversation several times over several days where in a synchronous interaction experience that develops more quickly and fluidly. This was illustrated as "I found it onerous to get on the discussion numerous times and reviewing the messages gets tedious and time-consuming."

Focus of the discussion.

The focus subcategory cut across the lecture and discussion treatments. The asynchronous methods had more focus than the synchronous methods. The lack of focus in a chat was described as "there was too much digression into areas of little relevance" and "I did not appreciate the background chatter. There were many personal conversations going on that took away from the learning experience." Students noted that this also happens in a synchronous classroom experience with "It is, however, easier to get off track with an in-class presentation" and "A drawback to lecture is that it is much easier to get off track in discussion." The high amount of focus with the

asynchronous online presentation was described as, "It was nice in the sense that his lectures were focused rather than being pulled off topic by student questions."

Feedback.

The importance of prompt feedback subcategory showed up in both the lecture and discussion treatments. The students had a strong need to know that they would get feedback on their ideas. Feedback could be in the form of verbal and non-verbal. With the technology methods, the students could not detect non-verbal feedback and required written comments back from the instructor or other students to know if they were on the right track. The feedback problem was illustrated in the chat by "Chatting seemed to produce more information and flowed through to some unanticipated areas. I would have liked to have more comments on the material from the instructor." The problem with the asynchronous discussion was "I think this is a great method, but there was no feedback to the questions I posted. It would have been nice to find out if my comments were on the right track or had some insight." The strength of synchronous face-to-face communication was noted as, "Talking to people in person is easier for me to communicate. I can receive feedback immediately when I am face to face with a professor or student."

Students also discussed the importance of having feedback in a lecture for the delivery of content. The synchronous lecture provided an opportunity for immediate feedback and the ability to ask clarification questions. This was described for the synchronous lecture as, "If I have a question, it is answered immediately. I feel that I pay more attention to the material when someone is speaking directly to me." The problem

with the online PowerPoint presentation was, "I missed the interaction that questions generate about the material—that's valuable to me."

Learning Community

The last theme area pertained to the importance of developing a sense of community among the learners. The comments about community came from the chat and threaded discussion treatments. Students mentioned the comfort level with participating in online discussions with people that they already knew as well as the surprise of hearing from students that do not normally participate in the traditional classroom setting. The importance of having an established learning unit or community where people already know each other was exhibited by, "First by knowing these people prior to this interaction it made it easier to contribute." The broader participation by all students in the asynchronous threaded discussion was described as, "I prefer a threaded discussion to an in class discussion because everybody is forced to contribute. In class only those who are most aggressive get a word in which sometimes doesn't leave others much room to interject." Another student commented "The threaded discussion was interesting since you were able to hear from students you might not normally hear from in class."

Conditional Matrix

The development of a conditional matrix was used to triangulate with the quantitative findings of the study. The matrix looked at how many students were receptive to the different instructional treatments in the study as well as if the themes had any impact on how well students performed on exams and how satisfied they were with the different treatments. The matrix in Table 16 has columns that include the four

treatments from the study: (1) synchronous face-to-face or videoconference lecture and a synchronous face-to-face discussion (F2F Lecture/F2F Discussion); (2) synchronous face-to-face or videoconference lecture and an asynchronous threaded discussion (F2F Lecture/Thread); (3) asynchronous online PowerPoint lecture and a synchronous chat discussion (Online PowerPoint/Chat); and (4) asynchronous online PowerPoint lecture and an asynchronous threaded discussion (Online PowerPoint/Thread). The top rows of the chart looked at how receptive students were to the different methods for lecture (L) and discussion (I) delivery. The bottom part of the chart looked at student performance and satisfaction compared to the qualitative themes, which was rated as positive, negative, or neutral.

The matrix was developed to compare the qualitative themes to the student performance and satisfaction with the experimental treatments. The subcategories were selected based on the comments from the students in order to see if there was a relationship between the interaction methods and student performance and satisfaction with the method. The students selected to analyze within each of the themes were the ones that mentioned the theme as important. Performance and satisfaction was evaluated only for the treatments where the theme was mentioned. The researcher looked for patterns of student characteristics to help explain student performance and satisfaction with the synchronous and asynchronous lecture (L) and discussion (I) treatments. The following sections present the results for the subcategory themes of reflection, self-concept, prefer traditional learning paradigm, facilitation and feedback from the instructor, access and convenience with technology, learning curve with technology, the ability to store and archive information, the focus of a discussion, the importance of

Table 16: Qualitative Conditional Matrix

	Synchronous F2F Lecture by Synchronous F2F Discussion		Synchronous F2F Lecture by Asynchronous Threaded Discussion		Asynchronous Online Lecture by Synchronous Chat Discussion		Asynchronous Online Lecture by Asynchronous Threaded Discussion	
Receptiveness to method								
Lecture Format	Sync F2F Lecture		Sync F2F Lecture		Async Online		Async Online	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Positive	9	69.23%	9	69.23%	12	33.33%	12	33.33%
Neutral	1	7.69%	1	7.69%	5	13.89%	5	13.89%
Negative	3	23.08%	3	23.08%	19	52.78%	19	52.78%
Discussion Format	Sync F2F		AsyncThread		Sync Chat		AsyncThread	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Positive	18	69.23%	12	33.33%	11	27.50%	12	33.33%
Neutral	2	7.69%	17	47.22%	26	65.00%	17	47.22%
Negative	6	23.08%	7	19.44%	3	7.50%	7	19.44%

	Synchronous F2F Lecture by Synchronous F2F Discussion				Synchronous F2F Lecture by Asynchronous Threaded Discussion				Asynchronous Online Lecture by Synchronous Chat Discussion				Asynchronous Online Lecture by Asynchronous Threaded Discussion			
Codes: (+) positive, (-) negative, or (o) neutral	Obj. Exam	Essay Exam	Sat. Lecture	Sat. Interact	Obj. Exam	Essay Exam	Sat. Lecture	Sat. Interact	Obj. Exam	Essay Exam	Sat. Lecture	Sat. Interact	Obj. Exam	Essay Exam	Sat. Lecture	Sat. Interact
Student Themes																
Reflection					-	+	-	-	-	+	+	o	+	+	o	+
Self concept					-	+	+	o	-	+	-	+	-	+	-	-
Traditional paradigm	+	-	+	+	+	+	+	-					+	+	-	-
Instructor Themes																
Facilitator or Guide	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Technology Themes																
Access/Convenient									+	+	+	+	+	+	+	+
Learning curve					+	+	+	-	+	+	+	+	+	+	+	o
Stored/Archived									+	+	+	+	+	+	+	o
Interaction Themes																
Focus	+	+	+	+	+	+	+	-	+	+	+	-	+	-	+	-
Feedback timing	+	-	+	+	+	+	+	-	+	+	-	+	+	+	+	-
Community Themes																
Social	+	-	+	+	+	+	+	-	+	+	+	+	+	+	+	-
Broader Participation	+	-	+	+	+	+	o	-	+	+	o	-	+	+	o	-

immediate feedback, the social part of the learning community, and the broader participation by students in discussions.

Reflection.

Students that mentioned this theme did well on the objective and essay exams with the asynchronous lecture by asynchronous discussion treatment. They were satisfied with the interaction method and neutral to the lecture method. This points to the importance of the ability to cognitively reflect on the subject matter with the ability to learn effectively with asynchronous delivery of lecture and discussions.

Self-concept.

The analysis of the conditional matrix does not show any pattern between self-concept and the performance or satisfaction with the different treatments. One of the students in the group was very negative about the interaction experiences and provided the extreme end of the tolerance to these instructional methods. This comment might be considered an anomaly, but provides a bottom baseline on the receptiveness for learning with technology.

Prefer traditional paradigm.

The group of students mentioning this theme exhibited moderate to strong extrovert personality type and sequential learning style. The majority of the students in this subcategory were on-campus students that selected to learn in the traditional daytime face-to-face setting. Performance was actually improved on exams for this group by

using the asynchronous discussion and asynchronous lecture methods. This group was not very satisfied with using the technology to learn.

Facilitation and feedback from the instructor.

The students in this subcategory had a high need to interact and receive feedback from the instructor. They were high achieving students exhibited by their graduate GPA. This group performed best with the asynchronous lecture method of watching an online PowerPoint presentation.

Access and convenience with technology.

The students mentioning this theme were advanced computer users and were represented by six on-campus and four off-campus students. This group exhibited moderate to strong intuitor personality type that prefers to focus on the past and future. This group seemed excited and open to trying the new ways of learning. They performed well and were satisfied with the technology delivery methods for both lecture and discussion.

The technology learning curve.

The group of students that mentioned this theme had a high degree of proficiency with using computers and technology. This group did well with the synchronous and asynchronous lectures combined with the chat and threaded discussions. They were satisfied with both the synchronous and asynchronous lectures, but were more satisfied with the synchronous chat than the asynchronous threaded discussion.

Stored and archived materials

The characteristics of the students that exhibited this theme included high graduate GPA's and GMAT scores. This group had the most advanced computer and technology users. They performed well and were satisfied with the asynchronous online PowerPoint presentation.

Focus of discussion.

This group of students exhibited moderate to strong extrovert personality type and sequential learning style. They performed well with all of the treatments except the asynchronous PowerPoint presentation and the asynchronous threaded discussion. They were not satisfied with the interaction for either the chat or threaded discussion with the chat rated the lowest. This group of students had a strong need for synchronous face-to-face interaction.

Feedback.

This group of students also exhibited moderate to strong extrovert personality type and sequential learning style. They were all on-campus students that have self-selected to learn in a traditional face-to-face setting. They have a strong need for immediate feedback and have similar findings to focus theme. They performed well with all of the treatments except the asynchronous PowerPoint presentation and the asynchronous threaded discussion. They were not satisfied with the threaded discussion but did like the chat session.

Social.

The students mentioning this theme exhibited moderate to strong extrovert personality type and sequential learning style. They did poorly with the traditional synchronous lecture and synchronous face-to-face discussion. They really liked interacting with the chat and watching the asynchronous online PowerPoint presentation.

Broader participation.

This group of students exhibited moderate to strong introvert personality type and sequential learning style and had a high number of off-campus students represented. They did not do well with the traditional learning treatment of synchronous lecture and synchronous discussions, but were the most satisfied with these methods. They performed well with the asynchronous lecture and asynchronous discussion, but were not satisfied with the methods.

Summary

This mixed methodology study had results from the analysis of both quantitative and qualitative data. The mixed methodology provides the opportunity to triangulate the findings by looking at the phenomena of the importance of interaction in the learning environment from the quantitative and qualitative perspectives. These results are used to test the null hypotheses and used to give meaning to the summary, conclusions, and recommendations reported in Chapter Five.

CHAPTER FIVE: SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of this chapter is to evaluate and interpret the implications of the results and findings. This study adds to the empirical research base for distance and distributed learning and will help shape theory, practice, and future investigation into the phenomena of learning with technology both on-campus and at a distance. Higher education leaders can utilize this knowledge to more effectively use the different interactive technologies to facilitate interaction in the learning environment to improve student performance and satisfaction. The following sections discuss the summary of the findings from the quantitative and qualitative analysis, present conclusions and inferences based on those findings, make recommendations for theory and practice, and make recommendations for future research with synchronous and asynchronous interaction methods.

Summary

This section tests the research hypotheses and summarizes the qualitative findings of the study. The four treatments for the study were: (1) synchronous face-to-face or videoconference lecture and a synchronous face-to-face discussion (F2F Lecture/F2F Discussion); (2) synchronous face-to-face or videoconference lecture and an asynchronous threaded discussion (F2F Lecture/Thread); (3) asynchronous online PowerPoint lecture and a synchronous chat discussion (Online PowerPoint/Chat); and (4) asynchronous online PowerPoint lecture and an asynchronous threaded discussion (Online PowerPoint/Thread).

Quantitative Summary

This section tests the four hypotheses to answer the research questions. The quantitative hypotheses looked at comparing (1) synchronous and asynchronous interaction methods; (2) on-campus and off-campus students; (3) student-to-content, student-to-instructor, and student-to-student interaction; and (4) the time interaction, method of interaction, and on-campus to off-campus students. The following discussion tests the hypotheses based on student performance and satisfaction and summarizes the findings.

Synchronous to Asynchronous Interaction

The first null hypothesis to test was that there is no statistically significant difference between synchronous and asynchronous communication. $H_o: \mu_{Synchronous} = \mu_{Asynchronous}$ $\alpha=.05$ The student performance null hypothesis was rejected and there was a statistically significant difference between synchronous and asynchronous interaction methods for student performance on essay exam questions. Performance can be improved on the essay exam questions by combining synchronous and asynchronous method for the lecture and discussion treatment. The combination of methods enabled students to review and study asynchronous lecture materials along with the opportunity to reflect on asynchronous discussion.

The student satisfaction null hypothesis was rejected and there was a statistically significant difference in student satisfaction with synchronous and asynchronous interaction methods. Students strongly prefer learning that includes a synchronous face-to-face lecture with a synchronous face-to-face discussion. This points to the student

preference for the traditional learning paradigm with lecture and discussion experiences that are conducted at the same time.

On-Campus and Off-Campus

The second hypothesis was that there was no statistically significant difference between the on-campus and off-campus students. $H_o: \mu_{On-campus} = \mu_{Off-Campus}$ α=.05 The student performance null hypothesis was rejected and there was a statistically significant difference between the on-campus and off-campus students for performance on the objective and essay exam questions. The Off-campus group performed better on the essay exam questions (4.49) than the on-campus students (4.11). This can be explained by the fact that the off-campus students were older (average age of 36.75 years compared to 26.05 for the on-campus) and had more work experience to draw on to understand the concepts and to articulate that understanding. The on-campus group performed better on the objective exam questions (4.19) compared to the off-campus (3.72). The younger on-campus students used test-taking skills acquired from their more traditional program to perform better on the objective exam questions. The difference between the two student groups was not due to the delivery method of instruction (face-to-face for the on-campus and interactive videoconference for the off-campus) because the two classes received the same treatments and were counterbalanced by groups, which removed any potential for the delivery medium to cause this effect.

The student satisfaction null hypothesis was rejected and there was a statistically significant difference between the satisfaction with the interaction methods for the on-

campus and off-campus students. The off-campus students were more satisfied with the lecture (L) treatment (3.68) than the on-campus students (3.27). The lecture interaction enabled the off-campus students to interact with the instructor rather than learn the content by themselves. The on-campus students take classes on a more traditional schedule with many opportunities to interact with instructors and peers both in and out of class. The difference in preference for the lectures was largely due to the off-campus satisfaction with the asynchronous online PowerPoint presentation (3.61) compared to the on-campus (3.05) with an experimental difference of 11.2%. This difference can be accounted for because the off-campus students are working professionals that have busy schedules and the asynchronous online PowerPoint lectures were more convenient for them to watch from their home or work place than driving to a videoconference site.

Student-Content, Student-Instructor, and Student-Student Interaction

The third hypothesis was that there was no statistically significant difference between student-to-content, student-to-instructor, and student-to-student interaction. This hypothesis was only tested for student satisfaction because the students received a mix of student-to-content, student-to-instructor, and student-to-student interaction for each of the four treatments. It was impossible to separate out the effect of the three interaction types based on performance on the objective and essay exams.

$H_o: \mu_{StoC} = \mu_{StoI} = \mu_{StoS}$
$\alpha = .05$

The null hypothesis was rejected and there was a statistically significant difference between the satisfaction of students with student-to-content, student-to-

instructor, and student-to-student interaction. Students prefer to interact with content (3.42) and the instructor during the lecture (3.54) to interacting with the instructor (3.06) or other students (3.07) during discussions. This means that the students were more satisfied with interaction with the content and instructor during lectures than with the interaction that takes place in discussions. The students valued the discussion interaction, but placed more emphasis on interacting with content and the instructor during the lecture for their learning.

Time, Method, and Class

The last hypothesis tested was that there was no statistically significant difference between the three factors for time of interaction, method of interaction, and on-campus or off-campus students. The student performance null hypothesis was rejected and there was a statistically significant difference between time, method, and class. The findings for the time and class factors are the same as the findings summarized in the time section (synchronous vs. asynchronous) and class section (on-campus vs. off-campus). The new findings with this test are in the methods areas. The on-campus students performed better on the objective exam questions than the off-campus students and the asynchronous threaded discussion (4.42) helped them more than synchronous discussions (3.97). This was due to their experience with taking objective exams and the ability of the threaded discussion to help them to reflect more on discussion questions to learn the concepts. The method of combined lecture and discussion treatments made a difference because students performed better with the Online PowerPoint/Thread (4.02) or the F2F

H_o: $\mu_{Time} = \mu_{Method} = \mu_{Class}$
α=.05

Lecture/F2F Discussion (4.20) than the Online PowerPoint/Chat (3.62). The Online PowerPoint/Thread difference can be explained by the ability to study the lecture materials and reflect on the discussion questions. The F2F Lecture/F2F Discussion differences are accounted for by the opportunity to interact with the instructor during the F2F lecture to ask clarification questions. The chat discussion was fun for students, but its weakness was the tendency for social interaction rather than focusing on understanding of the concepts of the subject matter.

The student satisfaction null hypothesis was rejected and there was a statistically significant difference in the satisfaction with the interaction for time, method, and class. The satisfaction findings for this test are the same as the findings listed in the time section (synchronous vs. asynchronous) and the methods and class findings are the same as listed in the class section (on-campus vs. off-campus).

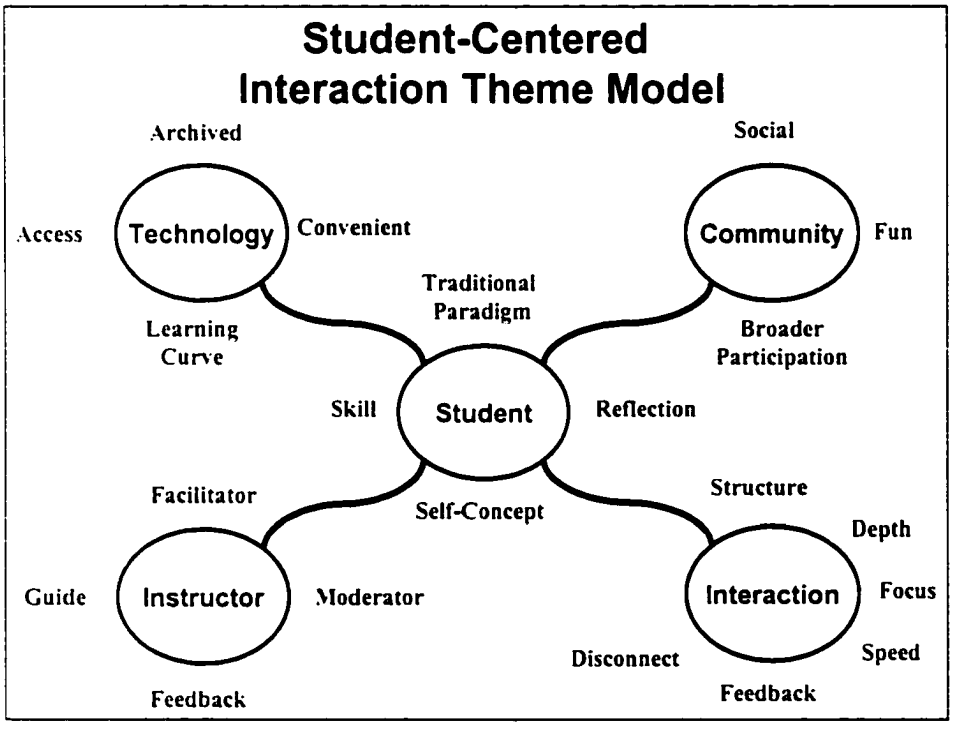
Qualitative Summary

The qualitative analysis and findings are used to answer the research question of what student characteristics facilitate success with synchronous and asynchronous delivery methods for interaction? The themes that emerged from the qualitative analysis were the issues facing students, instructors, technology, interaction, and the learning community.

These themes map well to the diagram for a student-centered distributed learning environment described in Chapter Two. The diagram in Figure 3 represents the themes in a student-centered model with all of the subcategory elements connected to the main themes. The issues facing the students in the center were reflection, self-concept, skill

with technology, and their concept of a traditional learning paradigm. The issues facing the instructor were being a guide, facilitator, and moderator, as well as providing students with meaningful feedback. The technology related issues were access, convenience, and storing or archiving information for repeated access, as well as where students are on the learning curve for using technology. The interaction issues were the structure, depth, focus, speed, immediate feedback, and being disconnected from the conversation. The issues facing the learning community were the social and fun aspects as well as having broader participation by more of the students.

Figure 3: Qualitative Theme Model for a Student-Centered Environment using Synchronous & Asynchronous Interaction Methods



The findings related to themes are discussed in the following sections. The discussion includes a general summary of the theme along with what was learned from the conditional matrix. The matrix provided another way to look at the phenomena of

using synchronous and asynchronous interaction methods and helped to triangulate with the quantitative findings.

Qualitative Themes and Conditional Matrix Summary

The students with moderate to weak preference for extravert/introvert personality type and sequential/global learning style provided some of the most unique insights into the synchronous and asynchronous interaction phenomena. The students with balanced to moderate strengths were more flexible and receptive to the new instructional methods that use technology to facilitate interaction.

Most students seemed comfortable with the learning paradigm that they have experience with and were resistant to taking risks to try new techniques for learning. The conditional matrix showed that performance actually improved on exams for this group of students by using the asynchronous discussion and asynchronous lecture methods, although they were not very satisfied with using the technology to learn. The instructor will get the most resistance to learning with technology from this group, but should work with students to change this paradigm in order to improve learning

Students with the ability to reflect on questions and content performed well on exams with the asynchronous threaded discussion and the asynchronous PowerPoint presentation treatment (Online PowerPoint/Thread). The ability to cognitively reflect on the subject matter while participating in a discussion and the ability to think about a lecture presentation to generate and answer questions explain why these students were able to improve performance on exams. The ability of the asynchronous methods to promote reflection made them effective learning tools for students.

The instructor needs to select different interactive strategies to work with the strengths and weaknesses of the synchronous or asynchronous medium. The analysis of the conditional matrix showed that it is important for the instructor to provide feedback to students with both synchronous and asynchronous discussion methods. Asynchronous interaction requires more guidance from the instructor in terms of the director of an orchestra guiding the delivery of a musical piece. This involves probing questions, refocusing the discussion, and providing continuous feedback to students. Synchronous interaction requires guidance in terms of a traffic cop controlling the flow of traffic. The instructor needs to guide the orderly exchange of information because of the speed of the synchronous conversation.

Learning with technology had the issues of convenient access to the learning materials and the user's advancement on the learning curve for how to use the technology for learning purposes. It was important to provide opportunities for all students to master and experience the new uses of technology for learning and to realize that not everyone comes into the learning environment on equal footing—some are more advanced than others in terms of knowledge and skill level with the technology. For the receptive student it is important to make the technology seem as transparent as possible and for the negative student the use of technology to deliver content must provide them additional conveniences beyond disrupting their regularly scheduled activities. The conditional matrix showed that a group of students performed well on exams and were satisfied with the asynchronous online PowerPoint presentation because the technology provided the ability to store and archive materials. The group that pointed out this theme exhibited high achievement by their GPA and GMAT scores. Their achievement might be related

to their ability to study and review content and how the asynchronous online PowerPoint lecture enabled them to access the presentation as many times as they wanted. Their skill with technology enabled them to rapidly experiment with the streaming PowerPoint presentation technology to use it to learn effectively. The instructor only needs to make materials available in an asynchronous mode to help these students.

The findings for the different interaction methods included structure, focus, and feedback. Asynchronous threaded discussions had more structure and synchronous chats had less structure. Asynchronous threaded discussions and online PowerPoint presentations had more focus than synchronous chat discussions and synchronous classroom lectures. Students felt they received more feedback from the instructor during the synchronous chat discussion and the synchronous lecture than the asynchronous threaded discussion and the asynchronous online PowerPoint lecture. The instructor needs to serve as a moderator to control and provide structure to the synchronous chat discussion, which will help with the problem of lack of focus for the discussion. The instructor should access the asynchronous threaded discussion area often, provide frequent feedback to students, and utilize thought provoking questions that promote debate to improve effectiveness. Both instructors and students must work with the disconnect problem inherent to the asynchronous interaction methods to help keep the discussion topic current in the minds of the participants.

The findings in the learning community area included the social aspects of learning and the importance of having more students participate in discussion activities. Students mentioned that participating in the synchronous chat discussion seemed more

social and fun than the asynchronous threaded discussion. They claimed that it was easier to participate in the synchronous chat and asynchronous threaded discussion because they already knew the other participants. Students also mentioned that more people felt comfortable about participating in the synchronous chat or asynchronous threaded discussion than with the synchronous face-to-face discussion. They enjoyed hearing the opinions from students that do not normally participate in the traditional classroom setting. Instructors must orchestrate opportunities for students to become familiar and meet one another by scheduling a face-to-face, chat, or threaded discussion specifically for that purpose. The instructor should also attempt to make the threaded discussion more social by interjecting humor, using stimulating questions, and letting students use the media to ask clarification questions.

Summary Based on Other Research

The qualitative and quantitative findings from this study relate to the findings by other authors. Webster and Hackley (1997) examined video-based delivery of instruction to outcomes related to student involvement and participation, cognitive engagement, and the technology used to facilitate distance learning. They stated that reliability of the technology related positively to learning outcomes. The qualitative findings for the technology theme of access and convenience support their findings. Webster and Hackley (1997) also found that students perceived learning with technology to be less rich than face-to-face instruction, which was supported by the satisfaction findings that students are the most satisfied with traditional synchronous lectures and synchronous discussions.

Schutte (1996) looked at student performance with face-to-face student-to-instructor interactions compared to that of a virtual classroom. He found that collaboration helped students perform better in a virtual classroom than with that of face-to-face interaction. He attributed the improved performance to collaboration rather than the technology itself. Schutte's findings were similar to the findings for improved student performance on the essay exams by adding synchronous chats, asynchronous threaded discussions, or asynchronous online PowerPoint presentations to the learning environment. Similarly, on-campus student performance on objective exams was improved with asynchronous discussions over synchronous discussion.

The research of Perdue and Valentine (2000) supports the qualitative finding that students are resistant to learning with methods that are different than the traditional synchronous lecture and discussion. They found that adult professionals were resistant to change in the way that continuing education was delivered to them in the past.

Sherry, Fulford, and Zhang (1998) found that distance learners indicated the importance of student-to-content and student-to-instructor interaction. The finding that students prefer student-to-content and student-to-instructor interaction during the lecture process compliments their findings. The importance of dialog with the instructor was also illustrated in Holmberg's (1989) interaction and communication theory where he claimed that dialog or interaction between student and teacher were the critical defining aspects of distance education.

Vrasidas and McIsaac (1999) found that students felt that lack of immediate feedback in online discussions was discouraging and contributed to limited participation by the students. Smith and Dillon (1999) discussed the element of "immediacy" in

synchronous interaction systems and how it promotes motivation and provides reinforcement. Both studies parallel the qualitative findings where students had a strong need for immediate feedback in both the synchronous chats and the asynchronous threaded discussions. Smith and Dillion's (1999) "immediacy" concept compares to the "disconnect" mentioned by students in this research. Vrasidas and McIsaac (1999) also found that structure and required activities increased interactions and dialog among students. Their research supports the finding in the qualitative theme on the need for more structure in a synchronous chat.

Wedemeyer's (1971) theory of independence described independence in terms of learners being self-directed and free to control the pace, time, and place of learning. This theory helps explain why the off-campus students that are distance learners were more satisfied with asynchronous online PowerPoint presentations than the on-campus students. The off-campus students were independent learners and the asynchronous online PowerPoint presentation enabled them to control the time and place of learning.

Conclusions

The following sections contain the list of conclusions and recommendations that were derived from this research. The areas are for improving performance with synchronous and asynchronous methods, improving satisfaction with synchronous and asynchronous methods, and conclusions based on the qualitative findings.

Performance with Synchronous and Asynchronous Methods

This research leads to the following conclusions to improve performance on essay and objective exams:

- Asynchronous lecture materials and asynchronous discussions help students to review, study, and reflect on content to learn the material and improve performance on essay exams.
- Instructors must realize that on-campus and off-campus students are different and that on-campus students perform best on objective exams, while off-campus students perform best with essay exams that relate to their real world experience.
- Students do best with a mix of synchronous and asynchronous lectures and discussions. The asynchronous methods enable students to reflect and review. The synchronous methods enable students to get immediate feedback and builds on the social aspect of learning.

Satisfaction with Synchronous and Asynchronous Methods

These are the conclusions to improve student satisfaction with synchronous and asynchronous methods:

- Students are most satisfied with traditional synchronous lectures and discussions. Instructors should work to provide the aspects that students like with synchronous methods in the asynchronous experiences.
- For off-campus students, utilize asynchronous methods for interacting with content because this provides them convenient access to the materials. Use the synchronous events for discussion and debate about the content and how it relates to their profession.
- Provide ample opportunities for students to interact with content and the instructor to gain initial understanding and knowledge in the area. Discussions

with the instructor and other students help build on that initial understanding and enable students to construct additional knowledge. Moving directly into a discussion without a basic understanding of the content was not the best strategy to keep students satisfied with the learning experience.

- Improve satisfaction with non-traditional methods for lecture and discussion by working hard to develop a sense of community among the learners.

Qualitative Conclusions

The following are the conclusions from the qualitative portion of the research:

- Work with students to help change the paradigm of a traditional class to include asynchronous methods and learning with technology. Facilitating this change will meet resistance, but will help students realize the benefits of learning with the technology based methods.
- Guide an asynchronous threaded discussion by checking the area often, by asking probing questions, by providing frequent feedback to students, and by enabling students to ask clarification questions. Encourage students to connect to the threaded discussion area often to help reduce the "disconnect" phenomena and improve the currency of the discussion. Interject humor or relevant discussion to increase the social aspect of participating in an asynchronous threaded discussion.
- Guide synchronous chat discussions by providing structure to the conversations, keeping the topic focused, asking probing questions, and providing prompt feedback to students.

- Provide students with the opportunity to learn to use new technologies in a non-threatening setting prior to using them for learning activities in a course.
- Provide opportunities for students to get to know one another on a personal level to improve participation and satisfaction with synchronous and asynchronous discussions.
- Utilize the synchronous chat and asynchronous threaded discussion to give more students the opportunity to participate and enable students to hear comments from all of their peers.

Recommendations

This section looks at the implications of this research on theory and practice as well as opportunities for further research in the area of using synchronous and asynchronous methods for learning. The implications of this study apply to on-campus learning as well as distance learning.

Recommendations for Theory & Practice

Moore's (1991) theory of transactional distance looks at the dimensions of dialog and structure to describe the distance between students and instructors. Programs with little transactional distance provide an ongoing dialog between the students and the instructor. Courses with high transactional distance have little dialog, but have high structure to provide learners with guidance. Vrasidas and McIsaac (1999) found that structure actually increased dialog, which contradicts the findings that increasing structure decreases dialog and increased transactional distance (Moore, 1991; Saba & Shearer, 1994).

This study supports Vrasidas and McIsaac's (1999) findings where the synchronous chat required more structure to increase dialog. The Chat Discussion had low transactional distance because of the large amount of dialog taking place and was fun for students. The weakness of the Chat Discussion was the tendency for social interaction rather than focusing on understanding of the concepts of the subject matter. Students performed better on objective exam questions with the F2F Lecture/F2F Discussion (4.20) than the Online PowerPoint/Chat Discussion. The F2F Lecture and the Online PowerPoint were balanced for structure, so the difference was accounted for by the increased structure of the F2F Discussion over the Chat Discussion. The transactional distance of the Chat Discussion needs to be increased in order to make it a more effective learning tool. This requires the instructor to moderate the discussion to increase the structure and to provide frequent feedback on student responses.

The asynchronous threaded discussion had a high level of structure and students felt it created a high degree of transactional distance. Performance was improved on the essay exam questions by students having a mix between synchronous and asynchronous methods for lecture and discussion. The combination of methods enabled students to review and study asynchronous lecture materials along to provide structure with the synchronous dialog. The asynchronous discussion provided structure to the dialog of the synchronous F2F Discussion and created an opportunity for students to reflect on the discussion questions. Instructors can improve the effectiveness of the asynchronous threaded discussion by increasing the amount of dialog through asking probing questions and providing frequent feedback to students, which in effect will reduce the transactional distance.

Recommendations for Future Research

The conclusions from this research study along with the findings in other studies in the area of learning with technology lead to opportunities to advance the knowledge base in the area of using synchronous and asynchronous lecture and discussion methods. The first area of further inquiry would be to look at the phenomena of student-to-content, student-to-instructor, and student-to-student interaction to see which type or combination of types helps improve student performance. The second area would be to perform discourse analysis on the transcripts from the face-to-face, chat, and threaded discussions to see which has the richest and most thorough discussion dialog. This research could be used to develop more effective strategies for guiding face-to-face, chat, and threaded discussions. The qualitative data should be further analyzed to try to develop learning models for synchronous and asynchronous interaction methods. These models would help practice to develop more effective facilitation techniques and would help theory to learn more about the phenomena of interaction with synchronous and asynchronous methods. Phipps & Merisotis (1999) noted that the higher education community has a lot to learn about how distance technology affects the teaching and learning process. Continuing research in this area will help validate the different methods used for distance learning.

This research has helped define some of the aspects of how synchronous and asynchronous lecture and discussion methods can be used in the learning environment for both on-campus and off-campus students. These techniques have application to distributed learning environments that include distance learning and traditional campus based learning. These distributed learning environments will provide a motivated student

with independence and access to collaborative and interactive learning opportunities. Distributed learning will emerge by combining many of the successful approaches from the past along with new technologies to reshape the future of education. Education will be about choices. Students and teachers will have the choice of learning in a physical location as well as in a virtual location. Regardless of the learner's choice, this will require incorporating best practices for distributed learning developed by research on how to provide a quality learning experience.

Higher education will continue to offer both face-to-face and distance learning opportunities in the future. Considerable research needs to be conducted to discover how the learning system operates without comparing face-to-face instruction with distance instruction. This research project determined that synchronous and asynchronous interaction methods have application for face-to-face and distance learning. Future studies need to continue to concentrate on the development of innovative learning techniques to help all students regardless of the location for instruction.

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APPENDICES

Appendix A: Information and Consent Form

INFORMATION AND CONSENT FORM

The title of this research study is Student *Performance and Satisfaction with Asynchronous and Synchronous Interaction Methods in Graduate Business Courses.* Shawn Clouse a doctoral student in the School of Education at The University of Montana is conducting the study with the assistance of a faculty advisor.

Purpose: You are part of a research study that is looking at your performance and satisfaction with interaction with the course content as well as the instructor and other students in the course. The interaction will be either asynchronous (different time) or synchronous (same time). This study will look at several learning modules that are part of the course syllabus.

Procedures: You will complete surveys both before and after you complete the learning modules in the study. The surveys before the modules will ask you about your learning style, experience with technology, and knowledge of the content. The surveys after the modules will ask you about your satisfaction with the experience and the knowledge gained. Your performance will be measured by the regular methods that your instructor selects to assess your learning on the module. The pre and post module surveys will take approximately 10 minutes to complete. There are no risks to you in completing the survey instruments.

Benefits: Your participation with this study will help us better understand the type of interaction methods that work best for you. The delivery methods for the courses in the study include traditional face-to-face, MetNet videoconferences, and online delivery. The results of the study will be used to better design instruction for these three delivery methods.

Confidentiality: Your records will be kept private and will not be released without your consent except as required by law. Only the researcher and the faculty advisor will have assess to the data and your identity will be kept confidential. If the results of this study are written in a scientific journal or presented at a meeting, your name will not be used. All data will be stored in a secure place and your signed consent form will be stored separate from the data.

Voluntary Participation/Withdrawal: You may withdraw from the study at anytime by sending an email to shawn.clouse@business.umt.edu. Participation in the study has no effect on your performance in the course. If you chose to withdraw from the study, you are still required to complete the course requirements that are outlined in the syllabus to achieve a satisfactory grade.

Questions: If you have any questions about the research now or during the study contact please contact Shawn Clouse at (406)243-5895, email shawn.clouse@business.umt.edu, or in his office Room 371 of the Gallagher Building. If you have any questions regarding your rights as a research subject, you may contact the Dr. Tony Rudbach through the Research Office at The University of Montana at 243-6670.

Statement of Consent: I have read the above description of this research study. I realize that no harm will come to me and that this information will be used for educational purposes. I have been informed of the risks and benefits involved. Furthermore, I have been assured that a member of the research team will answer any of my future questions. I voluntarily agree to take part in this study and understand that I may withdraw at any time.

Name: (enter your full name) _____

Press agree start the Pre-Learning Assessment [Agree] or reset to start over [Reset]

Appendix B: Survey Instruments Used

Pre-test Instruments:

- The Felder-Silverman Index of Learning Styles (ILS) will be used to assess learning style preferences. A copy of the instrument is attached. Felder, R. M. (1996, December). Matters of style. ASEE Prism, 6, (4), 18-23.
- The online Meyers-Briggs found at http://www.in-the-mood.com/tests/mbti-ref.htm. This test is a minorly modified Keirsey Temperament Sorter. The Meyer-Briggs will be used to assess learning and personality types. Myers, I.B. and M.H. McCaulley. (1986). Manual: A Guide to the Development and Use of the Myers-Briggs Type Indicator. 2nd Edition. Consulting Psychologists Press. Palo Alto, CA.
- The Computer and Technology Assessment survey used to measure the different proficiencies that the students have with using computers and other information technology.
- The Pre-Learning Module Assessment used to measure the student's understanding of the content area prior to the module and their experience with the technology used for interaction.

Post-test Instruments:

- The Post Learning Module Assessment survey used to measure the student's satisfaction with the learning experience and their own assessment of how well they mastered the content.
- Post module quiz or assessment. The instructor for the course evaluated the student's learning for each of the modules. This assessment was gathered from the final exam for the course and was provided to the researcher for analysis.
- Post Hoc qualitative interviews. The post course qualitative interviews will be used to further explain the relationships discovered with the quantitative surveys. These interviews will be conducted either by phone or face-to-face.

Felder-Silverman Index of Learning Styles (ILS)

Index of Learning Styles Questionnaire

Developed by Barbara A. Soloman & Richard M. Felder
North Carolina State University
Raleigh, NC 27695-7905

Directions

Please provide us with your full name. Your name will be printed on the information that is returned to you.

Enter your name: _____

Enter your Email: _____

For each of the 44 questions below select either "a" or "b" to indicate your answer. Please choose only one answer for each question. If both "a" and "b" seem to apply to you, choose the one that applies more frequently. When you are finished selecting answers to each question please select the submit button at the end of the form.

I understand something better after I

○ **(a)** try it out.

○ **(b)** think it through.

I would rather be considered

○ **(a)** realistic.

○ **(b)** innovative.

When I think about what I did yesterday, I am most likely to get

○ **(a)** a picture.

○ **(b)** words.

I tend to

○ **(a)** understand details of a subject but may be fuzzy about its overall structure.

○ **(b)** understand the overall structure but may be fuzzy about details.

When I am learning something new, it helps me to

○ **(a)** talk about it.

○ **(b)** think about it.

If I were a teacher, I would rather teach a course

○ **(a)** that deals with facts and real life situations.

○ **(b)** that deals with ideas and theories.

I prefer to get new information in

○ **(a)** pictures, diagrams, graphs, or maps.

○ **(b)** written directions or verbal information.

Once I understand

○ **(a)** all the parts, I understand the whole thing.

○ **(b)** the whole thing, I see how the parts fit.

In a study group working on difficult material, I am more likely to

○ **(a)** jump in and contribute ideas.

○ **(b)** sit back and listen.

I find it easier

○ **(a)** to learn facts.

○ **(b)** to learn concepts.

In a book with lots of pictures and charts, I am likely to

○ **(a)** look over the pictures and charts carefully.

○ **(b)** focus on the written text.

When I solve math problems

○ **(a)** I usually work my way to the solutions one step at a time.

○ **(b)** I often just see the solutions but then have to struggle to figure out the steps to get to them.

In classes I have taken

○ **(a)** I have usually gotten to know many of the students.

○ **(b)** I have rarely gotten to know many of the students.

In reading nonfiction, I prefer

○ **(a)** something that teaches me new facts or tells me how to do something.

○ **(b)** something that gives me new ideas to think about.

I like teachers

○ **(a)** who put a lot of diagrams on the board.

○ **(b)** who spend a lot of time explaining.

When I'm analyzing a story or a novel

○ **(a)** I think of the incidents and try to put them together to figure out the themes.

○ **(b)** I just know what the themes are when I finish reading and then I have to go back and find the incidents that demonstrate them.

When I start a homework problem, I am more likely to

○ **(a)** start working on the solution immediately.

○ **(b)** try to fully understand the problem first.

I prefer the idea of

○ **(a)** certainty.

○ **(b)** theory.

I remember best

○ **(a)** what I see.

○ **(b)** what I hear.

It is more important to me that an instructor

○ **(a)** lay out the material in clear sequential steps.

○ **(b)** give me an overall picture and relate the material to other subjects.

I prefer to study

○ **(a)** in a study group.

○ **(b)** alone.

I am more likely to be considered

○ **(a)** careful about the details of my work.

○ **(b)** creative about how to do my work.

When I get directions to a new place, I prefer

○ **(a)** a map.

○ **(b)** written instructions.

I learn

○ **(a)** at a fairly regular pace. If I study hard, I'll "get it."

○ **(b)** in fits and starts. I'll be totally confused and then suddenly it all "clicks."

I would rather first

○ **(a)** try things out.

○ **(b)** think about how I'm going to do it.

When I am reading for enjoyment, I like writers to

○ **(a)** clearly say what they mean.

○ **(b)** say things in creative, interesting ways.

When I see a diagram or sketch in class, I am most likely to remember

○ **(a)** the picture.

○ **(b)** what the instructor said about it.

When considering a body of information, I am more likely to

○ **(a)** focus on details and miss the big picture.

○ **(b)** try to understand the big picture before getting into the details.

I more easily remember

○ **(a)** something I have done.

○ **(b)** something I have thought a lot about.

When I have to perform a task, I prefer to

○ **(a)** master one way of doing it.

○ **(b)** come up with new ways of doing it.

When someone is showing me data, I prefer

○ **(a)** charts or graphs.

○ **(b)** text summarizing the results.

When writing a paper, I am more likely to

○ **(a)** work on (think about or write) the beginning of the paper and progress forward.

○ **(b)** work on (think about or write) different parts of the paper and then order them.

When I have to work on a group project, I first want to

○ **(a)** have "group brainstorming" where everyone contributes ideas.

○ **(b)** brainstorm individually and then come together as a group to compare ideas.

I consider it higher praise to call someone

○ **(a)** sensible.

○ **(b)** imaginative.

When I meet people at a party, I am more likely to remember

○ **(a)** what they looked like.

○ **(b)** what they said about themselves.

When I am learning a new subject, I prefer to

○ **(a)** stay focused on that subject, learning as much about it as I can.

○ **(b)** try to make connections between that subject and related subjects.

I am more likely to be considered

○ **(a)** outgoing.

○ **(b)** reserved.

I prefer courses that emphasize

○ **(a)** concrete material (facts, data).

○ **(b)** abstract material (concepts, theories).

For entertainment, I would rather

○ **(a)** watch television.

○ **(b)** read a book.

Some teachers start their lectures with an outline of what they will cover. Such outlines are

○ **(a)** somewhat helpful to me.

○ **(b)** very helpful to me.

The idea of doing homework in groups, with one grade for the entire group,

○ **(a)** appeals to me.

○ **(b)** does not appeal to me.

When I am doing long calculations,

○ **(a)** I tend to repeat all my steps and check my work carefully.

○ **(b)** I find checking my work tiresome and have to force myself to do it.

I tend to picture places I have been

○ **(a)** easily and fairly accurately.

○ **(b)** with difficulty and without much detail.

When solving problems in a group, I would be more likely to

○ **(a)** think of the steps in the solution process.

○ **(b)** think of possible consequences or applications of the solution in a wide range of areas.

When you have completed filling out the above form please click on the Submit button below. Your results will be returned to you. If you are not satisified with your answers above please click on Reset to clear the form.

Submit | Reset

Myers-Briggs Minorly Modified Keirsey Temperament Sorter

The Myers-Briggs Type Indicator
This test is a minorly modified Keirsey Temperament Sorter

In each question, select the statement that most applies to you.

1. At a party or large gathering, do you have

A: ○ Large group conservations with a lot of different people

B: ○ one-on-one conservations with a few people, known to you

2. Do you like to

A: ○ stay in the "here and now"

B: ○ use your imagination and wonder about possibilities

3. Is it worse to

A: ○ have your "head in the clouds"

B: ○ stuck "in the present" without considering alternative

4. Are you more impressed by

A: ○ principles--thinking of the "how things occur objectively"

B: ○ emotions--feeling the way things personally impress you

5. Are you more drawn toward

A: ○ logical reasoning

B: ○ the sense of touching the warmth and heart of others

6. Do you prefer to work

A: ○ to deadlines

B: ○ just "whenever"

7. Do you tend to choose

A: ○ rather carefully, considering all alternatives

B: ○ somewhat impulsively

8. At parties do you

A: ○ stay late, with increasing energy

B: ○ leave early, with decreasing energy

9. Do you identify with people who

A: ○ keep a continuous "presence of mind"

B: ○ "let their minds wander"

10. Are you more interested in

A: ○ what is actual: what is seen, heard, and felt

B: what might be possible with a little imagination

11. In judging others are you more swayed by

A: definite rules about social conduct

B: circumstances around the behavior and compassion

12. In relationships, do you usually find yourself

A: stepping back and objectively evaluating your relationships

B: finding yourself emotionally involved without much reasoning

13. Are you more

A: punctual and structured

B: leisurely and loose on discipline

14. You feel at rest

A: only when things get completed

B: even when things remain incomplete

15. In your social groups do you

A: keep abreast of other's happenings

B: get behind on the news

16. In doing minor things, you

A: do it the usual way, they way they are meant to be done

B: do it your in own innovative way

17. Writers should

A: "say what they mean and mean what they say"

B: express things more by use of analogy and example

18. Which is more familiar to you

A: reasoning

B: passion of relationships

19. Your decisions mostly are based on

A: logic and facts

B: emotions and personal values

20. You tend to

A: put energy in making a tough decision to get it over with

B: procrastinate on many difficult decisions

21. Would you say you are more

A: serious, determined, and goal-driven

B: easy-going and let the situation be the decisive factor

22. In phoning do you

A: talk without rehearsing and without reflection

B: go over what you will say in advance

23. What you see with your own eyes

A: is what reality really is

B: are examples of many possibilities

24. People who "see" other than the "common sense at hand" are

A: somewhat annoying

B: rather fascinating

25. Are you more dominated by

A: logic

B: the "warmth of others"

26. In every day cases, what is your first overwhelming reaction

A: justice

B: compassion

27. Events are more comfortable if

A: you can participate in them with your decisions

B: When they are left alone

28. When buying things, you feel better

A: after it is finished and done, so you can get on with other goals

B: before it happens, even if takes longer than usual

29. When talking to people, you usually

A: initiate the conversation

B: wait to be approached

30. With common sense, you should

A: trust it even if your intuition says otherwise

B: look beyond it

31. You want children to

A: be as useful and practical as possible

B: use their time for insights and dreams

32. In making decisions do you feel more comfortable with your

A: reasoning and thinking

B: feelings and personal values

33. In dealing with people, you are more likely to

A: "lay down the law"

B: understandingly "let them off the hook"

34. Which is easier and more admirable

A: the ability to organize and be methodical

B: the ability to adapt and make do

35. Which is more like you

A: to know things in advance

B: to leave things be so you don't spoil the thrill and surprise

36. Does spending a lot of time with a new group of people

A: stimulate and energize you

B: tax your reserves

37. Are you more frequently

A: a practical sort of person; down to earth

B: a fanciful sort of person; thinking what the world could be

38. Are you better at

A: seeing how a person can be best be put to use

B: having natural insight into other peoples' perceptions

39. In a debate, what is more satisfying:

A: the "truth"; discussing every logical aspect of a topic

B: finding an agreement with people

40. Which rules you more

A: your head

B: your heart

41. Are you more comfortable with work that is

A: contracted

B: done on a casual basis

42. Do you tend to look for

A: the orderly and structured

B: whatever turns up

43. Do you prefer

A: many friends with brief contact

B: a few friends with more lengthy contact

44. Do you go more by

A: facts; the things you see and touch

B: principles; the fascinating symbols that represent facts

45. What is more interesting

A: the practical use of things

B: the ideas that created them

46. In solving problems, which is easier

A: reasoning

B: ○ emotional guidance

47. What is more natural to you in critical situations

A: ○ to be consistent and logical

B: ○ to consider the feelings of others first and foremost

48. Do you more often prefer the

A: ○ final and unalterable statement

B: ○ preliminary statement so you can ponder on the alternatives

49. Are you more comfortable

A: ○ after an important decision

B: ○ before an important decision

50. Do you

A: ○ speak easily and at length with strangers

B: ○ find little to say to strangers

51. Are you more likely to trust your

A: ○ past experiences

B: ○ hunches

52. Do you prefer

A: ○ the time honored practical ways

B: ○ having insights that come from pondering all the possibilities

53. Who should be honored in our society

A: ○ those who have strong "logical natures"

B: ○ those who have tender-hearted compassionate natures

54. In dealing with people, which comes easier to you

A: ○ using logic, justice, and fairness

B: ○ sympathy and personal feelings

55. It is most preferable to

A: ○ plan things ahead of time so you know what will happen

B: ○ just let things happen without much planning

56. With people that are closest to you, do you

A: ○ leave the rules of your relationship open to debate

B: ○ avoid anything that could create an expectation of behavior

57. When the phone rings do you usually

A: ○ hasten to get to it first

B: ○ hope someone else will answer

58. Which is easier

A: ○ sticking to the here and now reality of situations

B: ○ to imagine different possibilities in any given situation

59. Are you drawn more to

A: ○ the basic facts of what you see

B: ○ the implications and symbolic meanings of things

60. Which seems the greater error

A: ○ to be too passionate

B: ○ to be too logical and objective

61. You

A: ○ think with your head

B: ○ feel with your heart

62. What appeals to you more:

A: ○ the structured and scheduled

B: ○ the unstructured and unscheduled

63. You more easily

A: ○ fall into routines

B: ○ go along with whatever suits your fancy at the moment

64. Are you more inclined to be

A: ○ easy to approach

B: ○ somewhat reserved

65. In writings, you prefer

A: ○ the more literal and factual

B: ○ the more figurative and symbolic

66. Which more like you

A: ○ getting another person to do what needs to be done

B: ○ "understanding" what another person is going through

67. What is the greatest natural strength for you

A: ○ reasoning

B: ○ compassion for others

68. Which is the greater fault: to

A: ○ favor and pick out someone to honer just because you like him

B: ○ criticize another person on a wrong even if it hurts his feelings

69. When tomorrow comes, would you rather

A: ○ know exactly what is planned

B: ◉ avoid all knowledge of any plan

70. Do you tend to be more

A: ○ deliberate

B: spontaneous

Submit for Scoring | Clear

Computer and Technology Competency Assessment

Computer & Technology Competency Assessment

The purpose of this survey is to get information from you on your proficiency with using technology. This survey will ask you questions about your level of competency working with computers and other information technology. This information will be used to evaluate the interaction methods for graduate business courses at The University of Montana.

Name: _____

Email: _____

Answer the following questions about learning with technology by circling or checking the most appropriate choice.

1) What is your feeling about working with computer technology for learning?

Very Apprehensive 1. 2. 3. 4. 5. Very excited

2) Have you taken an online course before? Yes No (go to question 3)

If yes, answer the questions in the table below

Who was the course from? (Check all that apply)	U of M School of Business Other U of M Department (Please Specify) _____ Other University (Please Specify) _____
If you have taken a class from UM School of Business, please check all that apply.	Systems and Operations Management and Law Marketing and Statistics Economics and Finance Managerial and Financial Accounting
What was your overall level of satisfaction with previous online learning experiences?	Not Satisfied 1. 2. 3. 4. 5. Very Satisfied
What was your overall level of satisfaction with the instructor(s)?	Not Satisfied 1. 2. 3. 4. 5. Very Satisfied
What was your overall level of satisfaction with the technology used?	Not Satisfied 1. 2. 3. 4. 5. Very Satisfied

Please answer the following questions about your level of comfort with computer technology.

3) Rate your overall level of proficiency for using and working with computers?

Beginner Intermediate Advanced Never used

4) How many years have you worked with computers?

1 or less 2 3 4 5 6 7 8 9 over 10 years

5) Rate your level of proficiency for using and working with the following software packages in the following table?

Word processing (WordPerfect, Word, etc.)	Beginner	Intermediate	Advanced	Never used
Spreadsheet (Lotus, Excel, Quattro, etc.)	Beginner	Intermediate	Advanced	Never used
Database programs (Dbase, Access, FoxPro, Filemaker Pro, etc.)	Beginner	Intermediate	Advanced	Never used
Presentation Packages (PowerPoint, Presentations, etc.)	Beginner	Intermediate	Advanced	Never used
Graphics & Multimedia (Photoshop, Macromedia, Premiere, Visio, etc.)	Beginner	Intermediate	Advanced	Never used
Web Browsers (Netscape, Internet Explorer, etc.)	Beginner	Intermediate	Advanced	Never used
Email Packages (Outlook, Eudora, Lotus Notes, Netscape Mail, Hotmail, etc.)	Beginner	Intermediate	Advanced	Never used
Programming Languages (Basic, Java, C ++, etc.)	Beginner	Intermediate	Advanced	Never used
Operating Systems (DOS, Windows, Apple, MAC, UNIX, etc.)	Beginner	Intermediate	Advanced	Never used

6) Have you used a computer for a job either now or in the past? Yes No (Go to question 7.)

If Yes, Estimate how many hours per day that you use the computer for work.

1 or less 2 3 4 5 6 7 8 or more hours

What do you use the computer for? (Check all that apply)

- Communicating by writing letters, memos, or email
- For budgeting or financial tasks
- For planning and organizing tasks
- To conduct research
- To work with databases to manage customers, clients, products, inventory, etc.
- To work with business packages (accounting or enterprise resource planning ERP)
- For personal use
- Other (Please Specify) _____

7) Do you use a computer in your graduate program? Yes No (Go to question 8.)

If Yes, Estimate how many hours per day that you use the computer for school purposes.

1 or less 2 3 4 5 6 7 8 or more hours

What do you use the computer for? (Check all that apply)

- Communicating by writing letters or email

- [ ] Writing papers
- [ ] Preparing assignments
- [ ] Research
- [ ] To study
- [ ] To retrieve course information (syllabus, assignments, study guides, etc.)
- [ ] To take tests
- [ ] Other (Please Specify) _____

8) Do you have a computer at home? ○ Yes ○ No (Go to question 9.)

If Yes, Estimate how many hours per day that you use the computer for personal use.

○ 1 or less ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 or more hours

What do you use the computer for? (Check all that apply)

- [ ] Communicating by writing letters or email
- [ ] Personal finance
- [ ] For planning and organizing tasks
- [ ] Research for purchases & entertainment
- [ ] Making purchases
- [ ] To play games
- [ ] Other (Please Specify) _____

9) Have you used the Internet before? ○ Yes ○ No (Go to question 10.)

If Yes, Estimate how many years you have been using the Internet.

○ 1 or less ○ 2 ○ 3 ○ 4 ○ 5 or more years

Rate your level of proficiency for using the Internet.

○ Beginner ○ Intermediate ○ Advanced

How often to you go online in a week?

○ Everyday ○ 6 times per week ◉ 5 times per week ○ 4 times per week

○ 3 times per week ○ 2 times per week ○ Once per week ○ rarely

What online technologies do you have experience with? (Check all that apply)

- [ ] Chat
- [ ] Threaded Discussion
- [ ] Email
- [ ] Search Engines
- [ ] Internet Videoconferencing (NetMeeting)
- [ ] Instant Messaging
- [ ] Streaming Video
- [ ] Streaming Audio
- [ ] Other (Please specify) _____

What do you do online? (Check all that apply)

☐ Email ☐ Play games ☐ Research products or services for work

☐ Buy products or services for work ☐ Research products or services for home use

☐ Buy products or services for home ☐ Participate in online communities

☐ Other (Please specify) _____

Please fill out the following demographic information.

10) How old are you? _____

11) What is your gender? ○ Female ○ Male

12) What is your income level?

○ $10,000 or under ○ $10,001 to $20,000 ○ $20,001 to $30,000

○ $30,001 to $40,000 ○ $40,001 to $50,000 ○ over $50,001

13) What is your race & ethnicity?

○ American Indian or Alaska Native ○ Asian ○ Black or African American

○ Hispanic or Latino ○ Native Hawaiian or Other Pacific Islanders

○ White ○ Some other Race

14) What is the population of the city or town that you live in?

○ 1000 or under ○ 1001 to 5000 ○ 5001 to 10,000

○ 10,001 to 20,000 ○ 20,001 to 30,000 ○ 30,001 to 40,000

○ 40,001 to 50,000 ○ over 50,001

15) Are you currently employed? ○ Yes ○ No (Go to question 16.)

If yes, how many years have you worked at your current job?

○ 1 or less ○ 2-5 ○ 6-10 ○ 11-20 ○ 21-30 ○ Over 30

What industry do you work in?

○ Wood products ○ Petroleum ○ Agriculture ○ Manufacturing

○ Service ○ Sales ○ Education ○ Government

○ Other (Please specify) _____

16) What degrees do you have? (Check all that apply)

☐ Business ☐ Engineering ☐ Agriculture ☐ Forestry ☐ Education

☐ Medical ☐ Liberal Arts ☐ Fine Arts ☐ Science ☐ Political Science

☐ Communication ☐ Computer Science

☐ Other (Please specify)

17) What is your undergraduate GPA (on a 4.0 scale)?

18) What is your graduate GPA to date (on a 4.0 scale)?

Please press submit to complete the survey or press reset to start over.

Submit | Reset

Pre-Learning Module Assessment ERP (Enterprise Resource Planning)

Pre Learning Assessment

The purpose of this survey is to get information about your level of competency working with the content to be presented in the module and with using technology for interaction.

This learning module covers the following subject areas: **ERP**

Answer the following questions about your knowledge of the content for this learning module:

Enter your name:

Enter your Email:

1) Rate you knowledge of the content prior to the module.

Never heard of it before 1. 2. 3. 4. 5. Very knowledgeable

2) What is your comfort with your ability to learn this content?

Not comfortable 1. 2. 3. 4. 5. Very comfortable

3) How would you apply your knowledge of this content to real world problems?

4) How would you integrate your current knowledge of this content with the larger scope getting a graduate degree in business?

Answer the following questions about your experience with the technology used for interaction for your learning module.

5) Have you participated in a threaded discussion before? Yes No (go to question 6.)

If yes, check all that apply in the following table and rate your level of satisfaction.

	In this class	Not Satisfied Satisfied	1.	2.	3.	4.	5.	Very
	In another School of Business class	Not Satisfied Satisfied	1.	2.	3.	4.	5.	Very
	In another class at UM	Not Satisfied Satisfied	1.	2.	3.	4.	5.	Very
	In another class at another university	Not Satisfied	1.	2.	3.	4.	5.	Very

		Satisfied					
☐	Through a place that I currently work	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○ Very
☐	Through a place that I worked in the past	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○ Very
☐	On my own on the Internet	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○ Very
☐	Other (Please Specify)	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○ Very

6) Have you participated in a chat session before? ○ Yes ○ No (go to question 7.)

If yes, check all that apply in the following table and rate your level of satisfaction.

☐	In this class	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○ Very
☐	In another School of Business class	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○ Very
☐	In another class at UM	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○ Very
☐	In another class at another university	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○ Very
☐	Through a place that I currently work	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○ Very
☐	Through a place that I worked in the past	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○ Very
☐	On my own on the Internet	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○ Very
☐	Other (Please Specify)	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○ Very

7) Have you used a study guide before? ○ Yes ○ No (go to question 8.)

If yes, check all that apply in the following table and rate your level of satisfaction.

☐	In this class	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○ Very
☐	In another School of Business class	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○ Very
☐	In another class at UM	Not Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○ Very

		Satisfied							
☐	In another class at another university	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○	Very	
☐	Through a place that I currently work	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○	Very	
☐	Through a place that I worked in the past	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○	Very	
☐	On my own on the Internet	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○	Very	
☐	Other (Please Specify)	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○	Very	

8) Have you observed an online PowerPoint presentation on the Internet before?

◉ Yes ○ No (go to the end to submit survey)

If yes, check all that apply in the following table and rate your level of satisfaction.

☐	In this class	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○	Very	
☐	In another School of Business class	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○	Very	
☐	In another class at UM	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○	Very	
☐	In another class at another university	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○	Very	
☐	Through a place that I currently work	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○	Very	
☐	Through a place that I worked in the past	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○	Very	
☐	On my own on the Internet	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○	Very	
☐	Other (Please Specify)	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○	Very	

Please press submit to complete the survey or press reset to start over.

Submit | Reset

Post-Learning Module Assessment ERP (Enterprise Resource Planning)

Post Learning Module Assessment

The purpose of this survey is to get information about your level of competency working with the content presented in the module and with using technology for interaction.

This learning module covered the following subject areas: **ERP**

Enter your name:

Enter your Email:

Answer the following questions based on the knowledge gained from completing this learning module:

1) Rate your knowledge of the content of the module.

I don't understand it 1. 2. 3. 4. 5. I have a good grasp of the content

2) Rate your comfort level with how well you learned this content?

Not comfortable 1. 2. 3. 4. 5. Very comfortable

3) What grade would you give yourself for this module?

A B C D F

4) How would you apply your knowledge of this content to real world problems?

5) How would you integrate your current knowledge of this content with the larger scope getting a graduate degree in business?

Answer the following questions about your experience with the interaction methods used in your learning module.

6) Did you participate in an in-class discussion either in GBB 108 or on MetNet on the topic?

Yes No (go to question 7.)

If yes, rate your level of satisfaction in the following areas:

Rate your overall level of satisfaction with the interaction experience.	Not Satisfied Satisfied	1.	2.	3.	4.	5.	Very
Rate your level of satisfaction with **not** using technology for the discussion.	Not Satisfied Satisfied	1.	2.	3.	4.	5.	Very
Rate your level of satisfaction with the interaction method and how well you learned the content.	Not Satisfied Satisfied	1.	2.	3.	4.	5.	Very

Rate your level of satisfaction with the interaction between you and your instructor.	Not Satisfied Satisfied	1.	2.	3.	4.	5.	Very
Rate your level of satisfaction with the interaction between you and other students.	Not Satisfied Satisfied	1.	2.	3.	4.	5.	Very

What comments do you have about this method of interaction?

7) Did you participate in a threaded discussion? Yes No (go to question 8.)

If yes, rate your level of satisfaction in the following areas:

Rate your overall level of satisfaction with the interaction experience.	Not Satisfied Satisfied	1.	2.	3.	4.	5.	Very
Rate your level of satisfaction with the technology used.	Not Satisfied Satisfied	1.	2.	3.	4.	5.	Very
Rate your level of satisfaction with the interaction method and how well you learned the content.	Not Satisfied Satisfied	1.	2.	3.	4.	5.	Very
Rate your level of satisfaction with the interaction between you and your instructor.	Not Satisfied Satisfied	1.	2.	3.	4.	5.	Very
Rate your level of satisfaction with the interaction between you and other students.	Not Satisfied Satisfied	1.	2.	3.	4.	5.	Very

What comments do you have about this method of interaction?

8) Did you participate in a chat session? Yes No (go to question 9.)

If yes, rate your level of satisfaction in the following areas:

Rate your overall level of satisfaction with the interaction experience.	Not Satisfied Satisfied	1.	2.	3.	4.	5.	Very
Rate your level of satisfaction with the technology used.	Not Satisfied Satisfied	1.	2.	3.	4.	5.	Very
Rate your level of satisfaction with the interaction method and how well you learned the content.	Not Satisfied Satisfied	1.	2.	3.	4.	5.	Very
Rate your level of satisfaction with the interaction between you and your instructor.	Not Satisfied Satisfied	1.	2.	3.	4.	5.	Very

Rate your level of satisfaction with the interaction between you and other students.	Not Satisfied	1.	2.	3.	4.	5.	Very Satisfied

What comments do you have about this method of interaction?

9) Did you read the assigned material in the course textbook? Yes No (go to question 10.)

If yes, rate your level of satisfaction in the following areas:

Rate your overall level of satisfaction with the textbook material.	Not Satisfied	1.	2.	3.	4.	5.	Very Satisfied
Rate your level of satisfaction with learning the material by only reading it in the textbook.	Not Satisfied	1.	2.	3.	4.	5.	Very Satisfied

What comments do you have about learning with a textbook?

10) Did you view an online PowerPoint slide show for this module? Yes No (go to question 11.)

If yes, rate your level of satisfaction in the following areas:

Rate your overall level of satisfaction with the PowerPoint presentation.	Not Satisfied	1.	2.	3.	4.	5.	Very Satisfied
Rate your level of satisfaction hearing your instructor talk about the content in the module.	Not Satisfied	1.	2.	3.	4.	5.	Very Satisfied
Rate your satisfaction with how well you learned the material with the assistance of the presentation.	Not Satisfied	1.	2.	3.	4.	5.	Very Satisfied
Rate your level of satisfaction with the watching the presentation at any time convenient for you.	Not Satisfied	1.	2.	3.	4.	5.	Very Satisfied
Rate your level of satisfaction with the technology used to access the presentation.	Not Satisfied	1.	2.	3.	4.	5.	Very Satisfied

What comments do you have about the online PowerPoint presentation?

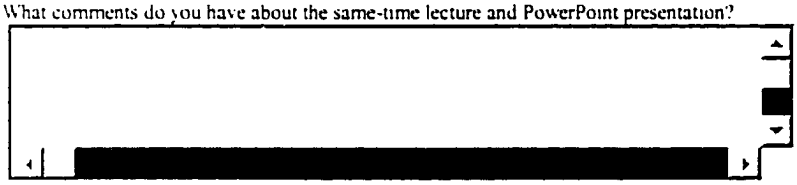
11) Did you watch a lecture on the content for this module during your regularly scheduled class time?

Yes No (go to question 12.)

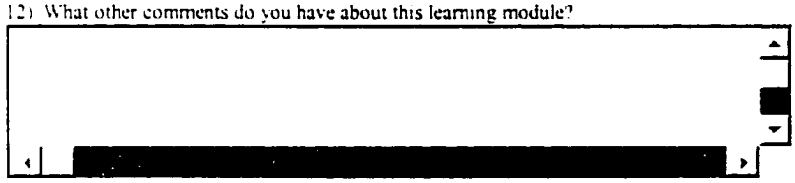
If yes, rate your level of satisfaction in the following areas:

Rate your overall level of satisfaction with the lecture and PowerPoint presentation.	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○	Very
Rate your level of satisfaction hearing your instructor lecture about the content in the module.	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○	Very
Rate your satisfaction with how well you learned the material with the assistance of the lecture and presentation.	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○	Very
Rate your level of satisfaction with coming to class at the same-time to watch the lecture and PowerPoint presentation.	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○	Very
Rate your level of satisfaction with the technology used during the lecture and PowerPoint presentation.	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○	Very

What comments do you have about the same-time lecture and PowerPoint presentation?



12) What other comments do you have about this learning module?



Submit | Reset

Pre-Learning Module Assessment ASP (Application Service Provider)

Pre Learning Assessment

The purpose of this survey is to get information about your level of competency working with the content to be presented in the module and with using technology for interaction.

This learning module covers the following subject areas: **ASP**

Answer the following questions about your knowledge of the content for this learning module:

Enter your name:

Enter your Email:

1) Rate your knowledge of the content prior to the module.

Never heard of it before 1. 2. 3. 4. 5. Very knowledgeable

2) What is your comfort with your ability to learn this content?

Not comfortable 1. 2. 3. 4. 5. Very comfortable

3) How would you apply your knowledge of this content to real world problems?

4) How would you integrate your current knowledge of this content with the larger scope getting a graduate degree in business?

Please press submit to complete the survey or press reset to start over.

Submit Reset

Post-Learning Module Assessment ASP (Application Service Provider)

Post Learning Module Assessment

The purpose of this survey is to get information about your level of competency working with the content presented in the module and with using technology for interaction.

This learning module covered the following subject areas: **ASP**

Enter your name:

Enter your Email:

Answer the following questions based on the knowledge gained from completing this learning module:

1) Rate your knowledge of the content of the module.

I don't understand it 1. 2. 3. 4. 5. I have a good grasp of the content

2) Rate your comfort level with how well you learned this content?

Not comfortable 1. 2. 3. 4. 5. Very comfortable

3) What grade would you give yourself for this module?

A B C D F

4) How would you apply your knowledge of this content to real world problems?

5) How would you integrate your current knowledge of this content with the larger scope getting a graduate degree in business?

Answer the following questions about your experience with the interaction methods used in your learning module.

6) Did you participate in an in-class discussion either in GBB 108 or on MetNet on the topic?

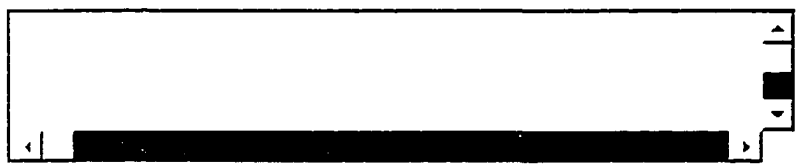
Yes No (go to question 7.)

If yes, rate your level of satisfaction in the following areas:

Rate your overall level of satisfaction with the interaction experience.	Not Satisfied Satisfied	1.	2.	3.	4.	5.	Very
Rate your level of satisfaction with not using technology for the discussion.	Not Satisfied Satisfied	1.	2.	3.	4.	5.	Very

Rate your level of satisfaction with the interaction method and how well you learned the content.	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○	Very
Rate your level of satisfaction with the interaction between you and your instructor.	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○	Very
Rate your level of satisfaction with the interaction between you and other students.	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○	Very

What comments do you have about this method of interaction?



7) Did you participate in a threaded discussion? ○ Yes ○ No (go to question 8.)

If yes, rate your level of satisfaction in the following areas:

Rate your overall level of satisfaction with the interaction experience.	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○	Very
Rate your level of satisfaction with the technology used.	Not Satisfied Satisfied	1. ○	2. ○	3 ○	4. ○	5 ○	Very
Rate your level of satisfaction with the interaction method and how well you learned the content.	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○	Very
Rate your level of satisfaction with the interaction between you and your instructor.	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○	Very
Rate your level of satisfaction with the interaction between you and other students.	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○	Very

What comments do you have about this method of interaction?

8) Did you participate in a chat session? ○ Yes ○ No (go to question 9.)

If yes, rate your level of satisfaction in the following areas:

Rate your overall level of satisfaction with the interaction experience.	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○	Very
Rate your level of satisfaction with the technology used.	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○	Very
Rate your level of satisfaction with the interaction method and how well you learned the content.	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○	Very

Rate your level of satisfaction with the interaction between you and your instructor.	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○	Very
Rate your level of satisfaction with the interaction between you and other students.	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○	Very

What comments do you have about this method of interaction?

9) Did you read the assigned material in the course textbook? ○ Yes ○ No (go to question 10.)

If yes, rate your level of satisfaction in the following areas:

Rate your overall level of satisfaction with the textbook material.	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○	Very
Rate your level of satisfaction with learning the material by only reading it in the textbook.	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○	Very

What comments do you have about learning with a textbook?

10) Did you view an online PowerPoint slide show for this module? ○ Yes ○ No (go to question 11.)

If yes, rate your level of satisfaction in the following areas:

Rate your overall level of satisfaction with the PowerPoint presentation.	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○	Very
Rate your level of satisfaction hearing your instructor talk about the content in the module.	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○	Very
Rate your satisfaction with how well you learned the material with the assistance of the presentation.	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○	Very
Rate your level of satisfaction with watching the presentation at any time convenient for you.	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○	Very
Rate your level of satisfaction with the technology used to access the presentation.	Not Satisfied Satisfied	1. ○	2. ○	3. ○	4. ○	5. ○	Very

What comments do you have about the online PowerPoint presentation?

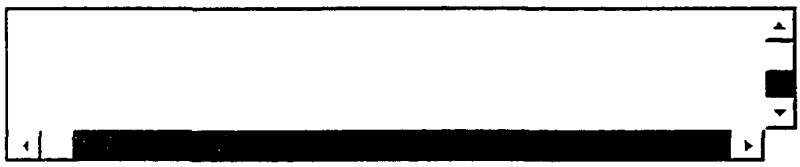
11) Did you watch a lecture on the content for this module during your regularly scheduled class time?

Yes No (go to question 12.)

If yes, rate your level of satisfaction in the following areas:

Rate your overall level of satisfaction with					
Rate your level of satisfaction hearing					
Rate your satisfaction with how well you					
Rate your level of satisfaction with coming					
Rate your level of satisfaction with the					

What comments do you have about the same-time lecture and PowerPoint presentation?



12) What other comments do you have about this learning module?

Answer the following questions based on your experience with the last two learning modules.

13) Now that you have completed the ERP and ASP learning modules, rate the following synchronous (same-time) and asynchronous (different-time) interaction methods:

	Satisfied
Threaded discussion (asynchronous)	Not Satisfied 1. 2. 3. 4. 5. Very Satisfied
Which do you prefer?	synchronous (same-time) asynchronous (different-time)
Which was the most convenient for you?	synchronous (same-time) asynchronous (different-time)
Which helped you learn the most?	synchronous (same-time) asynchronous (different-time) both were fine don't care for either

14) What comments do you have about the synchronous (same-time) or asynchronous (different-time) interaction methods?

15) What comments do you have about the overall learning experience?

Submit Reset

Post-Hoc Qualitative Interview Protocol

Interview Protocol

Purpose: The purpose of this interview is to get your thoughts about the interaction experiences that you had in the MBA 600 course for the ERP and ASP modules. I will ask you questions in two areas: the interaction methods of a chat, threaded discussion and viewing the online PowerPoint as well as interaction between you and the content of the modules, you and your instructor, and you and other students.

Consent: This interview is bound by the requirements that were stated in the consent form that you submitted last semester. That form described that this research study will be used for educational purposes. Do you still agree to participate based on that original consent form?

The first area of questions that I have are about the different methods that were used to facilitate interaction in the two modules.

1) Asynchronous threaded discussion interaction.
   a) What did you like about this method?
   b) What did you not like about this method?
   c) What are your thoughts about this method and the way that you learn? What connections can you make between this method and the way that you learn?
2) Synchronous interaction via chats
   a) What did you like about this method?
   b) What did you not like about this method?
   c) What are your thoughts about this method and the way that you learn? What connections can you make between this method and the way that you learn?
3) Which of method do you prefer chats or threaded discussions and why?
4) Asynchronous interaction with content via Online PowerPoint presentation
   a) What did you like about this method?
   b) What did you not like about this method?
   c) What are your thoughts about this method and the way that you learn? What connections can you make between this method and the way that you learn?
5) Student-to-content interaction involves reading in a textbook, listening to lectures, and researching the subject in the library or on the web. In the two modules, the student-to-content interaction that you experienced was reading the materials in the textbook and from Tech Republic as well as the lectures given in class and the online PowerPoint presentation. What are your thoughts about how student to content interaction affects the way that you learn?
6) Student-to-instructor interaction involves discussions with the instructor either as a class or one-on-one. In the two modules, the student-to-instructor interaction that you experienced was the class, chat, and threaded discussions as well as the ability to ask Dr. Evans questions either during class or at another time. What are your thoughts about how student to instructor interaction affects the way that you learn?
7) Student-to-student interaction involves discussions with other students either in a class or one-on-one. In the two modules, the student-to-student interaction that you experienced was during the class, chat, and threaded discussions. What are your thoughts about how student-to-student interaction affects the way that you learn?
8) Which of these three types of interaction methods are the most important for you learning?
9) What are your thoughts about learning in a synchronous face-to-face learning environment (GBB or MetNet)?
10) What are your thoughts about learning using online resources?
11) What motivates you to learn?
12) Since you have participated in a course that uses technology to facilitate learning, what are your thoughts about using technology for learning.

Appendix C: Research Design Charts

Off-Campus Videoconference Class

	Subject	Date	Group 1	Group 2
Learning Module 1	ERP-1	Week 1 Class	Read Lecture Class Discussion	Read Lecture Threaded Discussion
	ERP-2	Remainder of Week 1	Group 1 Read Online PowerPoint Threaded Discussion	Group 2 Read Online PowerPoint Chat
	Subject	**Date**	**Group 1**	**Group 2**
Learning Module 2	ASP-1	Week 2 Class	Read Lecture Threaded Discussion	Read Lecture Class Discussion
	ASP-2	Remainder of Week 2	Group 1 Read Online PowerPoint Chat	Group 2 Read Online PowerPoint Threaded Discussion

On-Campus Face-to-Face Class

	Subject	Dates	Group 1	Group 2
Learning Module 1	ERP-1	Class 1	Read Lecture Class Discussion	Read Online PowerPoint Threaded Discussion
	ERP-2	Class 2	Group 1 Read Online PowerPoint Threaded Discussion	Group 2 Read Lecture Class Discussion
	Subject	**Dates**	**Group 1**	**Group 2**
Learning Module 2	ASP-1	Class 3	Read Lecture Threaded Discussion	Read Online PowerPoint Chat
	ASP-2	Class 4	Group 1 Read Online PowerPoint Chat	Group 2 Read Lecture Threaded Discussion

Online Internet Class

	Subject	Dates	Group 1	Group 2
Learning Module	Pivot Tables	Oct 10-17	Read Chapter 7 Study Guide Threaded Discussion	Read Chapter 7 Study Guide Chat
	Subject	**Dates**	**Group 1**	**Group 2**
Learning Module 2	Regression and Correlation	Oct 18-25	Read Chapter 8 Online PowerPoint Chat	Read Chapter 8 Online PowerPoint Threaded Discussion