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DIFFERENCES IN STUDENT KNOWLEDGE AND PERCEPTION OF LEARNING EXPERIENCES AMONG NON-TRADITIONAL STUDENTS IN BLENDED AND FACE-TO-FACE CLASSROOM DELIVERY

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ABSTRACT

The purpose of this study was to examine the efficacy of traditional and blended (partially online and partially face-to-face) course delivery methods. This study further examined the impact of using technology to improve student learning by providing meaningful learning in the areas of content delivery, communication and collaboration, evaluation and feedback, and personal learning experiences.

Non-traditional students enrolled in an elementary statistics course either delivered as a traditional course or a blended course participated in the study. It was hypothesized that students enrolled in the blended course would perform better and prefer this method of delivery compared to students enrolled in the traditional course. Student knowledge was assessed by *test grades, course grades*, and *post-tests*. Analysis of the first two indicators did not support the hypothesis that students in the blended course delivery would perform better than students enrolled in the traditional course delivery method. Contrary to the hypothesis, students in the face-to-face course scored higher in the post-test compared to the students in the blended course.

These contradictory results may suggest that the differences in teaching strategies and/or the use of technology have not resulted in a significant change or improvement in the performance of students. Past experience, familiarity with instructional format and types of assessment used may be considerations in the findings obtained.

Student perceptions were also measured. Results indicated that students in the blended course were more satisfied with using technology to facilitate and help them improve their learning than students in the traditional course.

Students in the blended course had more positives perceptions of their learning experiences than students in the traditional course in the following areas: (a) accessibility and availability of course materials; (b) use of web-based or electronic tools for communication and collaboration; (c) assessment and evaluation; and (d) student learning experiences with real-life applications. The perception of the majority of the students in both courses indicated a positive view of technology use in the classroom. The findings further suggest that student participants would choose blended course delivery as an alternative to face-to-face instruction.

Both course delivery methods emerged as enhancing the students' appreciation of the integration of technology and recognizing the role of the teacher as the expert in the classroom, engaging students in meaningful learning. In spite of the emergence of technology in the classroom, the value of traditional instruction was indicated.

DEDICATION

For Papa

"Wala akong yaman o ginto na ibibgay sa inyo. Mag-aral kayo kahit igapang at ipangutang ko dahil ito ang tanging yamang maibibigay ko sa inyong mga anak ko."

Mr. Ruperto Marquez Araño
(1929 – 1995)

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Very special thanks to my mother who has been faithful, selfless, and tireless *waiting on* me since elementary school up to this very moment.

Special thanks to my brothers, Ramon and Romeo Araño and their families, to my aunt, Dr. Fely Araño, and Pastor Joe Spicer and for their steadfast prayer, guidance, and encouragement.

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To God be all the glory!

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CHAPTER I

INTRODUCTION

The emergence of computer and telecommunications technology is not only evident in the corporate or the business world but also in educational institutions. Technology in various forms has long been used to facilitate teaching and learning. Historically, the printing press allowed textbooks to be developed and replaced slates and chalk. Paper and pencil permitted a permanent record of one's writings to be preserved. In the late 1950s and 1960s, television was utilized as a means of teaching large groups of students remotely (Matusevich, 1995). Today, a new wave of electronic solutions using computer and telecommunications technologies have greatly impacted the government, business, and educational sectors nationwide and around the world. The emergence of campus technology has the potential to bring competitive advantage for most colleges and universities by integrating technology into the teaching and learning process.

In education, technology is used throughout the world for gathering information, keeping records, creating proposals, constructing knowledge, performing simulations to develop skills, facilitating distance learning, allowing web-based course delivery systems, and promoting global collaboration for life-long learning and work (Kimble, 1999). Most institutions nationwide recognize the major role technology plays in the classroom, and administrative and support offices. Technology has contributed to the changing environment of education where institutions are faced with the increasing demands for instant access, interactive experiences and stable and robust access to the teaching and learning resources.

Educational institutions continue to find ways to leverage technology in facilitating effective and efficient teaching and learning environments ranging from correspondence courses to interactive television to digital solutions merging computer and telecommunication technology. Higher education has explored e-learning technologies such as electronic books, simulations, podcasting, wikis, and blogs (Kim and Bonk, 2006). Colleges and universities are responding to pressures from a range of forces to move into the delivery of courses via online methods (Martyn, 2003). The rate at which a variety of institutions are entering the distance learning arena is increasing rapidly (McCombs & Vakili, 2005).

Technology provides teachers infrastructure, resources, and tools during course preparation and delivery. Educators, researchers, and policy makers continue to search for innovations and initiatives of learning and schooling models and the increased use of new and emerging technologies that can better prepare students for an increasingly global, changing, and complex world (McCombs & Vakili, 2005).

Johnson, McHugo, and Hall (2006) also wrote that the developing nature of information and communication technology offers opportunities and benefits in the educational field when blended with more traditional approaches to learning. These approaches include monitoring online activity, rich administrative support, repository of learning materials, multiplicity of assessment options and strong collaborative tools. Similarly, Jonassen, Howland, Moore, and Marra (2003) stressed the use of technology to provide students with a more meaningful learning environment which is active, authentic, constructive, cooperative, and intentional.

Why blended course delivery? With the perception that blended learning is easier to offer than pure online courses by having the "best of both worlds" in blended courses, a study showed that pure online courses are more prevalent than blended courses (Ward, 2004). The Sloan Consortium (2006) conducted a study on the nature, extent, and promise of blended learning in higher education in the United States. The schools reported a decline from 6.8% in 2003 to 5.6% in 2005 while online course offerings were up from 6% to 10.6% in 2003.

In spite of what the study revealed, the Sloan Consortium (2008) reported that colleges and universities continue to offer blended courses. Higher education institutions have been investing in both online and blended courses. The study reported that in their most recent survey, consumer experience and perception of online and blended courses are both positive and indicated that the market for both online and blended courses has a lot of room for growth.

The Midwest University

In this study, Midwest University is an assumed name for a medium sized private university located in the state of Missouri to preserve the identity and privacy of the participants in this study and that of the institution. Midwest University is among many institutions of higher learning which embraced the integration of technology to provide quality and enhanced teaching and learning. The academic leaders of Midwest believe technology, when used properly and appropriately, will facilitate teaching and learning effectiveness, efficiency, and affordability in the classroom.

Midwest leaders have identified technology initiatives to improve student campus life by improving access and availability of needed resources through the use of

technology. Technology supported services provided students with more flexibility, availability, convenience, robustness and ease of web-based access to campus resources. These resources included student access to online resources from their residence hall. Similarly, Midwest provided student services with online registration, online library catalogs, university bookstore online transaction processing, course management system, electronic mail, wireless network, university interactive web sites, and other technology resources. These technology solutions were corollary to one of Midwest's goals to develop and implement a student-centered information technology plan enhancing and sustaining a vibrant academic life for Midwest constituencies (Midwest Planning and Research Guide, 2008).

As articulated in its strategic plan, one of the core values of Midwest was to create an engaging campus culture through the use of technology and new pedagogies (Midwest Strategic Plan, 2008). One of the major goals of this plan was to promote faculty development focused on new pedagogies, externally peer-reviewed scholarly activities, teaching excellence, the integration of liberal and professional learning and assessment strategies.

The Information Technology and Library departments at Midwest University continuously implemented its technology strategic plan to build the infrastructure to support and improve the instructional, administrative, and business processes. Over the last five years Midwest increased its number of computing facilities, services, and support staff (Midwest Planning and Research Guide, 2008, pp. 77-84). During the last five years, affordable, robust, and high-speed computer and telecommunications solutions were installed for efficient, easy, and secure access to web-based teaching and learning

solutions. Communications within and outside the academic community were continually enhanced using a state-of-the art electronic email system, telecommunication, and current web design and development.

Midwest provided significant funding for enterprise resources and planning solutions to manage and support administrative information systems and applications using Datatel Colleague® systems. Likewise, the University adopted and adapted to best practices in educational technology. Technology solutions that were recently implemented included online and automated systems for registration, course evaluation, access to student grade and transcript information, library databases and catalog system, and student online services that include dining and the purchase of books and school supplies.

The University recognizes the role of technology in providing students and teachers with tools to support a responsive, student-centered, and meaningful learning environment. In early 2001, Midwest University introduced the WebCT® course management systems (CMS) to supplement traditional classroom teaching. It provided an efficient and reliable course content distribution with enhanced communication and online evaluation tools.

Midwest University started using WebCT® course management system in 2001. In 2006, WebCT was replaced with Desire2Learn® (D2L) which was judged to be more responsive, easy to learn, and provided a robust system that meets the needs of the students and faculty. The new system is used to support face-to-face instruction, blended and online course delivery.

The Vice-President of Academic Affairs took the initiative to enhance faculty resources and support the integration of technology in the classroom. As part of its main services, the Academic Computing and Instructional Technology department staff provides faculty members with technical training on how to use new applications and technology solutions to enhance course preparation and delivery. Likewise, the Center for Teaching and Learning sponsored faculty technology training and professional development programs during each academic term to equip faculty with the right technology tools. These programs included technology skills training, course design, development, and maintenance of blended courses. A course designer position was also created to assist faculty members in the development and maintenance of blended and web-enhanced courses.

With the emergence and continued use of technology in teaching and learning, this study attempted to determine the impact of technology in one of the academic programs for non-traditional students at Midwest University. This study focused on non-traditional students in the Weekend College program. This study investigated two courses in Elementary Statistics of the Weekend program which were offered as traditional and blended courses during spring 2009. The Weekend Program first began to offer blended courses or hybrid courses in fall 2008. These courses were two of the first few courses that were offered in a face-to-face and blended course delivery format during spring 2009.

Scope of the Study

This study was carried out in a predominantly four-year private institution located in the mid-west region of the United States. The institution offers four major areas of

academic studies, namely: College of Arts and Sciences, School of Business, School of Education, and School of Health Professions.

Research participants are non-traditional students from two undergraduate courses in elementary statistics in the Weekend program. The students of the Weekend program primarily consist of non-traditional aged students who have been away from post-secondary schooling for a while and/or returned to school to earn their degrees or another degree for those changing careers. The majority of the students in the Weekend program consist of adult learners who are 25 years old and older.

The study includes 36 students with 13 students in the traditional class and 23 in the blended course. Students enrolled in these courses self-selected or enrolled through curriculum advisement. Some of them enrolled based on the availability of the courses, which is dependent on the number of course offerings offered each semester. The data were gathered from an intact group of students from elementary statistics courses enrolled in traditional and blended courses possibly limiting the representative characteristics of the sample. There are only a few blended courses as counterparts of the traditional courses offered for the Weekend program during spring 2009, thus potentially limiting the scope of this study.

Statement of Problem

According to Jonassen, Howland, Moore, and Marra (2003), technology plays an important role in engaging students in *active, constructive, intentional, authentic,* and *cooperative* learning influenced by the constructivist theory of learning. Blended courses integrate technology to engage students in active learning with enhanced communication,

and to facilitate collaborative learning, which describes a student-centered teaching and learning.

On the other hand, teacher-centered classroom delivery is based primarily on behaviorist theory wherein students learn through behavior modeling or behavior shaping as defined by B. F. Skinner (Leonard, 2002). This type of teaching uses a lecture-based approach where students take notes, participate, and in general respond to achieve the learning objectives defined by the teacher. This is characterized as teacher-centered course delivery with very limited or no use of technology.

The teacher-centered and student-centered course delivery approaches have their own strengths and weaknesses which are discussed in Chapter 2 of this paper. This situation raises questions as to which is a more effective approach to teaching and learning between face-to-face (teacher-centered) and blended (student-centered) course delivery format. How is technology used to facilitate learning? How is technology used to design a more effective course delivery method? How do students perceive these teaching strategies based on their learning experiences?

This study was conducted to determine the efficacy of traditional, teacher-centered classroom teaching and blended, student-centered course delivery. This study further investigated the attitude and level of satisfaction of students towards face-to-face instruction and blended course delivery method. The results of the study were used to answer the following research questions:

1. What changes occur in the student knowledge in an elementary statistics course as measured by post-tests, major test scores, and course grades in face-to-face instruction and blended course delivery?

2. What is the difference in the perception of the learning experiences of students in an elementary statistics course in face-to-face instruction and blended course delivery in the areas of (a) content delivery; (b) communication and collaboration; (c) assessment and evaluation; and (d) learning experiences?

Purpose of the Study

This study is conducted to determine the effectiveness of blended course delivery as an alternative to traditional classroom instruction. The enormous investment of resources to support these new directions in the integration of technology in most universities requires a deeper look as to how technology is appropriately and effectively used to facilitate and improve the quality of teaching and learning. The findings of this study will further provide information for planning, funding, and implementation of future programs, course offerings, and initiatives in the area of instructional technology. The outcome of this study will facilitate creation and development of faculty training and technology support and services for teaching and learning.

Prior to the school year 2008-2009, there were very few online courses and blended courses that were offered and initiated by faculty members at the university in this study. For the first time, Midwest University officially initiated a program to offer 20 or more blended courses in the Weekend program in fall 2008 utilizing technology as an alternative to traditional course delivery. Faculty members were trained to design, develop, and teach blended courses. Faculty members were mentored by their peers who had experience in blended course design and delivery. Faculty members were provided the necessary technology training and technical support.

The impact of technology in the classroom requires faculty to equip themselves on how to use these tools to prepare course materials and manage classroom delivery. This requires an effective and on-going user training and technology support. A significant amount of financial support was evident in the acquisition of hardware and software to equip teachers with tools such as a course management system, web-based collaboration using Web 2.0 tools and other technology applications. The teachers who use these tools are no longer just teachers but they become the "creators" and skilled "designers" in preparing and delivering course materials. It became necessary for them to learn the technology to support pedagogical needs in the classroom.

In this study, for example, the teacher in the blended course had to be prepared to assist students to use Excel in conducting statistical data analysis. Teachers became not only the authority in delivering the concept but they became sources of information and experts in this area of managing and using the technology tools.

Like most colleges and universities, the faculty and students in this institution experienced a change in their roles in how teachers teach and students learn. The faculty had to learn to use technology during course preparation, instruction, and the management of the course. In the same way, the students were asked to respond to changes in the learning environment and had equipped themselves with the necessary technology skills required to facilitate their learning. In some cases, the teachers who did not use technology were asked by their students to use technology in the classroom. Responding to these needs, the institution must provide the necessary pedagogical and technical training for the faculty.

Significance of the Study

Durbin (2002) wrote that the use of computers and the Internet to convey content to students is popular, but the amount of research relating to the effectiveness of the technology to learning is relatively sparse. The Institute for Higher Education Policy (1999) published a report entitled, "*What's the Difference? A Review of Contemporary Research on the Effectiveness of Distance Learning in Higher Education*." The report included an in-depth review of studies and current research on the effectiveness of distance education through online learning. This report was intended to help policy makers and faculty make properly informed judgments about key issues in distance education with the use of technology and to assist with policy development in this important area.

The report from this study found several key shortcomings in the research studies on the effectiveness of distance learning using technology. The report emphasized the vital need to develop a more integrated, coherent, and sophisticated program of research on distance learning based on these theories of learning. One of the major shortcomings of the research studies was the absence of a theoretical or conceptual framework that will guide the design and delivery of the courses.

The report addressed the impact of technology on the educational effectiveness of colleges and universities and examined the limited number of original research studies. The following three broad measures of the effectiveness of distance education were used: (a) measurement of student outcomes, such as grades and test scores; (b) measurement of student attitudes about learning through distance education or web-based instruction; and (c) measurement of overall student satisfaction toward distance learning or web-based

instruction. This dissertation study utilizes the kinds of measures recommended by the report.

This research study paved the way to identify issues and challenges concerning the design and implementation of the blended course integrating technology to promote meaningful learning. Although the use of technology in the traditional classroom delivery was limited, the study provided an opportunity to re-design the course to enhance and improve the course delivery for both traditional and blended course. The continuous re-design of the two courses created a model identifying the differences using technology or very limited use of technology in content delivery, communication and collaboration, and evaluation of student performance. The study also included important information about how students perceived the use of technology based on their learning experiences.

Midwest University is still in its early stage in implementing and offering blended courses. The experiences and lessons learned in the research process will give an opportunity to contribute towards the development of instructional initiatives in the area of teaching and learning. This study will further contribute toward the improvement of the integration of technology in the classroom and faculty technology training and development.

It is also important to understand that typical students from a decade ago are rapidly changing to a new breed of learners. Institutions of higher education have increasingly begun to rethink the way in which teaching and learning occurs on their campuses in response to the new breed of learners, the so-called digital-age students often referred to as the Net Gen or Millennials (Lohnes and Kinzer, 2007).

These students have not only been taught to learn with technology but have lived using technology tools, hardware and software in the classroom and at home. Some learned from technology using web-based instruction, videotaped lessons, and other forms of mediated instruction through distance education, complementing face-to-face instruction. They are digitally literate, connected, multitasking individuals who have acquired those skills and practices that they can use in the classroom (Lohnes and Kinzer, 2007).

Non-traditional age students today follow the trend of seeking academic degrees for career or professional advancement to remain competitive in the new economy. Like the Millennials, this group of adult learners is now exposed to different types of technology innovations in the work place, their homes, and day-to-day life activities. This group of learners, like the millennial students, is in search of different alternatives to traditional classroom learning offered through distance learning---with online and blended courses.

According to Skopek and Schuhmann (2008), higher education in the United States is experiencing a fundamental shift in student demographics where more non-traditional students are seeking educational opportunities and alternative modes of curriculum delivery. Graham (2004) wrote that adult learners or non-traditional learners will continue to have more exciting learning options and avenues in the coming decades where most of the learning opportunities were not conceivable ten or twenty years ago.

Allen and Seaman (2008), in a study published in November 2008 in collaboration with the Sloan Consortium, the College Board, and Babson Survey Research Group, reported about the impact of the changing economy on online learning.

The study reported that bad economic times have often been good for education, either because decreased availability of good jobs encourages more people to seek education or because those currently employed seek to improve their chances for advancement by increasing their education. The availability of online courses will minimize the cost of actual attendance while providing convenience and flexibility in a self-paced or self-directed learning environment for students.

Institutions take into account the idea that economic changes will have a positive impact on overall enrollments and that the specific aspects of an economic downturn resonate closely with the increasing demand for online courses with specific types of schools (Allen and Seaman, 2008). According to the same study, higher fuel costs will lead to more students selecting online courses. Similarly, institutions that offer programs to serve working adults are most positive about the potential for overall enrollment growth being driven by rising rates of unemployment.

For more than three decades now, numerous teaching strategies have been adapted by the researcher to engage students into meaningful learning even without the use of computer technology. During the research process, the researcher gained first-hand experience on how to re-design and identify challenges and issues in conducting a blended course through the appropriate use of today's technology solution and tools.

This study provided a better understanding to connect and apply the theories and principles of learning in designing, developing, and managing blended course delivery to provide students with meaningful learning environment specifically anchored on the attributes of meaningful learning and taking advantage of the available technology resources.

Statement of Hypotheses

This study attempts to provide evidence to support the following hypotheses:

Null Hypotheses:

a) There is no significant difference in the knowledge of students in hybrid (blended) courses of elementary statistics and face-to-face (traditional) classroom instruction.
b) There is no significant difference in the attitudes and level of satisfaction of students in face-to-face and blended courses in elementary statistics.

Alternative Hypotheses:

a) The students taking blended courses in an elementary statistics course perform better academically than students in face-to-face course delivery as indicated by their knowledge based on test scores and course grades.
b) The attitudes and levels of satisfaction of students in an elementary statistics course based on their learning experiences are higher in blended course delivery than face-to-face course delivery.

Theoretical Framework of the Study

This study focused on the two different types of course delivery that were designed based on traditional teaching embracing the learning theory of behaviorism and blended course instruction based on constructivism. The first method includes the traditional classroom instruction (also called face-to-face instruction) characterized by teacher-centered approach. The teacher is more or less in control of the materials to be learned in class. The teacher develops and delivers the lecture, assigns projects and

homework, and oversees classroom activities which are mostly instructor-led such as seatwork and problem-solving exercises with very limited use of technology.

Face-to-face instruction is defined as time and place bound, face-to-face instruction typically conducted in an educational setting and consisting primarily of a lecture/note-taking model (Achacoso, 2003). Traditional or face-to-face instruction as opposed to learner-centered learning has its focus on the teacher instead of the student. The teacher takes an active role in the course design and delivery centered on pre-defined objectives and measures of learning outcome.

The standard teaching method for face-to-face classroom instruction includes lecture where students as a group are receiving the content presented by the instructor. The student listens, takes notes, memorizes the content, and is tested giving feed back to the teacher for course performance evaluation. Some students learn passively where learning is achieved by observable, measureable, and controlled objectives set by the instructor and met by the learners (Leonard, 2002).

Based upon the behaviorists' theories of learning of Edward L. Thorndike, and B.F. Skinner, learning can be achieved if learners are provided with the correct stimuli and are trained to respond in a particular manner exhibited by a set of pre-defined or predictable behavioral outcomes (Leonard, 2002). In the 1900s, Thorndike developed a more scientific learning theory based on stimulus-response hypothesis (also known as *connectionism*) that a neutral bond would be established between the stimulus and the response when a particular stimulus produced satisfactory response within a given environment.

Thorndike (1931) believed that learning takes place when these bonds formed into patterns of behavior. These patterns of behavior are influenced by the frequency of occurrence of a situation. He further wrote that as man lives and learns, his reaction or response to the same situation or state of affairs changes where the connection exists in various degrees of strength.

In the design of the blended course delivery format, the theories of Bruner and Piaget provide an approach in which the learner builds information in a team-based manner that emphasizes learner knowledge sharing and collaboration. Students actively acquire knowledge and share knowledge among their classmates while the teacher acts as a 'guide on the side' and co-learner. Students do not only absorb or receive knowledge but they explore and interpret the knowledge with a new meaning.

Bruner (1996) wrote that passing on knowledge and skill like any human exchange involves a sub-community of interaction. Learners help each other learn, each according to her or his abilities. He further wrote that in matters of achieving mastery, learners need to gain good judgment, to become self-reliant, and to work well with each other. Bruner's discovery learning theory describes that learners are more likely to remember concepts if they discover them on their own, apply them based on the knowledge they have acquired and through life experiences (Leonard, 2002; Murphy, 1997)

Perkins (1991) wrote that the role of the teacher shifts to something more like that of a coach and facilitator through the use of technology resources. According to him, these tools include computer technology that is directly used in the class or technology infrastructure that allows collaboration and sharing of ideas and learning resources

through the Internet and local area networks. Blended learning is student-centric using technology to help learners to build on what they already know and what they learned. In a student-centered learning environment, the role of the teacher changes from *sage on the stage* to *guide on the side*, in the process, the teacher becomes a *co-learner* or a *coach.* Teachers coach or mentor students to facilitate their learning and in similar manner, the role of the student also changes.

The constructivist approach transforms a passive learner to an active participant in the learning process (Jonassen et al, 2003). Barr and Tagg (1995) wrote that universities moved away from a faculty-centered and lecture-based paradigm to a model where learners are the focus. According to their own investigation, faculty members become learning designers and students become critical thinkers.

On the other hand, Duffy and Cunningham (1996) argued that the shift is a shift in method rather than a shift in the conceptual framework underlying the method. The teacher is still the fount of knowledge and possesses the knowledge the student has to acquire. Polman (2000) wrote in his book that constructivism does not discount the active role of the teacher or the value of the expert. Constructivism modifies or *transforms* the role of the teacher by providing them tools to engage students in active and collaborative learning. Polman (2000) further wrote that teachers use these tools as supportive resources for teaching and learning.

In spite of the affirmative endorsement of a student-centered approach, teachers are still in command of the classroom. Fisher (1972) wrote that teachers place the interest and needs of the learners in the heart of the learning process. Some teachers manipulate situations so that the learners appear to be making their own choices. Teachers for the

most part evaluate the students rather than helping them to evaluate themselves. Teachers still do a lot of direct teaching and arrange the learning environment to engage their learners.

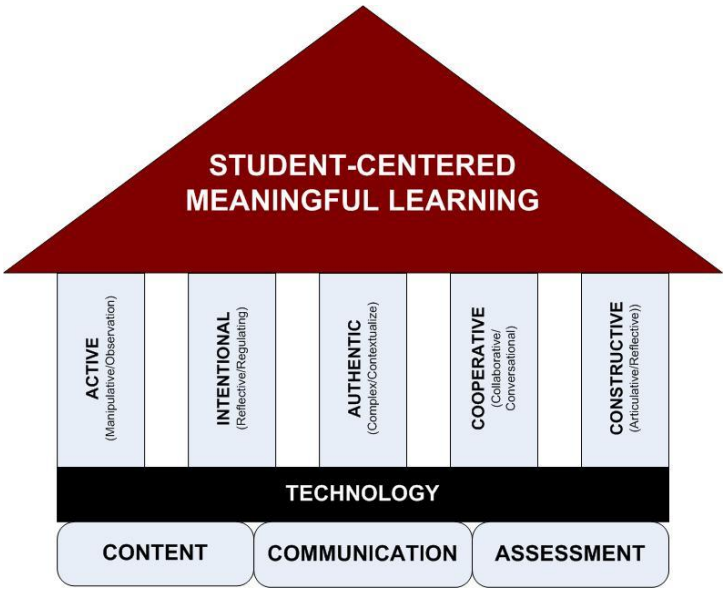
Similarly, in spite of the emergence of technology in the classroom, well-grounded behavioral and educational theories still apply in the teaching and learning processes. Pecorino (2004) wrote that in the use of technology care must be taken not to discount what was valuable in traditional classroom teaching and teacher-student interaction. There is value in learners taking notes while the teacher is presenting the information. The learner makes the decision and makes appraisals of what was important to note. Pecorino added that when learners use technology and other related tools, the learner progresses with mechanisms for retaining information but none of that is learning. How the information is taken down and stored must involve the learner making appraisals and seeing connections and relations. It is one of the basic challenges for any teacher whether working on chalkboards or technology devices.

Schunk (1991), in his book *Learning Theories: An Educational Perspective*, wrote that when computer learning shows advantages over traditional instruction, it may be because computers allow for better prepared instructional materials and for the implementation of more instructional design strategies. The computer is not the cause of learning but rather a medium for applying principles of effective instruction and learning. He further wrote that computers facilitate instruction and learning.

Central to this study are the five meaningful learning attributes described by Jonassen, Howland, Moore, and Marra (2003) which defined the five attributes of meaningful learning emphasizing the importance of technology as shown in Figure 1.

According to Jonassen, Howland, Moore, and Marra (2003), technology plays an important role to engage students in *active, constructive, intentional, authentic,* and *cooperative* learning.

Figure 1 - Technology and Meaningful Learning



This model depicts the five learning attributes defined by Jonassen, Howland, Moore, and Marra (2003). These attributes are anchored on technology under three major functional areas: (a) Content Design, Development, and Delivery; (b) Communication and Collaboration; and (c) Assessment and Evaluation

Jonassen, Howland, Moore, and Marra (2003) advocate active learning with minimal intervention of formal instruction. Learners can acquire sophisticated skills and advance their knowledge about what they are learning in an environment that supports effective and appropriate use of technology. Students learn by doing. Learners will learn to manipulate the objects or tools available to them and learn new ideas from their experiences and observations. Students in traditional classroom teaching are less involved in active learning where teachers tend to lead the learners by assigning more specific or standardized procedures on how to complete a learning activity.

Rice, Wilson, and Bagley (2001) wrote that one way to accomplish effective learning is by actively involving students in critical thinking, problem-solving, decision-making, and exploration through the use of technology and constructivism. Active learning involves interaction and manipulation. Students are more in control on how they will learn or achieve their learning goals and seek a more efficient way to do their work.

According to Jonassen et al (2003) technology effectively and efficiently supports the learning process constructively where students are able to reflect, interpret, articulate, and collaborate in class using available technology tools. The technology tools are used to enhance group discussions and facilitate collaboration, online assessment, content development and delivery. These tools also include web logs ("blogs"), wikis, podcasting, and other technology applications. Most universities have used proprietary course management systems such as WebCT®, BlackbBoard®, Angel ® or Desire2Learn® (D2L).

Active learners are responsible for their interpretation based on their personal observations and learning experiences. In a constructivist approach, learners are active seekers and constructors of knowledge. Perkins (1991) wrote that learners do not simply take in and store information. Students just do not absorb knowledge or just take and store up information. They attempt to interpret their experiences and build on and test those interpretations.

Human behavior is naturally goal-oriented. Students must be intentional in their learning with their own learning goals (Jonassen et al, 2003). Students are involved in identifying their own learning goals and setting their own strategies and procedures to meet their expectations. This process sets the direction for learners about what to achieve

where further manipulation is necessary to take them to a higher level of learning. In traditional classroom teaching, teachers identify learning goals which are very structured and sometimes cannot be altered to address student learning needs.

Authentic learning involves complex tasks. Students who already have knowledge will acquire new knowledge learned from building new applications or activities towards more complex tasks. Learners will continue to explore, manipulate, observe, and interpret. Students are able to identify and present or articulate facts or complex situations if transformed to real-life applications.

Technology is utilized to contextualize complex or abstract thoughts and ideas, which some teachers find difficult to teach or sometimes fail to deliver. In a teacher-centered approach, the teacher simplifies the learning task and concepts in a lecture or activity. These are presented to the students in a "box". Students tend to think only about what is inside the box and cannot deal with what is outside. Often times, in face-to-face instruction, the teacher contextualizes the information for students to be able to understand them.

In a student-centered instruction, through the use of technology, complex concepts are contextualized and applied with real life situations facilitating towards a better and more meaningful understanding by students. As mentioned earlier in this study, traditional schooling simplifies knowledge and practice, presenting concepts and information abstractly rather than in the context of meaningful application (Resnick, 1989).

Cooperative learning involves collaboration, interaction, and conversation (Jonassen et al, 2003). Meaningful learning involves a great deal of collaboration and

communication which are facilitated through the use of technology. Matusevich (1995) summarized her findings using technology-rich classrooms with the following observations: (a) the learning environment provides a shift from class to small group discussions, (b) changing role of the teacher as facilitator, (c) actively engaged-students, (d) provides collaboration and cooperation, and (e) students learn different things instead of all students learning the same things.

In student-centered learning, learners share each other's ideas, opinions, and other skills where they can investigate independently or collaboratively. They build a support structure, seeking out each other to approach a problem, perform tasks or deal with the complexities of the learning process. Students learn to explore new ideas and have opportunities to investigate beyond what is "unknown" to them. These new ideas are used to construct, build, or integrate what they have previously known and/or experienced, elevating their thinking and processing to a higher or different level of learning. On the other hand, traditional teaching is usually taught with less collaboration during class time or outside the classroom. Students are limited to individual tasks assigned to them especially if there is no use of technology to enhance their communication.

In a technology supported collaborative environment, these five attributes are interdependent with the three major components of a course design and delivery: *content development, communications, and assessment and evaluation.* For this study, the model illustrated in Figure 1 was the main blue print in designing and developing the blended course anchored on the five learning attributes of meaningful learning.

Technology allows creation, development, and deployment of course materials in various digital formatting, text enhancements, multimedia applications, animation, and

enhanced and high resolution images readily. These materials are made available to students using course management systems which can be accessed anytime and anywhere using the Internet.

Technology provides the infrastructure to allow communication (also in different languages) and sharing of resources within the confines of the classroom or beyond the classroom. Email as a form of communication becomes an essential part of class interaction. This type of communication increases opportunities for students and faculty to exchange ideas and course materials safely from authenticated systems anytime and anywhere. Electronic communication using electronic mail, bulletin board, blogs, wikis, and other web-based synchronous and asynchronous discussion and multimedia tools facilitate collaboration not only among students and teacher but among students themselves during class time or outside the classroom anytime and anywhere.

Chickering and Ehrmann (1996) wrote that one of the most effective and appropriate uses of technology are to advance the following seven principles of learning.

1. *Good practice encourages student –instructor contact.*

   Students in both courses are engaged in learning activities which require maintaining communication between faculty and students. In the blended course, the students use electronic communication tools such as email, online discussion, news and announcements, and group discussion using D2L course management systems. Communication was not only maintained between faculty and students in the classroom but was also maintained among students inside and outside class time. The students in the face-to-face course maintain communication using a telephone communication tree and electronic mail.

2. *Good practice encourages cooperation among students.*

   Collaboration is a big part of the student learning activities implemented in the blended course. Team effort is fostered in the blended group working together to accomplish their goals towards successful completion of the course. The blended course utilizes online group discussion and collaboration which allowed exchange and sharing of ideas and file exchange beyond class time. The students in the face-to-face group worked independently from each other. They had limited access to electronic collaboration tools.

3. *Good practice encourages active learning.*

   Students in both course deliveries are expected and encouraged to participate in all aspects of the learning activities. The students in the blended course were given exercises to work on the computer and on their desks as a group. The students in the face-to-face course were given in-class exercises and they worked individually. There is no group collaboration in the face-to-face course. Students in both courses were given opportunities to demonstrate their work in class. Students in both classes were allowed enough time to ask question.

4. *Good practice gives prompt feedback.*

   Student evaluation and feedback were done on a regular basis. The grades and relevant information were posted in the course management system readily accessible to the students. However, there were times student expected results right away even though the due date for the submission has not ended while there were students who were still in the process of completion. The students

in some learning activities in the blended course were able to obtain immediate feedback from the online interactive learning and assessment tools (e.g. online quiz; review and practice exercises). The students were given the opportunity to improve their work based on the feedback.

5. *Good practice emphasizes time on task.*

   Both courses were designed as 8-week courses. Students in both courses were aware of the format where scheduling or management of their time is vital to their learning. The course designs for both courses have to consider realistic amount of time towards successful completion of the teaching and learning goals.

6. *Good practice communicates high expectations.*

   Learning goals were identified at the beginning of the course. Students in the blended learning defines their own learning goals in each activity in class and expectations were clearly explained and enumerated (e.g. class projects – students can devise their own methods, procedures, and activities to accomplish project completion). The students in the face-to-face course were given complete instructions and guidance how to accomplish these same goals with the similar expectations. Constant consultation with the instructor is encouraged to monitor progress in both courses.

7. *Good practice respects diverse talents and ways of learning.*

   Reinforcing students through personal consultation and scaffolding allowed the teacher to use a range of problem solving approach to address students' issues. Students were guided to different processes which may require some revisions in the learning activity

without significantly sacrificing the learning goals. This includes real-life applications for projects; use of video and other library resources and use of creative tools available in the web such as blogs, wikis, and social networking.

Technology can facilitate implementation of these principles, which provides frequent student-faculty contact in and out of the classroom where students have more access to the teacher and learning resources. The authors further stated that technology facilitates sharing of useful resources augmenting face-to-face contact and collaboration inside and outside the class meeting.

Technology serves as a vehicle to communicate, reflect, and articulate what students have learned not only within the classroom but even outside the school and globally, crossing cultural boundaries. They become a part of the knowledge-building community blending cultural and traditional experiences, viewing the world differently from what they thought it used to be. In essence, learning goes beyond cultural, geographical boundaries, and time zones.

Through technology, the monitoring, evaluation, and assessment of student progress and performance were easily and more accurately processed. Testing and submission of student work and deliverables can be done online. The results are readily available to students, providing immediate feedback. This also provides important information for students to make appropriate improvement of their work.

In a teacher-centered environment, teachers are treated like a savings bank or repository (authority) of knowledge where students *withdraw* from and make limited use of those *investments*. Freire (1993) wrote that teacher-student relationship in this setting

involves the teacher as a narrating subject and the students as patient listening objects. Narration leads the students to memorize mechanically.

In the process, there is a tendency to over-simplify the ideas and modify even the process itself to ease the transfer of knowledge. Teachers tend to structure or 'package' learning within certain boundaries or with simplified context and procedures at times with predictable outcomes. In such a passive learning environment, students are pre-conditioned based on these expected outcomes and tend to think the same way teachers thought, limiting the opportunity to explore and possibly take this learning to a higher level.

In some cases, this process leads to short-term memorization, preventing learners from expanding their thoughts in exploring the unknown, and prevents them from becoming more involved in a higher order of learning. When students memorize formulae, definitions, and the like, divorced from applications that have meaning to them, then the context for learning becomes merely that of passing a test or getting by in the classroom and limits student's capacity to retain and apply the content (Duit, 1991).

Definition of Terms

The following key terms will provide a better understanding of the ideas, concepts, and principles used in this study. Statistical definitions are also included in the latter part of this study in Chapter 3 under "Research Methods."

a) Measurement of Student Knowledge – this includes measurement of student's performance based post-test, test grades, and course grade. Test scores consist of concept-related questions normally given during the midterm and final exam. Similar types of questions for the pre- and post-test were administered at the beginning and

end of the course term. The pre- and post-tests were not included in the calculation of the student's course grade. The course grade includes the total scores of all required learning activities itemized in the grading criteria such as tests, projects, assignments, graded discussions, etc.

b) Perception of Learning Experiences – this includes measurement of student perceptions in the areas of content delivery, use of communication and collaboration tools, assessment and evaluation tools, and student learning experiences in both class delivery formats. A survey instrument was administered to measure the students' level of perception based on their personal learning experiences.

c) Traditional Classroom Instruction [also referred to as face-to-face (F2F), on-ground instruction] is a lecture-based course delivery method where students listen and take down notes. This requires both students and teacher to be physically present in a classroom during instruction at the same time and location. The use of interactive technology is limited in this type of course delivery.

d) Blended Course Delivery (also referred to as hybrid or mixed course delivery) is conducted where students partially meet in the classroom and partially receive instruction online. This type of course delivery may be used with reduction in class time and/or physical class meetings in a classroom. In this study, the course is delivered partially online using Desire2Learn® (D2L) course management system. The course management system (CMS) is used to deliver the online components of the course, which includes content, communication, and evaluation and assessment. Students will have access to all the learning materials developed in the course management systems.

e) Online Course Delivery (also referred to as Online Education) is a course delivery format where students and teacher are not physically present in the classroom during instruction. This type of course delivery uses course management systems (examples: Angel®, BlackBoard®, Desire2Learn®, Moodle®, WebCT® or customized learning systems) to conduct the class completely online and deliver course content materials, for communications and interactivity; and for assessment and evaluation. Allan and Seaman (2007 define online courses differently where 80+% of the content is delivered online, refer to Table 1. In this study, reference to online course delivery is characterized with 100% of the content are delivered online without face-to-face instruction. The class is delivered, facilitated, and participated in using web-based courses on the Internet using both synchronous, (live and real time occurrence) and asynchronous (non-live or batched processing) communication. Web-based content, lectures, and other relevant course materials and tools are purely delivered online. There is no face-to-face instruction or class meeting.

f) Telecommunications technology – includes voice, video, and data communications and technology resources that allow computer connectivity between geographic locations; it also includes the infrastructure that allows connectivity for computers and other related technology resources over a distance such as web servers, email servers, print services, and course management systems.

g) Computer Technology – refers to computer hardware and software resources. Computer hardware are the tangible parts of the system, e.g. keyboard, monitor, etc. Software includes the application programs such as word processor (Microsoft

Word®); Internet browsers (Firefox® or Internet Explorer®); WebCT® course management system, etc.

h) Traditional-aged students – Students from secondary level entering college, returning students under 25 years of age, either full-time or part-time students.

i) Nontraditional students – Adult learners returning to college to complete a degree or changing careers for a different degree who are 25 years of age and older.

j) Course Management Systems (CMS) – also called Learning Management System (LMS) is a course management and delivery system which provides web-based access to course content materials, communication tools, and evaluation and assessment tools to support classroom instruction, blended, and online course delivery.

k) In addition to the above definition, this study will use the classification of course delivery methods summarized in Table 1 (Allen, Shearman, and Garrett, 2007). This table includes typical description of the different course delivery methods which are categorized depending on the amount of content delivered online to the amount of face-to-face sessions or classroom instruction.

Table 1- Types of Course Delivery Methods

Proportion of Content Delivered Online	Type of Course	Typical Description
0%	Traditional	Course with no online technology used content is delivered in writing or orally.
1 to 29%	Web Facilitated	Course which uses web-based technology to facilitate what is essentially a face-to-face course. Uses a course management system (CMS) or web pages to post the syllabus and assignments, for example.
30 to 79%	Blended/Hybrid	Course that blends online and face-to-face delivery. Substantial portion of the content is delivered online, typically uses online discussions, and typically has some face-to-face meetings.
80+%	Online	A course where most or all of the contents is delivered online. Typically have no face-to-face meetings.

Adapted from Allen, I.E., Seaman, J. (2007). *Online nations: Five years of growth in online learning*. The Sloan Consortium.

CHAPTER 2

LITERATURE REVIEW

The review of literature section contains information about the learning theories of behaviorism and constructivism. This section also includes information about the use of technology and information regarding the integration of technology in higher education in most institutions in the United States. Likewise, statistical information from the NCES (National Center for Education Statistics) was also included in this section describing the enrollment trend of online learning in higher education in the United States.

The latter section of this chapter includes results and discussion of the similar studies about the efficacy of face-to-face instruction compared to blended course delivery based on the student's performance and learning experiences. The performance of the students was measured based on test grades, scores on assignment, lab work, case studies, and projects, and overall course grade. Discussions of the attitudes of the students towards blended and face-to-face instruction were also included in this section.

Learning Theories: Constructivism and Behaviorism

B.F. Skinner, considered as the primary leader in popularizing the behaviorists' theory, introduced the notion of the operant conditioning or behaviorism extending Thorndike's connectionism. His concept implies that the key to successful instruction is to analyze the effect of reinforcement and then design techniques and set up specific, reinforcing sequences in which a response is immediately followed by a reinforcing stimulus (Leonard, 2002; Murphy, 1997; Schunk, 1991; Saettler, 1990)

Traditional schooling simplifies knowledge and practice, presenting concepts and information abstractly rather than in the context of meaningful application (Murphy, 1997; Resnick, 1989). The learner focuses on clear, pre-defined goals and ability to respond to these goals. Leonard (2002) contends that behaviorism is not concerned with the willfulness, creativity, and autonomy of the learners, all factors that characterizes constructivism.

Traditional teaching (also called face-to-face instruction) is characterized by principles and strategies found in the behaviorist theories. Students learn through behavior modeling or behavior shaping as theorized by B. F. Skinner using operant conditioning that will shape or control the behavior of the learner using stimuli with pre-determined or desired outcomes (Leonard, 2002). Skinner (1968) wrote that the teacher plays the active role of transmitter. He further wrote that teacher "gives" and the student "takes" where the teacher stocks the student's mind and the student retains what he has acquired.

Albert Bandura, one of Skinner's students, introduced learning by observation. Bandura studied behavior modeling in humans by noting how they learn by observing. Students apply what they viewed or observed and imitate the behaviors as they are presented to them (Leonard, 2002). Bandura (1977) also wrote that people are neither driven by inner forces nor buffeted by environmental stimuli. He reiterated that learners learn in terms of continuous reciprocal interaction of personal environment and environmental determinants. Learning occurs resulting from direct experiences by observing other people's behavior and its consequences for them. According to Bandura

(1977), the capacity to learn by observation enables people to acquire large, integrated patterns of behavior without having to form them gradually by tedious trial and error.

Blended course delivery is an alternative to traditional or face-to-face instruction. Blended course delivery is a combination of face-to-face and web-based course delivery where there is a reduction in the traditional face-to-face instruction which is replaced with increasing frequency of web-based instruction. Both parts of the blended course delivery (hybrid course delivery) which includes face-to-face and online delivery are characterized by constructivist theories of Jerome Bruner, Jean Piaget, and Lev Semyonovich Vygotsky.

The theories of Bruner and Piaget argue for a constructivist learning environment in which the learner builds information in a team-based manner that emphasizes learner knowledge sharing and collaboration. Students acquire and share knowledge among their teammates with the teacher acting as guide and co-learner. Bruner's discovery learning theory proposes that learners are more likely to remember concepts if they discover them on their own, apply them based on the knowledge they have acquired and through life experiences. The key assumption to this theory is that learners are mature enough, self-motivated enough, and experienced enough to actively take part in the formation and structuring of the learning content (Leonard, 2002).

In Piaget's development learning theory, he claims that the key to the growth and maturation of the person is through a two-fold learning process such as accommodation and assimilation. Through the process of accommodation, existing cognitive structures change to make sense of the new events occurring in the environment. Through

assimilation, the individual interprets environmental events based upon existing cognitive structures (Leonard, 2002).

Vygotsky (1997) asserted that the educational process must be based on the student's individual activity and the art of education should involve nothing more than guiding and monitoring of this activity. He further added that the student's personal experience become the fundamental basis of pedagogical work. Education should be structured so that it is not that the student is educated, but that the student educates himself. According to Vygotsky, the teacher may educate the students in deliberate fashion only by constantly collaborating with them, with their environment, with their desires and with their willingness to themselves work with their teacher.

Vygotsky's social development theory describes one of the learning attributes in providing a meaningful learning through collaboration. His social development theory is focused on co-emergence as an important aspect to the development of human consciousness and cognition through shared activity of learning occurring within social relationships of the individuals participating in the process (Leonard, 2002; Kanuka & Anderson, 1999).

In this study, face-to-face course design and delivery were based on the theory of behaviorism. The blended course design and delivery were anchored primarily on the five attributes of meaningful learning. Jonassen, Howland, Moore, and Marra (2003) enumerated and defined the five attributes of meaningful learning centered on the constructivist theory of learning emphasizing the importance of technology. According to Jonassen, Howland, Moore, and Marra (2003), technology plays an important role to engage students in active, constructive, intentional, authentic, and cooperative learning.

Behaviorism and constructivism learning theories have their own strengths and weaknesses. The behavioral approach can effectively facilitate mastery of the content and constructivist strategies are specially suited to dealing with ill-defined problems through reflection-in-action (Ertmer P. and Newby, T., 1993). Ertmer and Newby (1993) believe that the strategies promoted by different points of a continuum depend on the focus of the learning theory. They further suggested that in instructional design, theoretical strategies can complement each other, allowing course design approaches to draw from a large number of strategies to meet a variety of learning situations. This study established an objective approach in the investigation process based on this premise.

Technology and Education in the United States

The educational process, how we teach and the way students learn in secondary and higher education, has been affected by the emergence of campus technology particularly in the integration of technology in the teaching and learning processes. Most colleges and universities promote the integration of technology in teaching and learning and hence technology has become a vehicle to carry out the primary mission of the institution. Institutions of higher learning embraced online education and it continues to rise (Kim & Bonk, 2006).

Telecommunications and computer technology created a shift from multimedia, paper and print mediated instruction to computerized course management systems which promise ease of access, reliability, availability and security. This trend offered many opportunities for colleges and universities to implement alternative forms of instructional delivery not only for the traditional aged students but also for non-traditional students. NCES (2000) reported that participating in distance education allowed non-traditional

students to overcome some of the difficulties they encountered in coordinating their work and school schedules.

The emergence of and rapid changes in computing capability and availability of sophisticated telecommunications technology influenced not only the corporate world but heavily impacted learning institutions nationwide and globally. Many institutions of higher learning took the initiative of coupling technology and pedagogy together in providing quality instruction, thereby expanding and transforming the role of the instructor and shifting to a more student-centered learning environment.

Similarly, during the early introduction of technology in education, many expressed how technology would change the way teachers teach and the way students learn. Geoghegan (1994) stated in 1994 that the advent of digital computers on college campuses brought a growing belief that this new technology would soon produce fundamental changes in the practice, if not the very nature, of teaching and learning in American higher education.

Pecorino (2004) wrote that adopting and adapting educational technologies associated with computers and the Internet for use with instruction often transforms how we teach, affording new ways to address old problems. Moreover, it turns attention to some of the basic issues in teaching, focusing the educators on the pedagogy itself, its design and its efficacy.

The use of technology in both American colleges and universities and K-12 schools is also evidenced by increasing trends in institutional budgets. The budgets include significant amounts spent on technology hardware and software, network infrastructure, and operating budgets to support technology staff and maintain equipment

on the campus (NCES, 2002; NCES 2006). The emergence of campus technology in higher education is evidenced by increased funding and technologically supported programs and initiatives to enhance teaching and learning.

The Institute for Higher Education Policy (1999) reported that colleges and universities forged ahead to provide learning at a distance, and many institutions made substantial investments in new technologies for teaching. In 1993, Ayers and Doherty (1993) wrote community colleges spent millions of dollars implementing information technology in the campus environment. Most of this money was directed to improving the computing infrastructure of the campus to better support all aspects of campus operation. Similarly, a large portion of the expenditure supported the introduction and use of technology in the classroom, paving the way for alternatives to traditional teaching with online and blended courses.

During the early 2000s, one of the latest trends for instructional models includes hybrid or blended courses. The evolution of blended or hybrid courses is characterized by combining the best features of face-to-face instruction and online course delivery. These courses took advantage of the best features of online course delivery and face-to-face instruction and continue to extend and provide alternatives to traditional classroom learning environment through the use of technology (Graham, 2004; Ward, 2004; Young 2002).

Although traditional classroom teaching is the main course delivery format in most colleges and universities, there is no doubt that distance education, particularly online course delivery, experienced an exponential growth during the last decade. Web-

based learning and blended course offerings continue to grow, together with varying course delivery formats which have been developed and introduced.

Trends in Web-based Instruction

Distance education through online course delivery, technology enhanced or web-based learning, became one of the major initiatives of most colleges and universities in the United States providing students with alternatives to traditional or face-to-face instruction. Distance education has been in existence as early as the 1700's in the form of correspondence education as an alternative to traditional classroom delivery (Matusevich, 1995; Nasseh, 1997).

Instructional media were introduced in the form of movie films, television, audio recorded tapes, videotapes, CD-ROMs, and related multimedia delivered courses. The rapid changes in computing capability and availability of high-speed networks and sophisticated telecommunications technology contributed to this increase and changing classroom delivery format.

In higher education in the U.S., the trend indicates both online and blended course offerings have grown dramatically during the late 1990s and early 2000s. NCES (2002) reported that online education enrollment was on the rise where 1.6 million students took at least one online course during fall 2002 and where one-third of students took all their courses online. NCES projected for students enrolled in online courses to increase by almost 20% over a period of one year. This projection was realized with the actual growth of 23% during fall 2003 as shown in Table 2 (Sloan, 2006).

Utts, Sommer, Acredolo, Maher, and Matthews (2003) reported in their study that advances in technology coupled with increased student enrollment numbers have led

some universities to begin offering online classes. According to them, as technology advanced and student enrollment increased, many universities explored the use of web-based instruction which includes completely online and blended or blended courses as an alternative or to support traditional face-to-face classroom instruction.

Table 2 - Enrollment Statistics, Fall 2002-Fall 2006

Term	Total Enrollment	Students Taking At Least One Online Course	Online Enrollment as Percent of Total Enrollment	Annual Growth Rate Total Enrollment	Annual Growth Rate Online Enrollment
Fall 2002	16,611,710	1,602,970	9.70%	-	-
Fall 2003	16,900,479	1,971,397	11.70%	1.70%	23%
Fall 2004	17,272,043	2,329,783	13.50%	2.20%	18.20%
Fall 2005	17,428,500	3,180,050	18.20%	0.90%	36.50%
Fall 2006	17,647,720	3,488,281	19.80%	1.30%	9.70%

Source: The Sloan Consortium; NCES (2006)

Based on the 2007 annual report by the Sloan Consortium and NCES Annual report (2006), the National Association of College and University Business Officers (NACUBO) reiterated that the number of students taking online college courses reached nearly 3.5 million in fall 2006 which is approximately an increase of 10 % from fall 2005, as shown in Table 2. The same report indicated that the growth rate exceeded the 1.3% growth of the overall higher education population. Students taking at least one online course were estimated to represent around 20% of the postsecondary education students.

Although approximately 70 % of academic leaders believe that student demand for online learning will continue to grow, the Sloan Consortium report suggested that this growth will no longer be attributed to the new institutions entering the online learning arena. Instead, the full growth came from institutions currently engaged in online learning

and existing institutions have the highest expectations for growth (Allen & Seaman, 2007).

Furthermore, the 2007 annual report indicated that virtually all types of institutions of higher education in the U.S. have shown substantial growth in online enrollment. Two-year associate's institutions have the highest growth rates and account for more than half of the online enrollments for the last five years. Similarly, the report pointed out more than 86 % of online students in undergraduates and traditional baccalaureate colleges account for a very small percentage of the online undergraduate population.

In a report published in November 2008, Allen and Seaman (2008) indicated the steady growth in online learning and no signs of slow growth. It was also reported that online enrollments continue to grow at rates far in excess of the total higher education student population. The following findings were summarized in the report.

- Over 3.9 million students were taking at least one online course during Fall 2007 term, a 12% growth of the overall higher education student population.
- The 12.9% growth rate for online enrollments far exceeds the 1.2% growth of the overall higher education student population.
- Over 20% or more than 1 in five higher education students were taking at least one online course in the fall of 2007.

The Efficacy of Technology Supported Teaching and Learning

Computer and telecommunication technology has influenced the way teachers teach and the way students learn, providing opportunities not only to traditional-aged students but also to adult and distant learners. These courses not only provide

convenience but improved communication and interactivity beyond class time and classroom activities. This type of course delivery also provides flexibility, accessibility, and availability, as well as robust and secured authenticated access to teaching and learning resources.

Technology mediated instruction has proven to be an effective, and to some cohorts, a preferred method of educating outside the confines of traditional teaching. Zambia (2008) compared the effects of technological environment with that of paper-and-pencil environment on reasoning about the concept of derivatives in the content of maximum and minimum problems. The study revealed that participants (students in a calculus course) mostly depended on and were limited to analytical reasoning within the paper-and-pencil environment, whereas the students were able to refer to practical and creative reasoning within the technology environment.

Many studies reported the positive impact of technology use in the classroom. Wai-Chung Ho (2007) conducted a study to explore the effect of technology in Music learning in one of Shanghai's secondary schools. The findings suggest that the use of information technology could extend the boundaries of music learning in the classroom, giving rise to a multitude of new and exciting possibilities.

Most of the research findings have shown that while student success and high levels of student and instructor satisfaction can be produced consistently in the fully online environment, many faculty and students lament the loss of face-to-face contact. Blended learning retains the face-to-face element, making it the "best of both worlds" (Dziuban, Hartman, and Moskai, 2004; Ward, 2004; Young, 2002; Schulman and Sims, 1999).

A comparative study was conducted using a constructivist technology-intensive learning environment and traditional teaching. The study revealed that the constructivist learning approach yielded significantly higher achievement than traditional teaching. Similar studies also revealed that students who have used technology exhibited higher attendance and performance than traditional learning methods (Devevec, Shih, & Kashyap, 2006; Rosen & Salomon, 2007).

In contrast to the above findings, Achacoso (2003) noted in his report that computer based or non-computer based media are merely vehicles that deliver instruction but do not influence student achievement. He compared his findings to a truck that delivers groceries causing changes in our nutrition, based on the research work done by Richard E. Clark entitled, *"Reconsidering Research on Learning from Media."* Achacoso believes and supports Clark's advocacy that media do not help students learn in any circumstance and that the instructional method is the source of learning.

Bernard, Abrami, Lou, Borokhovski, Wade, Wozney, Andrew, Fiset, and Huang (2004) conducted a meta-analysis to compare distance education and face-to-face instruction. Their study found evidence that classroom instruction and distance education are comparable. However, they found that asynchronous distance education (internet-based courses) on average produced better learning outcomes than synchronous distance education using interactive TV or instructional TV or face-to-face instruction. Blended courses experienced high student demand because of increased convenience and flexibility.

The majority of the studies expect that learning outcomes for online education hypothesized that blended or technology supported course delivery method will be

superior to face-to-face classroom delivery. A comparative study conducted by Dutton and Dutton (2005) indicated that students taking statistics in the online course performed better than students in the traditional course. The performance was measured based on test scores, quizzes, assignments, projects, and laboratory assignments. The study included 137 students enrolled in the face-to-face course and 41 students enrolled in the online course in Introduction to Business Statistics course. The same teacher taught the course over a 10-week period. Their study revealed a significant difference in the academic performance of the students in the online course. The academic performance based on test scores and course grade of the students in the online course is significantly higher than the academic performance of the students in the traditional course. The researchers concluded the possibility that the online format works better to convey certain concepts or methods in teaching statistics than using traditional lecture.

Gutierrez and Russo (2005) conducted a similar study with 51 students (20 students in face-to-face, 18 students in hybrid, and 13 students in the online course) to compare the student's performance. Based on the student performance, their findings indicated that blended students outperformed students in the online and traditional course. Most of the participants indicated a strong preference to take a blended course. Such strong support exists when students had positive learning experience in taking a blended course. The study indicated that majority of the students have been exposed to online and hybrid course delivery.

Young (2002) in a similar study found high levels of student and faculty satisfaction and that student knowledge in blended courses are higher compared to face-to-face and fully online courses. The same research has found that blended courses have

the potential to increase student knowledge while lowering attrition rates in comparison to equivalent fully online courses and face-to-face instruction. The courses were also taught by the same instructor using the same syllabus and course requirements.

Reasons, Valadares, and Slavkin (2005) conducted a similar study to examine the efficacy of blended course compared to online and traditional course delivery. The differences were measured based on student's participation, course grade and frequency of interaction with the course website. The findings of the study suggested that online course model supports student learning more effectively than any other format based on the level of course participation, final course grade, and interaction with the course website compared to blended and traditional course delivery.

Although technology mediated instruction has proven to be an effective and to some cohorts, a preferred method of educating outside the confines of traditional teaching, there were studies that reported otherwise. Fields and Collins (2004) wrote that the students' performance were the same in the traditional and blended courses. However, the same study indicated that the student opinion of the blended format was very positive due to students' perception that the course format provided them with greater flexibility.

Thomas Russell (1999) pioneered the concept of "No Significant Difference Phenomenon" (NSDP) supported by the results of his investigation of at least 355 research studies on the integration of technology in education. Russell summarized in his book that learning outcomes from distance education (online, correspondence courses, or technology-mediated instructions) did not differ significantly compared to face-to-face instruction. Similarly, Carol Twigg (Russell, 1999) supports Russell's findings and wrote that no matter how courses are produced using technology, how they are delivered,

whether or not it is interactive, low-tech or high-tech, students learn equally well with each technology and learn as well as their on-campus face-to-face counterparts.

Ramage (2002) conducted a thorough review of Russell's work and wrote that Russell has cataloged at least 355 studies, technical reports, and dissertations that have reviewed student knowledge to determine whether significant difference exists. His analysis provided no evidence of any kind that categorically proves that technology does not impact learning whether positively or negatively. Ramage (2002) wrote that in spite of the emergence of campus technology in higher education and the evolutionary changes it brought about, many research studies in the field of instructional technology did not find significant differences between the integration of technology into teaching and learning and traditional classroom delivery in higher education.

Supporting Russell's findings, researchers found limited evidence of the effectiveness in using technology, but there is evidence that learners believe that technology is beneficial to them. The studies indicated that there is no significant difference in the achievement of students who participated in the traditional and technology-supported course delivery (Lowerison, 2007; Skylar, Boone, Jones, Pierce, & Gelfer, 2005).

Similarly, a study was conducted to evaluate the environmental literacy of post-secondary, non-science major students. The findings showed that the constructivist-based learning environment was not a significant factor of influence, suggesting that regardless of which learning environment they are exposed to, the student participants experienced similar improvements in their learning. The results of the study claim that the students

were getting the same education and that there is no significant difference in their academic performance (Gehlauf, Shatz, & Frye, 1991).

Chen and Jones (2007) conducted a comparative assessment of course effectiveness and overall satisfaction in the course of students enrolled in traditional and blended learning in an MBA accounting course. Overall perceptions of the course, instruction, and learning outcomes were positive for both groups, although students in the face-to-face class indicated more satisfaction with the clarity of instruction compared to blended course delivery. The majority of the students in the blended learning class indicated that they would take another accounting course using the same course delivery approach. The results suggest that the two course deliveries were similar in terms of final learning outcomes. The overall findings suggest that the two delivery methods were similar in terms of the learning outcome, but both may be improved by incorporating the best aspects of each course.

Oblinger and Hawkins (2006) also argued that learning occurs as a result of motivation, opportunities, an active process, interaction with others and the situation. According to them, students are motivated by being part of a team having an opportunity to interact and be involved in the learning process. Students use technology as a key enabler in problem-based learning, searching for background information, conferring, interacting and exploring with team members. Technology is used to investigate and develop solutions.

Summary

In spite of the arguments and differences in findings resulting from the different investigations included in this chapter, technology is perceived to have positive influence

in the learning experiences of the students. Technology will continue to play an important role as a way to engage students in meaningful learning. There has been a continuing and an exponential growth of blended and online course or distance learning in higher education, at both public and private universities in the United States, asserting the vital role of technology in education (Allen & Seaman, 2008; Allen & Seaman, 2009).

Consistent with the previous report in 2008, the latest report of Allen and Seaman (2009) indicated that online enrollments have continued to grow at a rate far exceeding the total higher education student population with the following highlights.

- Over 4.6 million students were taking at least one online course during the fall 2008; (indicating a 17% increase from fall 2007)
- The 17% growth rate for online enrollments far exceeds the 1.2% growth of the overall higher education student population.
- Over 25% or more than one in four higher education students now take at least one course online.

Constituents in this field of educational technology affirmed that institutions of higher education have increasingly embraced online education, and the number of students enrolled in distance programs is rapidly rising in colleges and universities throughout the United States (Kim & Bonk, 2006).

CHAPTER 3

RESEARCH METHODS

This first section of this chapter includes discussion of the course design and procedures to develop and implement the delivery of blended and face-to-face courses. A comparison of the design components of each delivery format is discussed in detail in this chapter. The research methodology also includes identification of data and variables, instrumentation, and data gathering. A section describing the characteristics containing the demographics of the participants is also included.

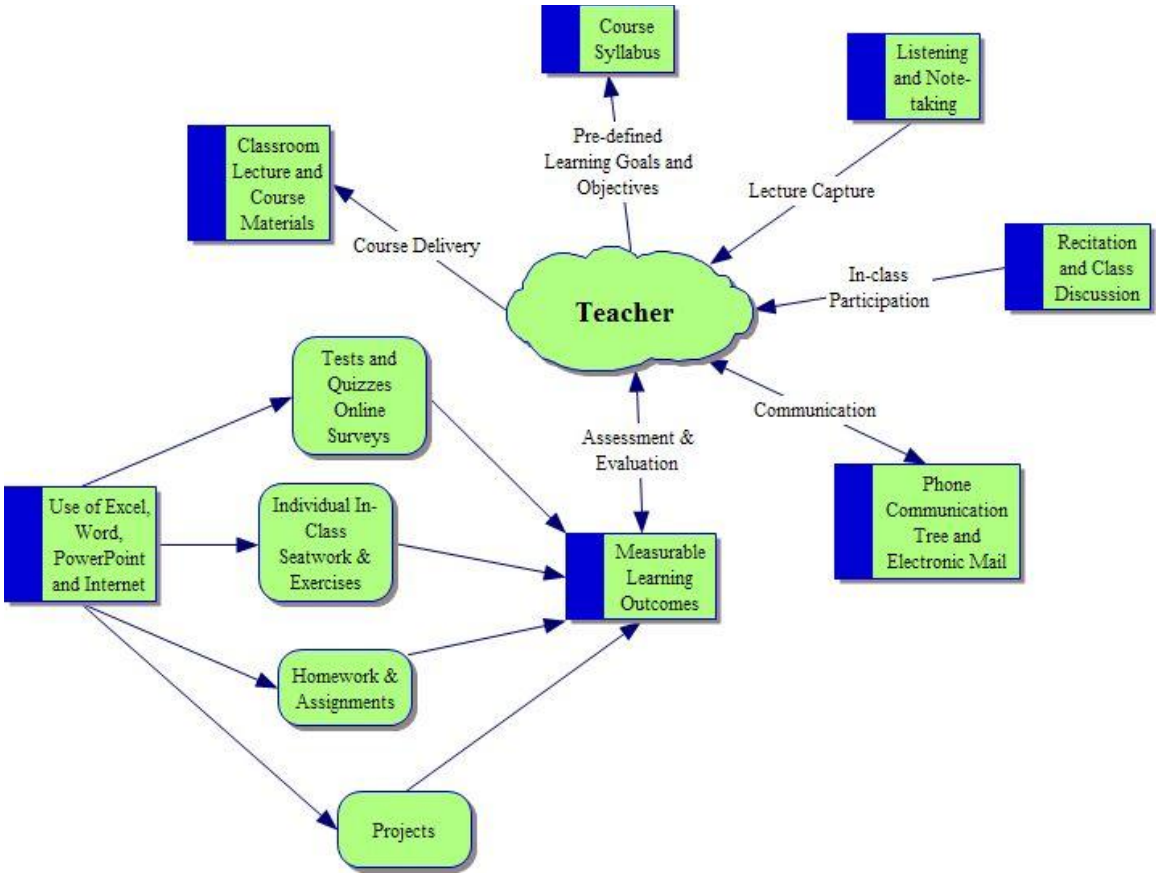
Course Design and Procedures

The purpose of this study is to examine the efficacy of traditional and blended course delivery based on the knowledge of non-traditional students measured by test grades and course grades with non-traditional students. This study further examined the impact of using technology to improve student learning by providing meaningful learning in the areas of content delivery, communication and collaboration, evaluation and feedback, and personal learning experiences.

The traditional and blended courses covered the same topics or subject matter in Elementary Statistics which includes the two main branches of descriptive and inferential statistics. The main objective of the course is for the students to understand and learn the basic principles in elementary statistics in data gathering, data presentation and data analysis. The students learn (a) to understand, identify and write problem/s (problem statement); (b) to gather facts (raw data gathering); (c) to explore different ways to organize and present data in meaningful ways (data organization and data description); (d) to manipulate, conduct inferences or conjectures and further evaluate and analyze data

using hypothesis testing (data analysis); (e) to make decisions based on the evidences provided by collected data; and finally (f) to be able to summarize their findings (summary and recommendation). Each course is designed for students to create a final project that will incorporate these principles.

Figure 2 - Teacher-Centered or Face-to-Face Instruction



The traditional course delivery implemented a controlled environment pre-defined by the teacher with specific and measurable learning goals and instructor-determined objectives for each class session, as shown in Figure 2. The traditional classroom delivery was composed of eight week sessions of traditional lecture using chalkboard/whiteboard and textbook to illustrate concepts, applications, and problem solving.

The main difference between the two courses was the course design and delivery format utilizing different teaching strategies based on behaviorist and constructivist models. Figure 3 illustrates a teacher-centered approach where the teacher defines all the learning objectives for each stage of the class activity. Students individually approached the problem based projects and cases based on established and observed procedures and solutions conducted in the classroom by the instructor.

Out of the eight sessions, the traditional course was taught with face-to-face classroom instruction utilizing lecture format for seven sessions and one session for the final project presentation. These sessions were conducted on alternating weeks for 3 hours and 20 minutes per session. The lecture includes introduction and discussion of the different theories and principles of descriptive and inferential Statistics. Discussion of the different application problems and cases were all done in the classroom by the teacher.

No class materials or handouts were distributed to the students. The main resource of the student in this class is the required readings, plus textbooks, classroom instruction and exercises. The lecture is delivered each class meeting emphasizing the basic principles and theories using illustrative problems and in-class exercises. Students were responsible for taking class notes. The lectures included illustration of procedures in analyzing and solving exercise problems.

In addition to homework, students were given at least 20 to 30 minutes to do individual seat work at the end of the lecture and problem illustration. Students were encouraged to ask questions. The students in the traditional class had very limited use of technology except using Microsoft Excel, Word, PowerPoint and Internet browser. The main part of the test and problem solving exercises includes word problems and case

applications using calculator and/or Excel, paper, and pencil. The students were provided a printed copy of the communication tree containing student email and phone numbers. This also includes instructor's contact information. These were the systems of communication available to this group of students.

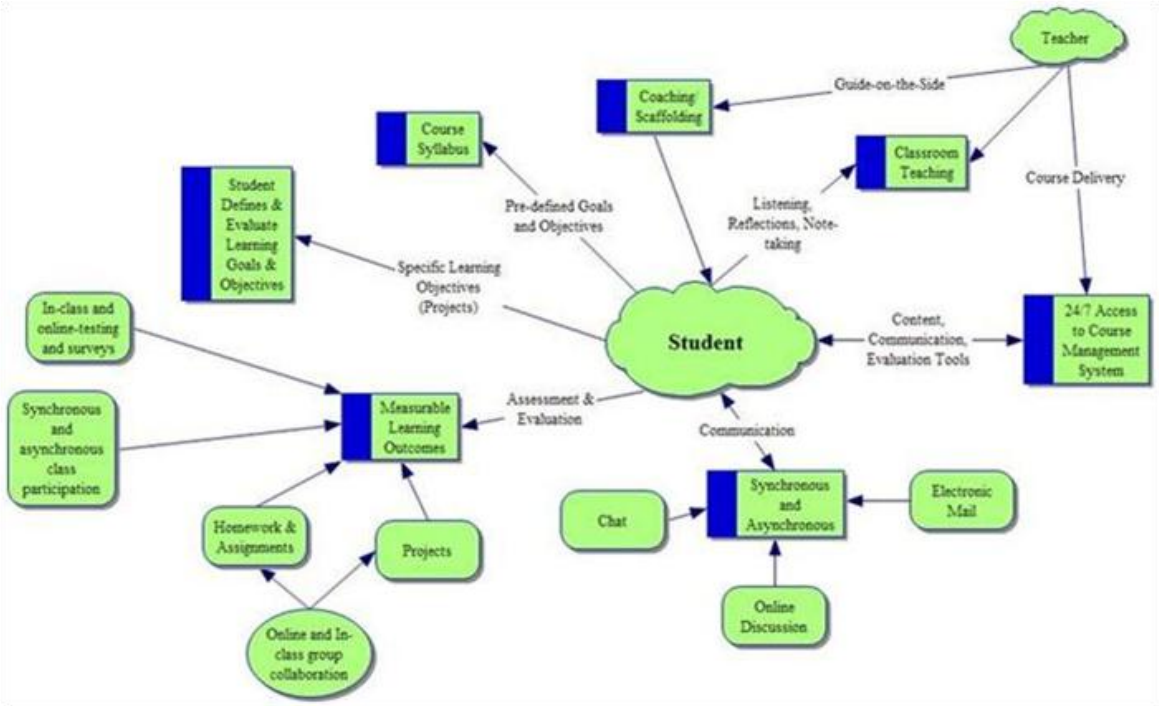
The students in the traditional class were provided with a complete data set instead of students researching them. All students in the traditional class worked on a similar data set as opposed to the hybrid class where students researched the topic of their choice and gathered relevant data. The data set was a collection of different scores (variables) that students analyzed using the theories and principles of descriptive and inferential statistics. The data set was used to conduct data analysis integrating the different principles covered in class.

The students in the traditional course were given detailed information about the final project. The students developed the problem statement and research questions based on the given data set. The students conducted data analysis using Excel. Most students in this class requested a sample of the completed projects, which they could use as a model to create their final project. The students used Microsoft PowerPoint during the final project presentation.

The blended course was delivered and facilitated using the Desire2Learn ® course management system. Students in this class had access to course materials, discussion board, collaboration tools, assessment and grades tool over the Internet, 24 hours and 7 days a week. Online discussion and live chats and email were available for students to use for sharing and project collaboration. Email and electronic/online bulletin board were used as the primary form of communication within their group and/or within the class.

Figure 3 illustrates a student-centered course delivery structure for the blended course. The blended course was taught with face-to-face classroom instruction utilizing lecture format and using D2L course management system to deliver the online part of the course. Out of the 8 sessions, 2 sessions were delivered online, 5 lecture sessions done in class, and one session for the final project presentation. Each face-to-face session was conducted on alternating weeks for 3 hours and 20 minutes.

Figure 3 - Student-Centered Blended Instruction Using Technology



The face-to-face instruction included introduction and discussion of the different theories and principles of descriptive and inferential Statistics. All course materials for the blended course were published in D2L course management system for the entire session throughout the semester. These materials were available to the students 24 hours per day and 7 days a week (24/7) through the Internet.

In the blended course, the materials for the online session included videotaped lectures with the slide presentation, instructional or Flash™ tutorials, etc. The materials for the face-to-face session included a slide presentation which the students could download and print. Each student or group was given their own individual and group Dropbox in D2L to upload homework, projects, file exchange, and other course requirements.

During classroom instruction, the students in the blended group were engaged in an instructor-led discussion of the different application problems highlighting what were included in the online materials. Some illustrative problems and cases were also done in the classroom. The online portion of the course allowed student to pace themselves towards the completion of each learning goal during each session. Instead of individual seatwork, students formed a group to work on the exercise problems collaboratively in the classroom and outside class time. In the blended class, group seatwork was also conducted for about 20 to 30 minutes towards the end of each class session. Digital drop boxes, as mentioned earlier, were also made available for students to submit their assignments online.

Small group discussions (non-graded) were created online to facilitate group collaboration and Q &A (question and answer) sessions where they could communicate or exchange ideas among themselves. Graded online discussions were also included in this class. Q & A (question and answer) sections were also provided for students to ‘converse’ or ‘ask questions’ about the online materials. Students were encouraged to use online collaboration (group discussion) instead of email. Email was used primarily for private communications. Class announcements were posted each week prior to each class

meeting by the instructor. The class announcement was used to follow-up, remind or share updates to the students instead of using mass emails.

Similarly, the students in the blended group were required to do a final project presentation. The students were given information about the final project. However, the students in the blended courses were not provided with data set to work on their final projects. The students decided on a topic of their choice and researched the data by themselves. Most of the students were successful in finding data to use. Some of them used data from their work place and from their own personal activities. For example, one of the students collected data of the number of mistakes to refill prescriptions over a period of one month. Students consulted with the faculty during the approval process on the data and topic they will be working on. Students who were challenged to find data or topic to work on were guided by the instructor.

The students developed their own research problem, wrote their research questions, and performed data analysis using Excel or SPSS. The students used Microsoft PowerPoint during the final project presentation. Most of the presentation not only utilized bulleted text but with enhanced graphics, graphs, external links, and multimedia objects with sounds and video. All presentations of both groups were done using the digital overhead projector instead of the traditional overhead projector using transparencies.

In this research, variation in the design of the course delivery format was used to differentiate teaching strategy predicted to the result in measurable differences in student knowledge. In Table 3, there are four (4) main components that determine the distinct features of the traditional and blended course delivery format as depicted in Figure 3 and

Figure 4. This includes content delivery, communication, assessment and evaluation and use of technology. Similarly, the courses were designed based on the model in Figure 1.

Table 3 - Comparative Design Components of Course Delivery Format

COURSE DELIVERY	TRADITIONAL COURSE	BLENDED COURSE
Content Delivery	Traditional classroom lecture	Classroom lecture
	Illustration of step-by-step problems solving exercises	Online lecture using video and narrated slide presentation
	Note-taking	Self-directed; self-pace (online part)
	Class participation (questions)	24/7 access to course materials
		Class participation (questions)
		Online question and answer covering subject matter for each session (graded and ungraded participation)
Communication	Printed copy of the class communication tree containing phone numbers and email of students and faculty	Use of classlist containing email of students
		Use of announcement/news tool in D2L
		Use of online discussions
		Printed communication tree (back up) with phone numbers and email
Assessment and Evaluation	All testing conducted in class.	Online testing (part 1) and in-class testing (part 2)
	Individual seatwork with problem-solving exercises	Group problem-solving exercises (in-class)-synchronous
	Individual projects (data set provided; sample projects provided)	Graded group discussion (online) asynchronous
	Homework (submit in paper)	Individual projects (students explore) with group pages for collaboration and sharing of ideas
		Homework (using digital dropbox in D2L)
Use of Technology	Microsoft Word	Microsoft Word
	Microsoft Excel	Microsoft Excel
	Microsoft PowerPoint	Microsoft PowerPoint
	Access to the Internet (browsers) – online survey	Access to the Internet (browsers) - online survey
	Electronic mail	Access to D2L course management systems for online content delivery; communication; group collaboration, assessment and evaluation; survey
		Electronic mail
Course Structure	8 sessions of face-to-face instruction	6 sessions of face-to-face instruction and 2 online course delivery

Instrumentation and Data Gathering

This study is based on a quasi-experimental design using an intact group where students are enrolled in the traditional and blended courses in Elementary Statistics. The subjects consist of undergraduate students at Midwest University enrolled in the Weekend Program courses in Elementary Statistics designed for non-traditional students. Thirteen students agreed to participate in the study in the traditional course and 23 students participated in the blended course.

Students were invited to participate and were informed in writing about the purpose and procedures of the research study, about maintaining privacy and anonymity of the respondents, about how data will be used and stored, and other relevant information about the research process. Each participant was asked to complete a consent form prior to the actual research process that included completion of the pre-test, post-test, and online satisfaction survey, see Appendix 1.

Most of the data gathering was hosted from a website or web-based system using online testing and online questionnaires. Selected-response types of question for the online pre- and post-testing were conducted at the beginning and at the end of the course to assess student knowledge using D2L course management system. The sample test questions are included in Appendices 2 and 3.

The survey questionnaire was designed to determine student's perceptions on the areas of content and course delivery, assessment and evaluation, and communication, and learning experiences. The online questionnaire was also designed to gather demographic data to describe the characteristics of the participants, which include gender; age, marital status; income level; academic level (freshmen, sophomore, junior, and senior); course

major; and technology skills or experiences. The questionnaire was composed of open-ended and force-choice questions, the latter containing a list of selections to choose from.

The survey instrument examined several factors that may affect, (i.e., hinder or encourage) a student's learning experiences. These factors include use of web-based learning or course management systems, prior experience with computers, peer interaction; teacher-student interaction; technical support, availability of technology resources, and previous experience in online or blended course.

The researcher is also the teacher in the two courses under study. To minimize instructor-researcher bias, a senior faculty member of the College of Education at a state university in Missouri administered the online testing (pre- and post-tests) and survey. Each student was asked to sign a consent form (as shown in Appendix 1) granting approval of their voluntary participation in the survey and testing process in compliance to the Institutional Review Board of the state university. The consent form includes information about the research project and initiated by the co-researcher. The co-researcher stayed in contact with the student participants via email.

Characteristics of the Participants

Thirty-two students completed the online survey which is 94% out of the possible 36 original participants. There were 19 out of 23 students from the blended course and all 13 students from the traditional course who participated in the online survey. Four students from the blended course did not complete the online survey but attended the whole duration of the class. The reason for non-participation of the four students was not determined at the time the survey was conducted.

Table 4 - Demographics of Participants

PARTICIPANTS DEMOGRAPHICS											
Age			**Marital Status**			**School**			**Academic Level**		
	f	%		f	%		f	%		f	%
Below 18	0		Single	9	28%	SSOB	29	91%	Freshman	1	3%
18 to 22	2	6%	Married	21	66%	SHP	1	3%	Sophomore	3	9%
23 to 27	7	22%	Divorced	2	6%	SOE	1	3%	Junior	14	44%
28 to 32	5	16%	Legally Separated	0	0%	CAS	1	3%	Senior	14	44%
33 to 37	3	9%	Widowed	0	0%						
38 to 42	6	19%									
43 to 47	3	9%	**Gender**						**Academic Status***		
48 to 50	4	13%	Male	10	31%				Full-time	7	22%
>50	2	6%	Female	22	69%				Part-Time	25	78%
									*Registered with >13credit hours		

Table 4 shows a summary of information describing the distribution and characteristics of the participants. Ninety-four percent of the participants are older than 23 years of age. This is the typical age-group for non-traditional college students which fit the common characteristics of non-traditional students. Sixty-six percent of these participants are married, 28% are single, and 2% are divorced. Among the student participants, 69% are female and the remaining 31% are male**.**

A majority of the participants identified themselves as junior and senior students (44% juniors and 44% seniors). Ninety-one percent are from the School of Business and the remaining 9% are equally distributed in the schools of Education, Health Professions, and College of Arts and Science. Most of these students are part-time students (78%) who are enrolled with less than 13 credit hours.

In Table 5, 81% of the student participants from both groups considered themselves as experienced or advanced users based on their experiences with using technology. Surprisingly, the ratio of students in the traditional course who have taken an online or hybrid course before is larger than the number of students in the blended course. There are more students (9 out of 13) in the traditional course who had taken a blended

course before compared to the number of students (6 out 19) in the blended course. Combining both traditional and blended course, more than half of the students in both courses have not taken a blended course before.

Table 5 – Responses of Student's Experience with Technology

Student's Experience with Technology		
	f	%
No Experience	1	3%
Novice User	5	16%
Experienced User	18	56%
Advanced User	8	25%
Expert User	0	0%
Took Online Course Before		
Blended Course	f	%
Yes	6	32%
No	13	68%
Traditional Course		
Yes	9	69%
No	4	31%

CHAPTER 4

RESULTS AND DISCUSSION OF FINDINGS

This section includes discussions of the findings and determination of measurements that provide evidence to test the hypotheses in this study on the effectiveness of face-to-face and blended course delivery. Using SPSS ®, data were analyzed by measuring significant group differences and strength of the variable relationship between two small independent samples of students in the traditional and blended courses.

The data analysis made use of descriptive and inferential statistics. Descriptive statistics included measurements of central tendency and variations. Inferential statistics included determination of the differences in and correlation analysis involving different variables such as the knowledge of the students based on test scores, course grade, post-tests, and GPA.

Discussion of the results of the survey concerning the perception of students based on their learning experiences in both face-to-face and blended course delivery methods is also included in this chapter. In the survey, the students were asked about four areas that helped them improve their learning. The first area focused on course content and delivery. This area included questions on how the students used the course materials and how satisfied they were in using them. The other two areas focused on the use, accessibility, and availability of the different learning technology materials, and tools. This included online course delivery management tools for online communication and online tools for assessment and evaluation of student performance. The fourth area

concentrated on the learning strategies of the students and their personal learning experiences in the class.

Reliability and Validity

One of the critical factors in measuring the effectiveness of using technology in teaching and learning is to ensure consistency and accuracy of the data. Prior to the development of the courses to be studied, a pilot test was conducted to evaluate the online testing and survey questionnaires to incorporate suggestions and feedback from the students and peers during course design and development.

The design process included creation of a pilot questionnaire and test questions to evaluate student achievement using pre-testing and post-testing. These instruments were tested to check the reliability of the test scores and validity of the results. Item analysis was conducted to eliminate ambiguous questions and maintain equity of the question items. Questions were modified with specificity and clarity minimizing ambiguity of the test items. The next section includes analysis of the scaled items using Cronbach's Alpha, α.

Survey Item Reliability Test Using Cronbach's Alpha (α)

The Cronbach's alpha was used requiring a single-item but complex calculation that will provide a measure of reliability. Using the equation below, the computation of Cronbach's alpha is based on the number of items on the survey (N) and the ratio of the average inter-item covariance ( ) to the average item variance (.

It should be noted that Cronbach's alpha is not a statistical test. It is a determination of the coefficient of reliability (or consistency). A reliability coefficient of

0.70 or higher indicates an acceptable level in most social science and educational research (SPSS ®, Inc.)

A. Test Item Analysis for Online Survey Instrument to Determine Student Perception on the Use of Technology

There were 32 student participants (cases) who completed the survey out of the possible 36 students. There are 27 valid cases equivalent to 84.4% of the total participants and 5 cases not valid which is 15.6% of the total participants, see Table 6. The final results of the calculation shown in the Reliability Statistics, Table 22 revealed a high and strong Cronbach's Alpha coefficient ($\alpha = 0.731$).

Table 6 - Case Processing Summary for Online Survey - Cronbach Analysis

Case Processing Summary			
		N	%
Cases	Valid	27	84.4
	Excluded[a]	5	15.6
	Total	32	100.0

a. Listwise deletion based on all variables in the procedure.

Table 7- Cronbach's Alpha Reliability Test for Online Survey Instrument

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.731	.683	28

B. Test Item Analysis for Pre- and Post-Test

There were 32 student participants (cases) who completed the 20-question pre-test and post-test administered at the beginning of the course and at the end of the course. All 26 cases were valid with 100% participation as shown in Table 8 below.

Table 8 - Case Processing Summary for Pre- and Post- Test Items

Case Processing Summary			
		N	%
Cases	Valid	36	100.0
	Excluded[a]		.0
	Total	36	100.0

Table 9 - Cronbach's Alpha Reliability Test for Pre- and Post-Tests

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.921	.947	18

In Table 9, the final results of the calculation to test reliability of the test items in the pre- and post-test instrument revealed a very strong and high correlation with Cronbach's Alpha coefficient ($\alpha = 0.921$) for all responses in the pre- and post-tests. SPSS® was used to collate all survey items generating a lot of information to look for in the correlation matrix table and detailed item listing which are found in Appendix 6 and Appendix 8. *(Note: For further comparison, several other reliability measures which were not included in this paper are available using Split-half such as the Equal-length Spearman-Brown coefficient and Guttman Split-half coefficient.)*

This research recognizes the problems which threaten its ability to draw correct cause-and-effect inferences that arise because of the experimental procedures or the experiences of the participants. Creswell (2008) listed the different threats to internal and external validity that challenge the veracity of the sampling, data collection procedures,

and variable treatments. The following threats to internal and external validity were examined and addressed very carefully.

a) Selection Bias – this occurs when factors characterizing the participants are considered subjectively or there is pre-existence of conditions or factors that influence the students to register for these particular courses being studied. This is a challenge in this study since participants are not randomly selected or assigned instead were taken as clustered or intact group. This threat characterized the inability to generalize the sample based on common characteristics to represent the population of the Weekend College program. Bias may also occur when some students may have taken the same course more than once and may be familiar with the course work. Upon investigation, all students in the course were first-time students taking Statistics. The GPA (grade point average) of all students in the face-to-face and blended course is comparable. There is no significant difference in their GPA means.

b) Mortality – this is an event during the course of the research study where students or participants drop out during the experiment for any number of reasons. A larger sample size may address this threat; however, this type of sample is limited to a pre-determined class size. The retention rate for the blended course is 92% (23 out of 25 students) and the retention rate of the traditional course is 93% (13 out of 14). These rates are much higher than the 87% institutional retention rate.

c) Compensatory Equalization/Compensatory Rivalry – This occurs when only one group receives a treatment and gains benefits (e.g. convenience of web-based courses such as blended or blended courses; preference of students to be in the face-to-face environment). These types of experimental biases may occur due to the nature of the groupings. There is

no implied or direct compensation or benefit given to the participants to register in the courses being investigated. The grades students received were solely based on class performance and were not based on how they participated in the research study.

d) Resentful Demoralization Procedures – This occurs when a control group is used and the participants in these groups become resentful or demoralized feeling "trapped" in the blended course while expecting to be in a traditionally delivered course. This can be minimized by identifying the blended course or traditional course prior to course registration. As part of the registration process of the Weekend Program, students are provided with the course syllabus during or before registration. Faculty members teaching in this program are required to submit their syllabi prior to the registration period. Syllabi are published at the main website of Midwest University.

e) Instrumentation – this occurs in the design of the instrument and administration procedures. The test was administered by another private investigator other than the teacher. Cronbach's item analysis was used to test for reliability which in this study yielded a high value of the Cronbach's alpha which indicates consistency (reliability) of the test and survey items. Statistically, most reliable tests indicate validity as well.

Limitations

This study focused on determining the impact of technology integration in traditional and blended courses. The randomness in the selection of sample study was a challenge in this study to have student-wide representation to generalize the findings of this study to the general population of the weekend program and the institution as a whole. This study was dedicated to measure the student knowledge limited to Statistics courses rather than for the entire academic program.

The limited number of classes or course offerings may have affected the validity of the research study using a clustered/intact group affecting the random selection of the sample. This has affected the generalizability of this study where the findings are not transferable to the population of non-traditional students at Midwest University and in a wider scope at other institutions of U.S. higher education. It may be necessary to conduct further study addressing this limitation, i.e., to expand the scope of the study not limited to a few courses. Future studies should include a group of courses in the Weekend Program representative of the course offerings for both traditional and blended courses.

The timeliness, amount, quality, and availability of technology resources and technical support to the students during the duration of the course may have affected positively or negatively the attitude and perception of the students. Students who are not technically equipped were challenged in completing some online course work or managing and conducting learning activities which would require use of hardware and software tools. The availability or limited access to computers and robust network or Internet connectivity may have hindered some students from taking advantage of the learning opportunities for those who do not have computers at home or have no access or more limited access of these resources outside the classroom.

The notion that technology would impact the academic performance of the students was not corroborated by the findings of this study. However, the student participants expressed a positive impact based on their learning experiences in the areas of content delivery, communication and collaboration, and evaluation and assessment.

It should be noted also that when a new method is introduced, most people have a hard time to give up what they were used to. The participants who are non-traditional

students were accustomed to traditional and teacher-centered learning environments. The student participants in this study have limited experience or exposure to the use of technology in teaching and learning. When these courses were published for enrollment, there was no mention of the courses being blended or there being a need to have access to some technology-based resources. However, the Weekend Program provides students with the course syllabi and has them available on the web.

The blended course was designed with 25% of the course conducted online, i.e., 2 sessions out of 8 sessions were conducted online and 75% conducted with face-to-face instruction. The ratio between the face-to-face meeting and online delivery in the blended course was not enough to cause a difference in the effectiveness of the course delivery. It should be noted however that availability of all course materials, most communication and collaboration, and some online testing were done using D2L course management system. Further studies should balance the delivery components of using face-to-face or online format. This includes the quality and interactivity of the online components of the course materials.

Lastly, this study was limited to compare face-to-face instruction and blended course. Further study is suggested to include a comparative study on the knowledge of students in a (pure) online course together with face-to-face and blended course delivery.

Measurement of Student Knowledge

There are many ways to measure efficacy of teaching methodology or course delivery method based on learning outcomes. Reasons, Valadares, and Slavkin (2005) measured learning outcomes based on level of participation and student performance. In this study, the measurement of student knowledge included determination of differences in students'

academic performance using fact-based testing to determine achievement in the subject area and student course grade. The dependent variables include post-test score, test grades, and course grade to measure student knowledge. The independent variables are face-to-face and blended course delivery format. The variable matrix is show in Table 10 below.

Table 10 – Variable Matrix

VARIABLE MATRIX			
	Measures of Student Knowledge (Dependent Variables)		
Course Delivery Format	Post-Test	Test Grades	Course Grade
(Independent Variables)			
Traditional or Face-to-Face	*t2f*	*tgf*	**GRF**
Blended or Hybrid	*T2b*	*tgb*	**GRB**

The quantitative procedure assumes that variables and scores are normally distributed. An appropriate or acceptable level of significance (α) of 5% was used, i.e. *P (type II error) = α* to make a comparison between the critical and test values with confidence level of interval of 95%. The following statistical principles and assumptions were used to describe and analyze the research data.

Measurements of Central Tendency

Data sets (variables and scores) were collated, described, and summarized using the measures of average (called measures of central tendency, namely: *mean, median, mode and midrange)*. Measures of variation were also included using *variance* and *standard deviation* of the sample.

In this research, variation within class format was used to measure differences in student performance while using test scores, post-tests, and course grade to measure the performance level of the students. Graphical and tabular representations were used to

characterize and visually describe the frequency distribution of the data scores using histogram and frequency tables.

The frequency tables and histograms of the independent variables (post-test, test grades, and course grade) indicate normal distribution of the variable scores. It also included comparison of the GPA (grade point average) of students in both courses to determine the level of academic performance of the students prior to taking the courses being studied.

SPSS was used to generate the frequency tables and histograms for both traditional and hybrid courses for the dependent variables (post-test, test grades, and course grade) including overall student GPA. The general trend showed that all scores for these variables are normally distributed. The frequency tables and histogram with normal curve are shown individually in Appendices 4 to 13. The normally distributed data provide a more dependable basis in this procedure which supports the earlier assumption to use the measures of central distribution and measures of variations to evaluate group differences using t-test and measure strength or relationship using correlation analysis.

Determination of Relationship Using Correlation and Regression Analysis

This study used Pearson's Product Moment Correlation (PPMC) coefficient (r) as shown in the equation below. The equation will determine the strength of the relationship if a relationship exists between course delivery format, student performance, and attitude. The significance of the correlation coefficient is strong and positively linear as the value of r nears +1 and strong and negatively linear if the value of r is near -1 (Bluman, 2008).

Equation 1- Pearson's Coefficient (r)

$$r_{xy} = \frac{n\sum xy - \sum x \sum y}{\sqrt{n\sum x^2 - \left(\sum x\right)^2 \; n\sum y^2 - \left(\sum y\right)^2}}$$

where:

$r_{xy=}$ correlation coefficient between variables x and y

n= sample size

x= individual score of the x variable

y= individual score of the y variable

xy= product of scores of variables x and y

x^2 = square of the individual score of variable x

y^2 = square of the individual score of variable y

In order to describe the nature or strength and the type of the relationship that exists, a best-fit regression line was constructed based on the value of Pearson's coefficient defining the relationship using the mathematical relationship below. Given the regression line: $y = a + bx$, where *a* is the y-intercept and *b* is the slope of the line. The y-intercept (*a)* and the slope (*b*) are calculated using the following equations based on the same variable definitions used in calculating Pearson's coefficient, *r*.

Equation 2 - Regression Line Correlation Coefficients

$$a = \frac{\sum y \sum x^2 - \sum x \sum xy}{n\sum x^2 - \left(\sum x\right)^2}$$

$$b = \frac{n\sum xy - \sum x \sum y}{n\sum x^2 - \left(\sum x\right)^2}$$

Measurement of Differences Between Two Means (Small Independent Samples)

A direct measurement of differences of means using class performance was used which is the *t*-test for small independent samples. The two independent samples defined as independent variables in this study representing face-to-face and blended course delivery formats.

Major analysis will be required to determine differences in variances using the factorial design determined by the variable matrix shown in Table 6 using *t-test*. The *t-test* produces a test statistic that compares the means of variables for both groups of students in the blended and traditional courses. This statistical approach evaluates the difference between the means of two independent groups which are mutually exclusive. Although, analysis of variance (ANOVA) using multiple factor analysis has certain advantages over the *t-test* for two independent samples (groups), it is limited to using more than two groups. ANOVA is more useful in comparing means of more than two independent samples which also includes post-hoc analysis. Post-hoc analysis can be performed to determine overall difference between the means of three or more groups and identifies where the difference lies.

Discussion of Research Findings

The results are evaluated centered on the following research hypotheses:

1. The students taking blended courses in an elementary statistics course perform better academically than students in face-to-face course delivery as indicated by their learning outcomes based on post-tests, test scores, and course grades.

2. The attitudes and levels of satisfaction of students in an elementary statistics course based on their learning experiences are higher in blended course delivery than face-to-face course delivery.

An independent-samples *t* test was conducted to evaluate the hypothesis that students in the hybrid or blended course have higher student knowledge than students in the traditional or face-to-face course based on test scores and course grade. The independent-samples *t* test compares the means of the learning outcome variables which are defined as follows:

a) Post-test score - The test score of the 20-item test questionnaire on the general concept about descriptive and inferential statistics administered at the end of the course.
b) Tests Grades – The test scores in major exams, which include midterm (Test#1) and final exam (Test#2) administered during sessions#4 and Session#7, respectively.
c) Course Grade -- The total grade point, which determines the grade of the student in the course. It includes all points earned by the student specified in the course requirements such as projects, online discussions, exercises, assignments excluding pre- and post- tests.
d) Grade Point Average (GPA) – is the weighted grade of the student prior to taking the course. This variable will be used as baseline to determine the level of academic performance of the students prior to taking this course.

The underlying assumptions for this test include the following: (a) The test variable or test scores is normally distributed in each of the two populations defined by the

grouping variable (Group 1=Blended, Group 2=Traditional); (b) The variances of the normally distributed variable for the populations are equal; and (c) the subject does not represent a random sample (intact group) from the population and the test scores of the test variable are independent of each other.

In this study, the interpretation and definition of terms and the values used in the data analysis and hypotheses testing are listed below (Bluman, 2008; Salkind, 2008).

a) ***t*** (t-value of the tested group) is the ratio of the differences between the sample mean divided by the standard error of the differences .

b) ***df*** (degrees of freedom) is the total sample size less 2 (groups) which is 36 – 2= 34.

c) ***Sig (2-tailed)*** is the probability from Z distribution with 34 df (total sample size, n =36; n-2, degree of freedom). This value is listed as the probability of obtaining absolute value greater than or equal to the t (statistics).

d) ***Mean Difference*** is obtained by subtracting the sample mean for the traditional group of students from the blended group of students.

e) ***Confidence Interval*** at 95% provides an estimate of the boundaries between which the true mean differences lies in 95% all possible random scores of 36 total students in both groups.

f) ***Skewness –*** is the measure of the symmetry of a distribution. The normal distribution is symmetric with skewness=0. The positive (+) skewness has its long tail on the right (skewed to the right). The negative (-) skewness has its long tail on the left (skewed to the left)

g) ***Standard Error of Skewness*** – determines the closeness or departure from the symmetry. A skewness that is more than twice its standard error indicates a departure from the symmetry.

h) ***Kurtosis*** – A measure of the extent to which observations cluster around a central point. Kurtosis value equal to zero indicates normal distribution; where too peak leptokurtic and too flat is platykurtic.

In this study, two groups of students were taught using two types of delivery methods such as traditional classroom or face-to-face and hybrid or blended course instructions. The group statistics displayed in Table 11 includes the sample size (n), mean, standard deviation, and standard error for both types of course delivery. Table 11 also shows the mean scores of the students in the traditional course based on pre- and post-test, test grades, and course grade are higher than the student in the blended course. A more in-depth analysis of the differences in the measurements of student knowledge (dependent variables) is done in the succeeding section to determine the significance of the variable differences.

The procedure assumes that the variances of the two groups tested are equal. Levene's Test for Equality of Variances is used and supports the assumption of normality where the significant difference is measured at $\alpha=0.05$. The results from Table 12 are interpreted for the following variables for measurement of student knowledge:

1. The Levene Test for Equality of Variances indicated that blended and traditional groups have equal variances measured on the following variables:

a) Post-test: (0.299 >0.05), (level of significance, p-value)

b) Course Grade: (0.553>0.05), (level of significance, p-value)

2. The Levene Test for Equality of Variances indicated unequal variances for the variable, test grade, in both blended and traditional groups with values 0.005< .05 (level of significance, p-value comparison)

Table 11 - Group Statistics with Mean Comparison

Group Statistics					
	Group	**N**	**Mean**	**Std. Deviation**	Std. Error Mean
PreTest	Blended	23	14.04	2.705	.564
	Traditional	13	14.62	2.755	.764
PostTest	Blended	23	16.83	1.337	.279
	Traditional	13	18.31	1.797	.499
CourseGrade	Blended	23	965.83	65.744	13.709
	Traditional	13	984.69	58.463	16.215

The alternative hypothesis claimed in this study states that the students in the blended or hybrid course perform better academically than students in the traditional or face-to-face course based on test scores and course grade. The findings in this study were counter to the research hypothesis based on the mean and standard deviation of the two groups using an independent-samples *t* test.

The results of this study do not provide evidence to support the hypothesis that the students in the blended course performed better than the students in the traditional course based on post-test scores. The test indicated there is significant difference in the learning outcome of the students based on average measure of the post-test score, $t(36)= -2.82$, $p=.008$ at $\alpha=.05$, as shown in Table 12.

Table 12 - Independent Samples t-Test

Independent Samples Test										
		Levene's Test for Equality of		t-test for Equality of Means						
							Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)			Lower	Upper
PreTest	Equal variances assumed	.306	.584	-.605	34	.549	-.572	.945	-2.492	1.348
	Equal variances not assumed			-.602	24.648	.553	-.572	.950	-2.529	1.385
PostTest	Equal variances assumed	1.115	.299	-2.818	34	.008	-1.482	.526	-2.550	-.413
	Equal variances not assumed			-2.594	19.628	.018	-1.482	.571	-2.674	-.289
CourseGrade	Equal variances assumed	.359	.553	-.859	34	.396	-18.866	21.954	-63.482	25.749
	Equal variances not assumed			-.889	27.595	.382	-18.866	21.233	-62.389	24.656

The negative sign of the *t* value is dictated by the sign of the mean difference which is the difference between the blended course group of students (Group 1) and the traditional group of students (Group 2). This indicates that the mean score of the traditional students (Group 2) is higher than the mean score of the blended course group (Group 1). Based on the post-test scores, the students in the traditional course perform better (M=18.31, SD=1.797) than the students in the blended course (M=16.83, SD=1.337). The 95% confidence interval for the difference in means is moderately large between -2.55 and -0.413, refer to Table 12.

Likewise, the independent-samples *t*-test was used to compare the mean differences of the variables to measure knowledge of the students based on course grade and test grades. The results using these variables provided no significant difference in the student knowledge in both traditional and blended course as summarized in Table 11 and Table 12. The test indicated no significant difference based on average measure specific to the following test variables:

a) Course grade: $t(36)= -0.86$, $p=0.396$ at $\alpha=.05$. Based on the course grade scores, the

students in the traditional course slightly scored higher (M=984.69, SD=58.463) than the students in the blended course (M=965.83, SD=65.744). The 95% confidence interval for the difference in means is moderately large between -63.482 and +25.749 which is more than 1 grouped standard deviation at 95% confidence interval.

b) Test grade: t(36)= -01.34, p=0.188 at α=.05. Based on the test grade scores, the students in the traditional course slightly higher (M=167.46, SD=14.414) than the students in the blended course (M=155.87, SD=29.032). The 95% confidence interval for the difference in means is moderately large between -29.132 and +5.948 which is more than one grouped standard deviation at 95% confidence interval.

Evaluation of Pearson's coefficient (r=.586) shows a moderate relationship between course grade and GPA and is significant at α=0.01, n=32. The non-parametric correlation using Spearman's Rho coefficient (ρ=.776) shows a strong correlation between course grade and GPA which is significant at α=0.01 and α=0.05, n=36, refer to Table 13 and Table 14.

Table 13 - Spearman's Rho Correlation Coefficient

Correlations: Spearman's rho (n=36) - Parametric			
	Post-Test	Course Grade	GPA
Post-Test, r		0.145	0.307
sig (2-tailed)		0.398	0.069
Course Grade, r	0.145		0.586**
sig (2-tailed)	0.307		
GPA	0.307	0.586**	
sig (2-tailed)	0.069		
**Correlation is significant at the 0.01 level (2-tailed)			

Table 14 - Non-Parametric Correlations

Correlations: Spearman's rho (n=36) - Non Parametric			
	Post-Test	Course Grade	GPA
Post-Test, r		0.273	0.362*
sig (2-tailed)		0.107	0.03
Course Grade, r	0.273		0.776**
sig (2-tailed)	0.107		
GPA	0.362*	0.776**	
sig (2-tailed)	0.03		

Student Perception

To determine the perception or behavior of the students based on their learning experiences in the traditional and blended courses, the students were asked about four areas where technology impacted or helped improve their learning. The first area focuses on access and availability of course content and delivery. This area includes how students access class materials or how other relevant resources were used during classroom instruction, in-class exercises, homework, and other course materials.

The second area includes using electronic tools or web-based communication tools for communication and collaboration. These tools are used for communication among students and between students and the teacher. The third area includes online tools for assessment and evaluation of student performance which includes using course management systems for online testing, assignment drop box, grades tools, and other relevant materials. The fourth area includes the learning strategies the students experienced in the class. This includes a self-assessment of how much the students learned with real-life applications based on learning activities in the classroom and outside the classroom.

There were two sets of similar questions created to determine student responses. The first set of individual questions asked the degree to which the students agree or disagree in these three areas of improving their learning. The second part was introduced at the end of the questionnaire for students to indicate from a list the areas that helped them improve their learning. The results of both parts of the survey revealed consistency in the student responses.

a. Availability and Access to Online Content and Course Materials

Based on the first set of questions, Table 15 below indicates 77% students in the face-to-face course agreed (Strongly Agree=8% and Agree=69.2%) that the availability and access to online content and course materials helped them improve their learning. The blended course indicated a lower rating of 68% (Strongly Agree=31.6% and Agree=36.8%) who agreed that the availability and access to online content and course materials helped them improve their learning. Using a weighted mean, the students in the face-to-face group scored 3.8 which is lower than the score of the students in the hybrid course of 4.0 on a 5-point scale (5=Strongly Agree and 1=Strongly Disagree).

Table 15 - Responses of Students Using Technology to Improve Learning

Q6: The availability of content course materials, communication, and assessment tools helped me improved my									
			Strongly Agree	Agree	Not Agree/Not Disagree	Disagree	Strongly Disagree	Total	Weigthed Mean
		Scale	5	4	3	2	1		
Type	Blended	Count	6	7	6			19	4.0
		% within Type	31.6%	36.8%	31.6%			100.0%	
		Products	30	28	18	0	0	76	
	Face-to-Face	Count	1	9	3			13	3.8
		% within Type	7.7%	69.2%	23.1%			100.0%	
		Products	5	36	9	0	0	50	

The weighted mean is consistent with the results from the second set of questions in Table 16 where in the blended course indicated that availability and access to online

content and course materials helped them improve their learning than the students in the face-to-face course, but not significantly higher.

Table 16 - Student Preferences on Using Technology to Improve Learning

Percentage of Student Preference on Areas that Helped Improve Their Learning										
Course Delivery Format	Availability and access to online content and course materials	Enhanced communication using email, online discussion, assignment drop box, etc.	Online testing and evaluation	Evaluation and feed back using the quiz and grade tools	Ease of use of the Web environment	In-class group discussion	Group collaboration	Working on the assignments and class work by myself	Mean	SD
Traditional Course (n=13)	74%	47%	53%	42%	37%	53%	16%	53%	47%	16.6%
Hybrid/Blended (n=19)	77%	31%	38%	54%	38%	69%	38%	54%	50%	16.5%

Students in the blended course commented that having the course materials online gave them the opportunity to access anywhere 24 hours a day and 7 days a week. Two students in the blended course got married and went on their honeymoons outside the country. They have indicated that they were still able to "participate" in class and completed their work away from the classroom. One wrote that they never had a "gap" away from the classroom by having access to the course materials, discussions, and content module to review them. On the other hand, some students in the traditional course indicated in the course evaluation that they would prefer to have the course materials and relevant resources to be available online.

b. Use of Electronic Communication Tools

In the blended course, students used technology tools which include email, online discussion, and assignment digital drop box, in-class group discussion, and group

collaboration among students and communication with their instructor. The face-to-face class used a printed communication tree with phone numbers, email of classmates and communication with their instructor.

Table 17 - Response of Students on Communication with Other Students

Q1: I communicated a lot with other students.									
			Strongly Agree	Agree	Not Agree/Not Disagree	Disagree	Strongly Disagree	Total	Weigthed Mean
		Scale	5	4	3	2	1		
Type	Blended	Count	3	8	4	2	2	19	3.4
		% within Type	15.8%	42.1%	21.1%	10.5%	10.5%	100.0%	
		Products	15	32	12	4	2	65	
	Face-to-Face	Count	1	5	6	1		13	3.5
		% within Type	7.7%	38.5%	46.2%	7.7%	.0%	100.0%	
		Products	5	20	18	2	0	45	

In Table 17, the results indicated around 58% (15.8%=Strongly Agree, 42.1%=Agree) of the students in the blended course agreed that they have communicated a lot with other students compared to 46% (7.7%=Strongly Agree, 38.5%=Agree) of the students in the face-to-face course. Using weighted means, the students in the blended course scored 3.4 which is lower than the score of 3.5 of the students in the face-to-face course on a 5-point scale (5=Strongly Agree and 1=Strongly Disagree).

In Table 18, the results indicated around 85% (15.8%=Strongly Agree, 68.4%=Agree) of the students in the blended course agreed that they had more communication with their instructor compared to 47% (7.7%=Strongly Agree, 38.5%=Agree) of the students in the face-to-face course. Using weighted mean, the students in the blended course scored 3.9 on the student's having more communication with the instructor which is higher than the score of 3.4 of the students in the face-to-face course on a 5-point scale (5=Strongly Agree and 1=Strongly Disagree).

The score on the impact of technology to improve their learning using the electronic communication tools is consistent with responses shown in Table 12. Table 12 shows that 69% of the students in the blended course have indicated that in-class group discussion helped them improve their learning compared to 53% of the students in the face-to-face course. Likewise, 38% of the students in the blended course indicated that group collaboration helped improve their learning compared to 16% of the students in the face-to-face course.

Table 18 - Response of Student's Communication with Instructor

Q2: I had more communication with the instructor.									
			Strongly Agree	Agree	Not Agree/Not Disagree	Disagree	Strongly Disagree	Total	Weigthed Mean
		Scale	5	4	3	2	1		
Type	Blended	Count	3	13	2	1		19	3.9
		% within Type	15.8%	68.4%	10.5%	5.3%		100.0%	
		Products	15	52	6	2	0	75	
	Face-to-Face	Count	1	5	5	2		13	3.4
		% within Type	7.7%	38.5%	38.5%	15.4%		100.0%	
		Products	5	20	15	4	0	44	

Students in the blended course were assigned to group discussions (or group folders) where only members of the group could upload/download, share files (file exchange) and deliberate online without personal meetings or meetings outside of regular class time. Blended course students acknowledged favorably comments about the convenience, flexibility, and availability of full access to the course materials, online testing, assignment drop box anytime and anywhere.

Surprisingly, Table 12 also revealed that 47% of the students in the face-to-face course indicated that enhanced communication using electronic email, online discussion, and assignment digital drop box helped them improve their learning compared to 31% of the students in the blended course. It should be noted that the face-to-face course was

designed and delivered with very limited use of the course management system or related technology resources. This result can be attributed to the fact that a majority (69%) of the students in the face-to-face course had previously taken an online or blended course, as previously shown in Table 5.

c. Assessment and Evaluation Tools

Table 12 shows more than half of the students (54%) in the blended course indicated that evaluation and feedback using online testing and grades tool helped them improve their learning compared to 42% of the students in the face-to-face course. Although the students in the face-to-face course did not use online testing and assessment, 53% indicated that using the evaluation and assessment online tools would improve their learning. It can be inferred that students in the face-to-face course would prefer to use online evaluation and assessment tools.

d. Student Learning Experiences

In Table 19, the results indicated 69% (21.1%=Strongly Agree, 47.4%=Agree) of the students in the blended course agreed that they learned a lot in their course compared to the students (15.4%=Strongly Agree, 84.6%=Agree) in the face-to-face course. Using weighted mean, the students in the blended course scored 3.8 which is lower than the score of 4.2 of the students in the face-to-face course on a 5-point scale (5=Strongly Agree and 1=Strongly Disagree).

Table 19 – Response of the Students of What is Learned in the Course

Q4: I found that I learned a lot in this course.									
			Strongly Agree	Agree	Not Agree/Not Disagree	Disagree	Strongly Disagree	Total	Weigthed Mean
		Scale	5	4	3	2	1		
Type	Blended	Count	4	9	4	2		19	3.8
		% within Type	21.1%	47.4%	21.1%	10.5%		100.0%	
		Products	20	36	12	4	0	72	
	Face-to-Face	Count	2	11				13	4.2
		% within Type	15.4%	84.6%				100.0%	
		Products	10	44	0	0	0	54	

It can be inferred that students in the blended course may find difficulty learning in this new type of course delivery. Midwest University started offering blended courses in fall 2008 which is one semester prior to conducting this research. The possibility exists of resentment to something new. The students in the face-to-face course may be comfortable with traditional classroom instruction as opposed to delivering a course online delivery.

Table 20 - Perception of Students on Learning with Real-life Applications

Q5: The learning activities I worked on deal with real life applications and information in this course.									
			Strongly Agree	Agree	Not Agree/Not Disagree	Disagree	Strongly Disagree	Total	Weigthed Mean
		Scale	5	4	3	2	1		
Type	Blended	Count	4	13	2			19	4.1
		% within Type	21.1%	68.4%	10.5%			100.0%	
		Products	20	52	6	0	0	78	
	Face-to-Face	Count	1	9	3			13	3.8
		% within Type	7.7%	69.2%	23.1%			100.0%	
		Products	5	36	9	0	0	50	

The students in the blended courses were assigned projects which allowed them to independently (without direct guidance from the teacher) explore ideas and scenarios with practical application to illustrate complex and abstract concepts covered during the lecture and included in the learning resources. The students in the face-to-face course

were provided with data sets to work on instead of putting together their own data structure. The pre-set data may have limited the students to experience actual process of sampling and data gathering or collection.

In Table 21, the results indicated 90% (5.3%=Strongly Agree, 84.2%=Agree) of the students in the blended course agreed that they applied their out-of-class experiences and learned from its practical applications compared to 62% (0.0%=Strongly Agree, 61.5%=Agree) of the students in the face-to-face course. Using weighted means, the students in the blended course scored 4.1 which is higher than the score of 3.8 of the students in the face-to-face course on a 5-point scale (5=Strongly Agree and 1=Strongly Disagree).

Table 21 - Perception of Student on Out-of-Class Experience

Q7: I applied my out-of-class experiences and learn from its practical applications.									
			Strongly Agree	Agree	Not Agree/Not Disagree	Disagree	Strongly Disagree	Total	Weigthed Mean
		Scale	5	4	3	2	1		
Type	Blended	Count	1	16	2			19	3.9
		% within Type	5.3%	84.2%	10.5%			100.0%	
		Products	5	64	6	0	0	75	
	Face-to-Face	Count		8	5			13	3.6
		% within Type	.0%	61.5%	38.5%			100.0%	
		Products	0	32	15	0	0	47	

This high response rates may indicate that authentic learning approach provides a learning environment where students are engaged to go beyond classroom lectures and understand complex concepts through real life applications and out-of-class experiences. Students in the blended course commented in the course evaluation that the real-life applications and using Excel or SPSS helped them understand the concepts in the book by doing the exercises both by hand and using technology. Students have also indicated that they were less intimidated with this approach of teaching a math course especially

for those who do not have the aptitude. Students commented that they have never understood statistics which they thought was another math class which is hard to comprehend and merely involves memorization.

Based on the students' feedback on the course evaluation, they wrote that they gained better understanding about the applications of statistics in what they read and in what they do at work. They further stated that they can now appreciate the day-to-day statistical data they read and have a better and deeper understanding of the information it conveys.

In Table 22, the results indicated 90% (31.6%=Strongly Agree, 57.9%=Agree) of the students in the blended course agreed that they would choose to take another hybrid course which is lower compared to 93% (15.4%=Strongly Agree, 76.9%=Agree) of the students in the face-to-face course. Using weighted means, the students in the blended course scored 4.2 which is slightly higher than the score of 4.1 of the students in the face-to-face course on a 5-point scale (5=Strongly Agree and 1=Strongly Disagree).

Table 22 - Responses of Students to Take Another Blended Course

Q11: I would choose to take another hybrid course.									
			Strongly Agree	Agree	Not Agree/Not Disagree	Disagree	Strongly Disagree	Total	Weigthed Mean
		Scale	5	4	3	2	1		
Type	Blended	Count	6	11	1	1		19	4.2
		% within Type	31.6%	57.9%	5.3%	5.3%		100.0%	
		Products	30	44	3	2	0	79	
	Face-to-Face	Count	2	10	1			13	4.1
		% within Type	15.4%	76.9%	7.7%			100.0%	
	Total	Products	10	40	3	0	0	53	

This question may not be relevant to the students in the face-to-face course since they are not currently in a hybrid or blended course. The higher response rate may be attributed to the previous experience in a technology supported classroom instruction.

Likewise, the students in the face-to-face course may have responded based on their previous experience in taking a blended course. It should be noted that there are more students in the traditional course who had previously taken blended courses compared to the students who are in the blended course as indicated in Table 5.

Table 23 - Responses of Students on Technical Support

Q9: I needed technical assistance for this class.									
			Strongly Agree	Agree	Not Agree/Not Disagree	Disagree	Strongly Disagree	Total	Weigthed Mean
		Scale	5	4	3	2	1		
Type	Blended	Count	2	4	2	6	5	19	2.6
		% within Type	10.5%	21.1%	10.5%	31.6%	26.3%	100.0%	
		Products	10	16	6	12	5	49	
	Face-to-Face	Count		3	3	5	2	13	2.5
		% within Type		23.1%	23.1%	38.5%	15.4%	100.0%	
	Total	Products	0	12	9	10	2	33	

In Table 23, the results indicated only 32% (10.5%=Strongly Agree, 21.1%=Agree) of the students in the blended course agreed that they needed technical assistance for this class while the majority which is 58% (31.6%=Disagree, 26.3% strongly Disagree) of the students in the blended course disagreed that they need technical assistance. Similarly, 23% (0.0%=Strongly Agree, 23.1%=Agree) of the students in the face-to-face course agreed that they needed technical assistance for this class while the majority which is 69% (15.4%=Strongly Agree, 38.5%=Agree) of the students in the face-to-face course disagreed that they needed technical assistance.

Using weighted mean, the students in the blended course scored 2.6 indicating the same results mentioned earlier which is slightly higher than the score of 2.5 of the students in the face-to-face course on a 5-point scale (5=Strongly Agree and 1=Strongly Disagree). It can be inferred that the students in both courses are comfortable using the

technology. This is consistent with the previous findings where a majority of the students in both course delivery formats were willing to take another blended course.

In Table 24, the results indicated 21% of the students in the face-to-face course agreed (10.5%=Strongly Agree, 10.5%=Agree) and 21% disagreed (15.8%=Disagree, 5.3%=Strongly Disagree) that the availability and access to technical support and technical resources helped them improve their learning. The majority of the students in the blended course remained neutral (57.9%=Not Agree/Not Disagree). Students in both courses perceived that the availability and access to technical support and resources helped them improve their learning.

Table 24 - Responses of Students on Impact of Technology

Q10: Availability and access to technical support and resources helped me improve my learning.									
			Strongly Agree	Agree	Not Agree/Not Disagree	Disagree	Strongly Disagree	Total	Weigthed Mean
		Scale	5	4	3	2	1		
Type	Blended	Count	2	2	11	3	1	19	3.1
		% within Type	10.5%	10.5%	57.9%	15.8%	5.3%	100.0%	
		Products	10	8	33	6	1	58	
	Face-to-Face	Count	1	4	7	1		13	3.4
		% within Type	7.7%	30.8%	53.8%	7.7%		100.0%	
		Products	5	16	21	2	0	44	

In the face-to-face course, similar results are shown where 38.5% (7.7%=Strongly Agree, 30.8%=Agree) of the students in the face-to-face course agreed that the availability and access to technical support and technical resources help them improve their learning and 7.7% disagreed. The majority of the students in the blended course which is 53.8% remained neutral (53.8%=Not Agree/Not Disagree) that the availability and access to technical support and technical resources help them improve their learning.

Conversely, using the weighted mean, the students in the blended course scored 3.1 indicating that the students tend to agree that the availability and access to technical

support and technical resources helped them improve their learning. Similarly, the students in the face-to-face course tend to agree that the availability and access to technical support and technical resources helped them improve their learning with a higher score of 3.4 on a 5-point scale (5=Strongly Agree and 1=Strongly Disagree). The latter findings using the weighted mean will be used to infer that the students in both course delivery formats perceive that the availability and access to technical support and technical resources helped them improve their learning.

Implications

The results of the study revealed there is no significant difference in the students' knowledge (academic performance based on test grades and course grade) in face-to-face and blended course delivery. The study did not provide significant evidence that a student-centered course delivery method was more effective than teacher-centered methods. However, the results based on student post-test scores revealed a significant difference where students in the face-to-face course performed better than students in the blended course. The assumption in the earlier part of the research study predicted that student-centered course delivery would be a more effective method than the teacher-centered method. These contradicting results may suggest that the differences in teaching strategies and/or the use of technology have not contributed to make a significant change or improvement in the performance of students. Past experience, familiarity with instructional format and types of assessment used may be considerations in the findings obtained.

Furthermore, individual students learn in different ways. Student-centered or teacher-centered methods may be appropriate to certain group of students. Future studies

should take into account the learning preferences of the students. This will allow the research to indicate the different characteristics and preferences of the learner which may have influenced the measurements of their knowledge or academic performance. Some students can easily learn and use technology while other students may be challenged technologically.

Students in the blended course assumed a higher level of responsibility as they defined their own specific learning goals for each projects assigned to them; however, most students were not able to define or articulate the objectives for each task in order to meet the goals they set. Most of them required constant teacher-student face-to-face interaction. Some of them can perform with minimal supervision and can adopt a self-directed or self-paced course delivery and work independently on their own.

The role of teachers changes as they use technology in their course preparation and instruction. Teachers who choose to use technology should recognize the need to equip themselves with the necessary skills and understanding about technology solutions and classroom tools. Likewise, teachers must understand how to weave technology with pedagogy.

In blended or technology supported course delivery methods, both students and faculty have to learn and must be equipped with the necessary technology skills that will enable them to contribute to a more successful delivery and completion of the course. There were students in the study who indicated some frustration with working independently and felt inadequate using technology particularly during the online portion of the course delivery. Both course delivery formats used at least word processor (Microsoft Word), electronic spreadsheets (Microsoft Excel), slide presentation

(Microsoft PowerPoint) and Internet browsers. These technology tools were used to complete hands-on exercises, homework, note taking, research, data analysis, projects, and oral presentations.

Although, Midwest University provides 24-hours access to some computer labs in the residence hall and open hours for commuters, access to technology resources may have encumbered students to avail of these resources especially those who do not have the appropriate technology in their homes. Some students may not have access to the Internet due to technical limitations or financial reasons.

The integration of technology in the classrooms will remain prevalent in higher education as it continue to provide the necessary tools to both faculty and students to enhance the teaching and learning processes. Institutions will continue to increase funding to support the infrastructure and provide faculty and students with quality and timely support and effective training. There will be more technology innovations of products and services designed to enhance and support classroom instruction.

The emergence of campus technology will continue to provide an alternative form of course delivery method to traditional classroom delivery. Technology is a vehicle to facilitate learning although it will not necessarily improve learning.

With respect to the practice in this field of teaching and learning, blended course delivery is considered a “new” culture to some institutions, faculty, and students. Faculty, student, administrative functions are to be equally positioned to support the integration of technology into teaching and learning. This cultural change requires focus on the process of adoption to the alternatives to traditional classroom instruction weaving pedagogy and technology into one fabric. Future studies have to focus on the course re-design and

establishing instructional standards for student-centered and teacher-centered course delivery format integrating appropriate technology tools and solutions.

Summary

Teaching blended courses was as effective as the traditional course based on the findings of this study. Students who participated in the blended course performed as well as the students in the traditional classroom. Both traditional and blended courses are comparable in their efficacy based on the results of this study. The perception of the majority of the students in the traditional and face-to-face instruction indicated a positive impact of technology use in the classroom. The student participants in both blended and face-to-face course delivery prefer blended course delivery as an alternative to face-to-face instruction based on their learning experiences. Students in both groups had expressed positive perception when using technology for availability and access of the course materials, enhanced communication and collaboration, and online testing and evaluation.

The results of the current study contradicted the findings of the studies below in spite of the similarities in the characteristics of the students and their learning experiences. The participants in the current study expressed positive attitude towards the impact of using technology. The participants further expressed similar perception compared to the studies below regarding having the convenience, flexibility, and availability of the course materials, feedback and evaluation, and enhanced communication. The differences in the results may be attributed to sample size, length of course work (8 weeks versus 10 weeks), ratio of face-to-face meetings versus online

delivery which can account for the main differences in the design of the course delivery format.

There were similarities in the framework of the course delivery and teaching strategies where courses taught by the same instructor over a period of 8 to 10 weeks. In spite of these similarities, the succeeding studies are not consistent with the results of this study which indicated significant differences based on the knowledge or academic performance of the students.

Bernard, Abrami, Lou, Borokhovski, Wade, Wozney, Andrew, Fiset, and Huang (2004) conducted a meta-analysis to compare distance education and face-to-face instruction. Their study found evidence that classroom instruction and distance education are comparable. However, they found that asynchronous distance education (internet-based courses) on average produced better learning outcomes than synchronous distance education using interactive TV or instructional TV or face-to-face instruction. Blended courses experienced high student demand because of increased convenience and flexibility.

Contrary to the findings of this study, Dutton and Dutton (2005) found that students taking statistics in the online course performed better than students in the traditional course. The performance used the similar measures based on test scores, quizzes, assignments, projects, and laboratory assignments. The study included 137 students enrolled in the face-to-face course and 41 students enrolled in the online course in Introduction to Business Statistics course. In the current study, the sample size is smaller with 13 students in the face-to-face course and 19 students in the blended course. Gutierrez and Russo (2005) conducted a similar study with 51 students (20 students in

face-to-face, 18 students in hybrid, and 13 students in the online course) to compare the students' performance. Based on the student performance, their findings indicated that blended students outperformed students in the online and traditional course. Most of the participants indicated a strong preference to take a blended course. Such strong support exists when students had positive learning experience in taking a blended course. The study indicated that majority of the students have been exposed to online and hybrid course delivery.

Young (2002) in a similar study found high levels of student and faculty satisfaction and that students' knowledge in blended courses was higher compared to face-to-face and fully online courses. The same research found that blended courses have the potential to increase student knowledge while lowering attrition rates in comparison to equivalent fully online courses and face-to-face instruction. The courses were also taught by the same instructor using the same syllabus and course requirements.

Although this study did not include online course delivery, the findings of Reasons, Valadares, and Slavkin (2005) in a similar study suggested that the online course model supports student learning more effectively than any other format based on the level of course participation, final course grade, and interaction with the course website compared to blended and traditional course delivery.

Although technology mediated instruction has proven to be an effective and to some cohorts, a preferred method of educating outside the confines of traditional teaching, there were studies that supported the findings of this study where there were no significant differences in the effectiveness of blended and face-to-face instructions based on student grades and test grades. The findings in the current study suggested that most

students in blended and face-to-face instructions indicated a positive attitude towards the use of technology.

The current findings of Fields and Collins (2004) are in agreement with the findings of this study indicating no significant differences on the performance of the students in both face-to-face and blended learning. Fields and Collins (2004) wrote that the students' performance was the same in the traditional and blended courses. The same study indicated that the student opinion of the blended format was very positive due to students' perception that the course format provided them with greater flexibility.

Thomas Russell (1999) compiled 355 research studies and found there is no significant difference in the learning outcomes of courses using technology compared to face-to-face instruction or traditional classroom delivery. In the book published by Thomas Russell (1999), most of the studies revealed that technology such as AV-TV broadcasting, videoconferencing, course management systems, and other learning tools did not affect the learning outcomes or improved the performance of the students compared to traditional classroom delivery.

Ramage (2002) conducted a thorough review of Russell's work and his analysis provided no evidence of any kind that categorically proves that technology does not impact learning whether positively or negatively. Ramage (2002) wrote that in spite of the emergence of campus technology in higher education and the evolutionary changes it brought about, many research studies in the field of instructional technology did not find significant differences between the integration of technology into teaching and learning and traditional classroom delivery in higher education.

Based on the overall results of this study, blended course delivery can be as effective as traditional course delivery. The faculty and students in the blended course experienced a different way to enhance teaching and learning. The perception of non-traditional students in both course delivery formats indicated more positive learning experiences and considered blended course as alternative to face-to-face instruction.

Technology resources are accessible and available to students and faculty to expand their teaching and learning experiences in a more improved and rich environment. Specifically, both course deliveries emerged as enhancing the students' appreciation of the integration of technology in the learning environment.

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APPENDICES

Appendix 1 – Consent Form

(Student Participant)

Researcher Name: Dr. Carl Hoagland
Address: School of Education, University of Missouri – St. Louis
Phone: 314.550-6516
Email: choagland@umsl.edu

Dear _____

Thank you for agreeing to participate in this study which will take place during the semester of Spring 2009. This form outlines the purposes of the study and provides a description of your involvement and rights as a participant.

The purpose of this project is to determine your learning experiences and knowledge based on your course grade, pre-test/post-test on related course materials. The identity and related information that will be gathered from this exercise will be held with high level of confidentiality and anonymity. The data obtained from this study will be kept and secured physically and digitally secured with a password.

You are encouraged to ask any questions at any time about the nature of the study and the methods that I am using. Your suggestions and concerns are important to me; please contact me at any time at the address/phone number listed above.

I will use the information from this study to prepare and complete my dissertation on the determination of the differences and relationships in the study of technology supported teaching and learning compared to traditional classroom delivery. I guarantee that the following conditions will be met:

1. Your real name will not be used at any point of information collection, nor in written case report; instead, you and any other person, and place names involved in your case will be given pseudonyms that will be used in all verbal and written record and reports.
2. If you grant permission for audio taping, no audio tapes will be used for any purpose other than to do this study, and will not be played for any reason other than to do this study. At your discretion, these tapes will be destroyed or returned to you.
3. Your participation in this research study is voluntary; you have the right to withdraw at any point of the study, for any reason, and without any prejudice, and the information collected and records and reports written will be turned over to you.
4. You will receive a copy of the report before it is submitted so that you have the opportunity to suggest changes to the researcher, if necessary.
5. You will receive a copy of the final report that is submitted to the instructor.

Do you grant permission to be quoted directly? _____Yes _____No
Do you grant permission to be audio taped? _____Yes _No

I agree to the terms:
Respondent: _____ Date _____

Appendix 2– Pre-Test Questions

Choose the best answer.

1. The following examples can be classified as descriptive statistics.

a. The average number of students in a math class is 20.

b. Eating garlic can lower blood pressure.

c. There is 15% chance that most people will buy a blue car.

d. There will be 10 out of 50 people who are less than 18 years old in the next 5 years.

e. None of the above.

2. Probability is used as a basis for inferential statistics.

a. True

b. False

3. A researcher divided subjects in two groups according to gender and then selected members from each group for his sample. What sampling technique method was used by the researcher.

a. Cluster

b. Random

c. Systematic

d. Stratified

e. All of the above.

4. These are different major sampling methods categorized in the textbook.

a. Random, systematic, stratified, and cluster

b. Random, scientific, ratio, and cluster

c. Random, scientific, stratified, and cluster

d. Random, discrete, independent, and cluster.

e. All of the above.

5. Statistics is a science to conducting studies to collect, organize, summarize, analyze, and draw conclusions from data.

a. True

b. False

6. A population is consists of all subjects that are being studied whose characteristics are measured using parameters in Greek letters. Likewise, a sample is a group of subjects listed from a population where its characteristics are measured using statistics (usually in Roman letters).

a. True

b. False

7. The t-test is used to test when the sample size is

a. n is greater than 30

b. n is less than 30

c. n is greater than or equal to 30

d. n is equal to 30

8. When testing hypothesis using p-value method, , the decision is to

a. Reject the null hypothesis

b. Accept the null hypothesis

c. No decision can be made

d. None of the above

9. The two major areas of statistics are descriptive and differential statistics.

a. True

b. False

10. A cluster is a group of all subjects under a study.

a. True

b. False

11. The resultant variable is also called the dependent variable or the outcome variable.

a. True

b. False

12. The two major branches of statistics are:

a. Elementary and Advanced Statistics

b. Descriptive and Differential Statistics

c. Descriptive and Inferential Statistics

d. Probability and Inferential Statistics

e. None of the above.

13. Data can be classified according to color are measured on what scale?

a. Nominal

b. Ordinal

c. Ratio

d. Interval

e. None of the above.

14. The number of absences per year in a class is an example of what type of data?

a. Nominal

b. Qualitative

c. Discrete

d. Continuous

e. None of the above

15. What graph should be used to show relationship between parts and the whole?

a. Histogram

b. Pie Chart

c. Pareto Chart

d. Scatter Plot

e. None of the above.

16. Inferential Statistics includes measurements of central tendency, variations, and positions.

a. True

b. False

17. A normal distribution is characterized by a bell-shaped curve, uni-modal, symmetric, and continuous; its mean, median, and mode are equal.

a. True

b. False

18. The null hypothesis is a statistical hypothesis that states that there is NO difference between a parameter and a specific value, or that there is NO difference between two parameters.

a. True

b. False

19. The alternative hypothesis is a statistical hypothesis that states the existence of a difference between a parameter and a specific value, or states that there is a difference between two parameters.

a. True

b. False

20. For this conjecture, that the average height of Filipino women is less than 62 inches, the null and alternative hypothesis is written as:

a.

b.

c.

d. None of the above

Appendix 3– Post-Test Questions

Choose the best answer.

1. Inferential Statistics includes measurements of central tendency, variations, and positions.

a. True

b. False

2. A normal distribution is characterized by a bell-shaped curve, uni-modal, symmetric, and continuous; its mean, median, and mode are equal.

a. True

b. False

3. The null hypothesis is a statistical hypothesis that states that there is NO difference between a parameter and a specific value, or that there is NO difference between two parameters.

a. True

b. False

4. The alternative hypothesis is a statistical hypothesis that states the existence of a difference between a parameter and a specific value, or states that there is a difference between two parameters.

a. True

b. False

5. For this conjecture, that the average height of Filipino women is less than 62 inches, the null and alternative hypothesis is written as:

a.

b.

c.

d. None of the above

6. The t-test is used to test when the sample size is

a. n is greater than 30

b. n is less than 30

c. n is greater than or equal to 30

d. n is equal to 30

7. When testing hypothesis using p-value method, , the decision is to

a. Reject the null hypothesis

b. Accept the null hypothesis

c. No decision can be made

d. None of the above

8. The following examples can be classified as descriptive statistics.

a. The average number of students in a math class is 20.

b. Eating garlic can lower blood pressure.

c. There is 15% chance that most people will buy a blue car.

d. There will be 10 out of 50 people who are less than 18 years old in the next 5 years.

e. None of the above.

9. Probability is used as a basis for inferential statistics.

a. True

b. False

10. The number of absences per year in a class is an example of what type of data?

a. Nominal

b. Qualitative

c. Discrete

d. Continuous

e. None of the above

11. A researcher divided subjects in two groups according to gender and then selected members from each group for his sample. What sampling technique method was used by the researcher.

a. Cluster

b. Random

c. Systematic

d. Stratified

e. All of the above.

f.

12. Statistics is a science to conducting studies to collect, organize, summarize, analyze, and draw conclusions from data.

a. True

b. False

13. A population is consists of all subjects that are being studied whose characteristics are measured using parameters in Greek letters. Likewise, a sample is a group of subjects listed from a population where its characteristics are measured using statistics (usually in Roman letters).

a. True

b. False

14. These are different major sampling methods categorized in the textbook.

a. Random, systematic, stratified, and cluster

b. Random, scientific, ratio, and cluster

c. Random, scientific, stratified, and cluster

d. Random, discrete, independent, and cluster.

e. All of the above.

15. The two major areas of statistics are descriptive and differential statistics.

a. True

b. False

16. A cluster is a group of all subjects under a study.

a. True

b. False

17. The resultant variable is also called the dependent variable or the outcome variable.

a. True

b. False

18. The two major branches of statistics are:

a. Elementary and Advanced Statistics

b. Descriptive and Differential Statistics

c. Descriptive and Inferential Statistics

d. Probability and Inferential Statistics

e. None of the above.

19. Data can be classified according to color are measured on what scale?

a. Nominal

b. Ordinal

c. Ratio

d. Interval

e. None of the above.

20. What graph should be used to show relationship between parts and the whole?

a. Histogram

b. Pie Chart

c. Pareto Chart

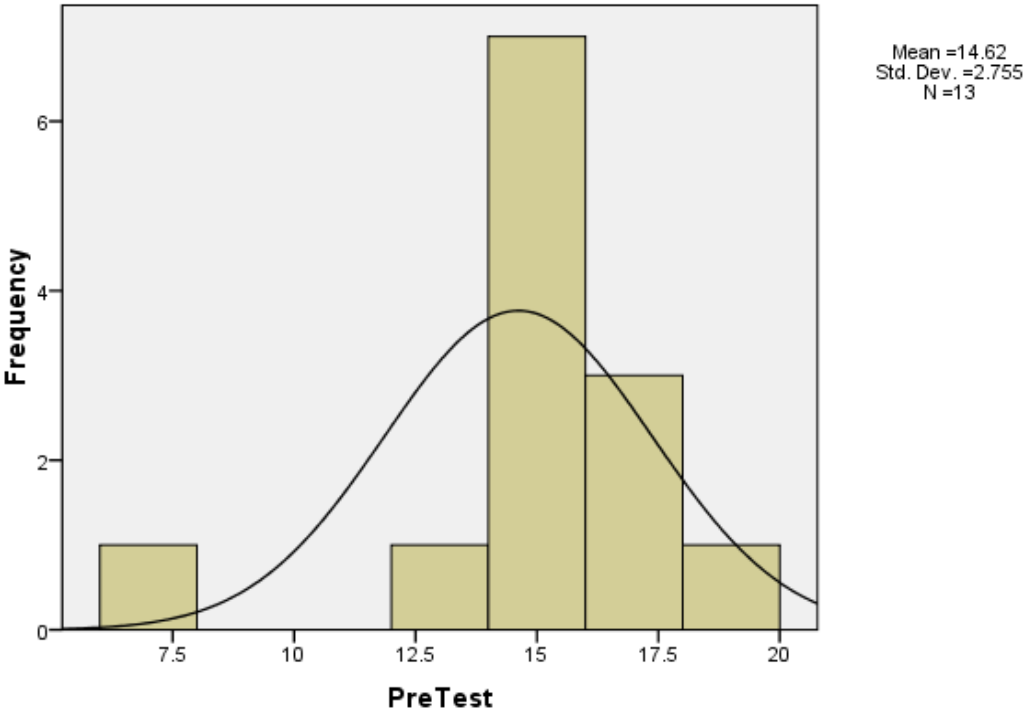
d. Scatter Plot

e. None of the above.

Appendix 4– Pre-Test Frequency Table and Histogram (Traditional Course)

Pre-Test

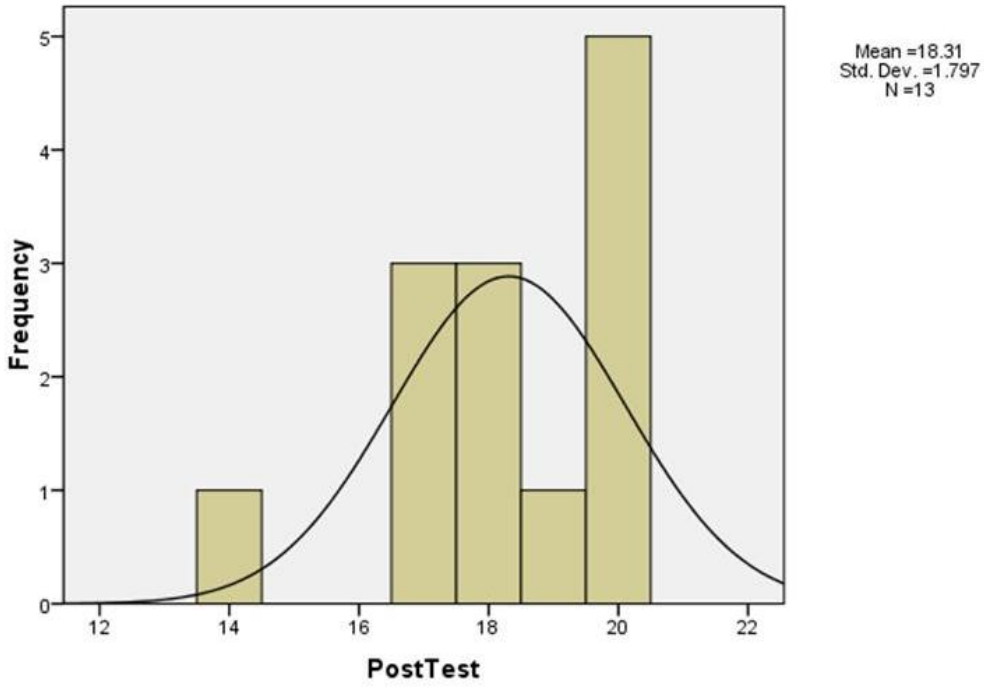
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	7	1	7.7	7.7	7.7
	13	1	7.7	7.7	15.4
	14	4	30.8	30.8	46.2
	15	3	23.1	23.1	69.2
	17	3	23.1	23.1	92.3
	18	1	7.7	7.7	100.0
	Total	13	100.0	100.0	



Appendix 5- Post-Test Frequency Table and Histogram (Traditional Course)

Post-Test

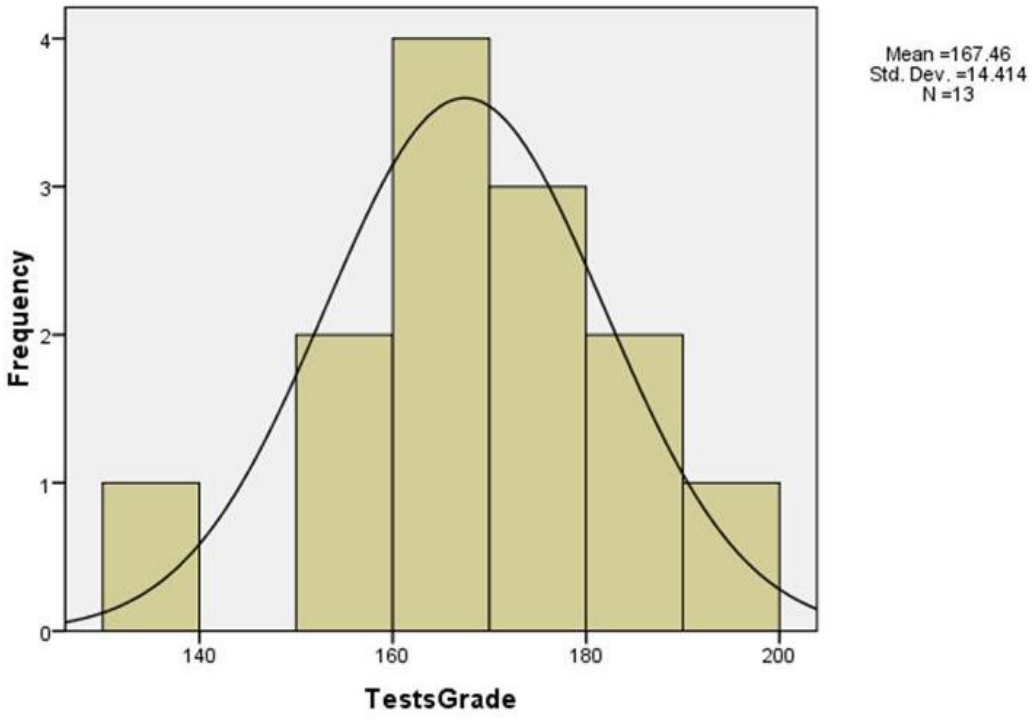
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	14	1	7.7	7.7	7.7
	17	3	23.1	23.1	30.8
	18	3	23.1	23.1	53.8
	19	1	7.7	7.7	61.5
	20	5	38.5	38.5	100.0
	Total	13	100.0	100.0	



Appendix 6 – Test Grade Frequency Table and Histogram (Traditional Course)

Tests Grade

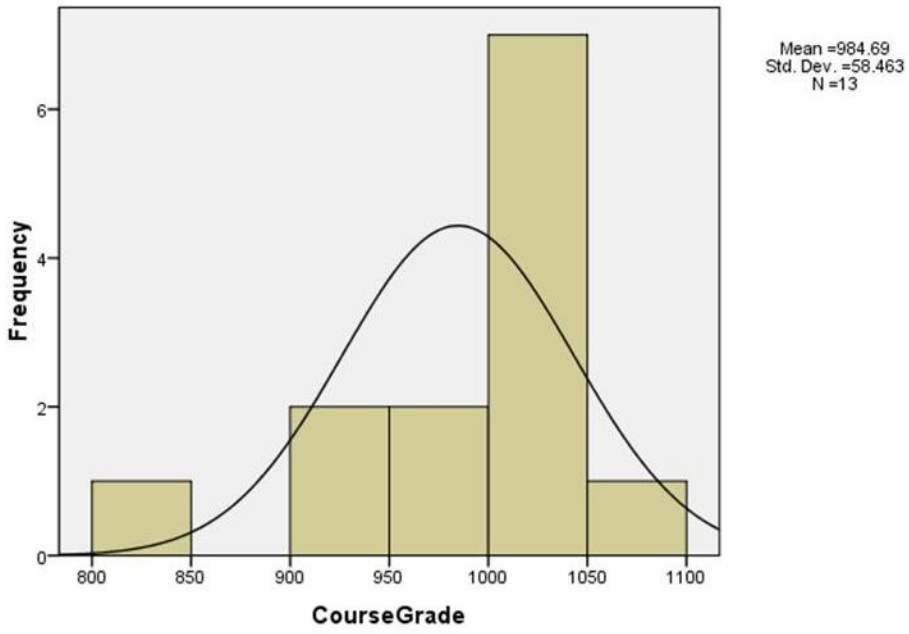
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	136	1	7.7	7.7	7.7
	155	1	7.7	7.7	15.4
	156	1	7.7	7.7	23.1
	161	1	7.7	7.7	30.8
	163	1	7.7	7.7	38.5
	164	2	15.4	15.4	53.8
	172	1	7.7	7.7	61.5
	175	1	7.7	7.7	69.2
	178	1	7.7	7.7	76.9
	180	1	7.7	7.7	84.6
	181	1	7.7	7.7	92.3
	192	1	7.7	7.7	100.0
	Total	13	100.0	100.0	



Appendix 7 - Course Grade Frequency Table and Histogram (Traditional Course)

Course Grade

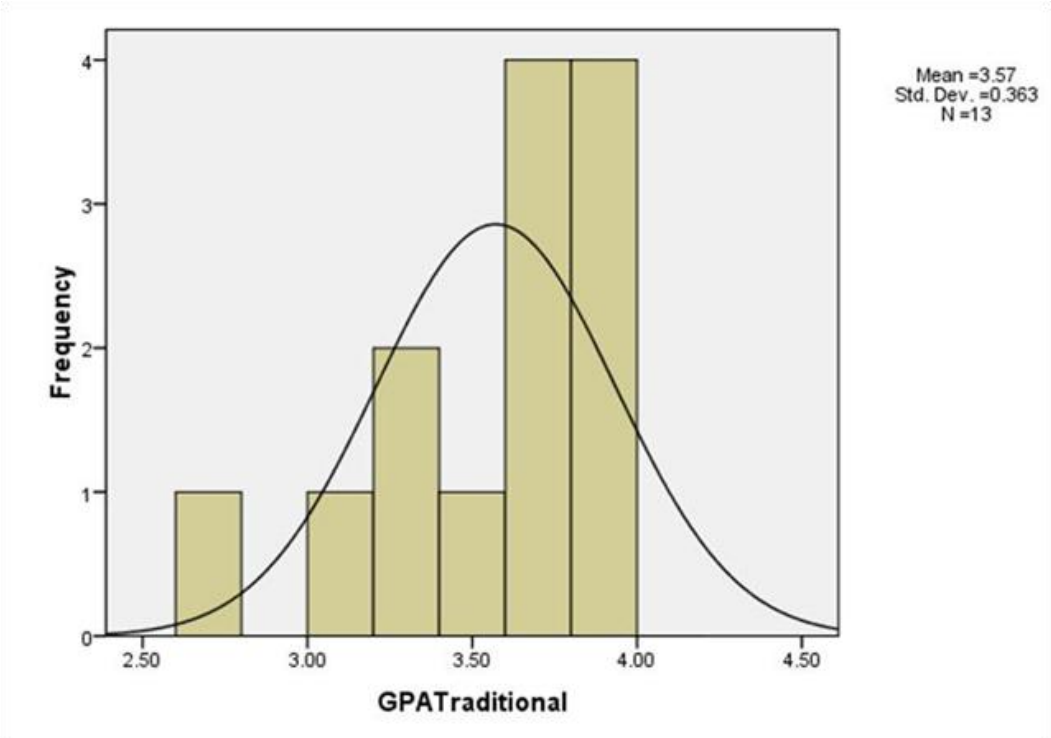
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	847	1	7.7	7.7	7.7
	905	1	7.7	7.7	15.4
	927	1	7.7	7.7	23.1
	983	1	7.7	7.7	30.8
	990	1	7.7	7.7	38.5
	1001	1	7.7	7.7	46.2
	1009	1	7.7	7.7	53.8
	1011	2	15.4	15.4	69.2
	1012	1	7.7	7.7	76.9
	1014	1	7.7	7.7	84.6
	1022	1	7.7	7.7	92.3
	1069	1	7.7	7.7	100.0
	Total	13	100.0	100.0	



Appendix 8 - GPA Frequency Table and Histogram (Traditional Course)

GPA

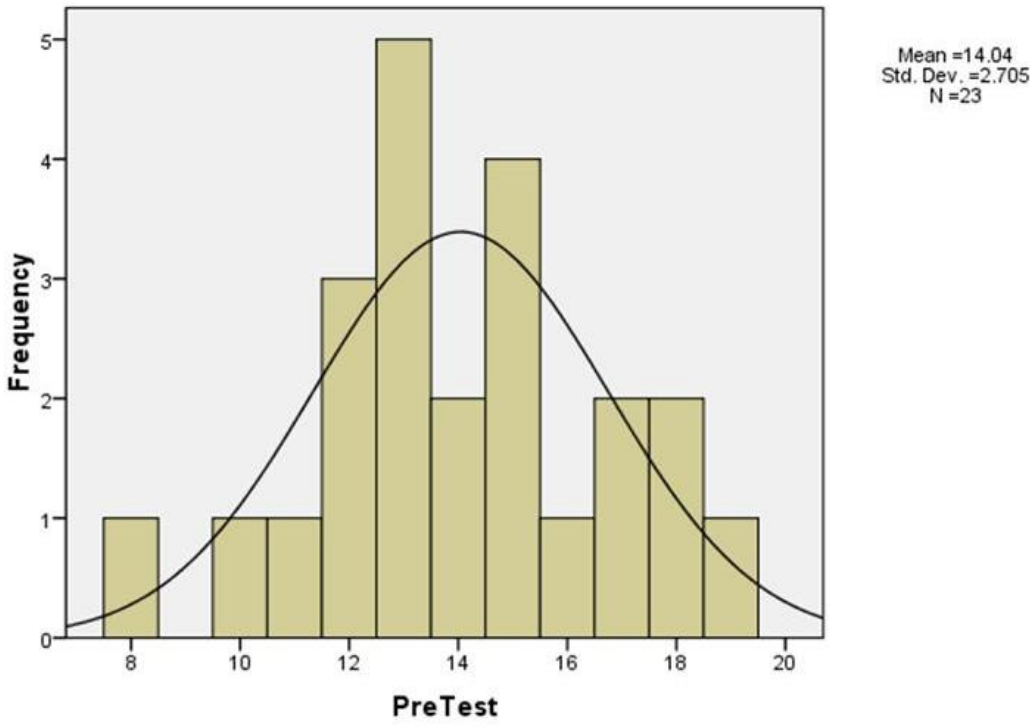
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2.678	1	7.7	7.7	7.7
	3.177	1	7.7	7.7	15.4
	3.341	1	7.7	7.7	23.1
	3.376	1	7.7	7.7	30.8
	3.545	1	7.7	7.7	38.5
	3.628	1	7.7	7.7	46.2
	3.649	1	7.7	7.7	53.8
	3.659	1	7.7	7.7	61.5
	3.743	1	7.7	7.7	69.2
	3.807	1	7.7	7.7	76.9
	3.825	1	7.7	7.7	84.6
	4	2	15.4	15.4	100.0
	Total	13	100.0	100.0	



Appendix 9 – Pre-Test Frequency Table and Histogram (Blended Course)

PreTest

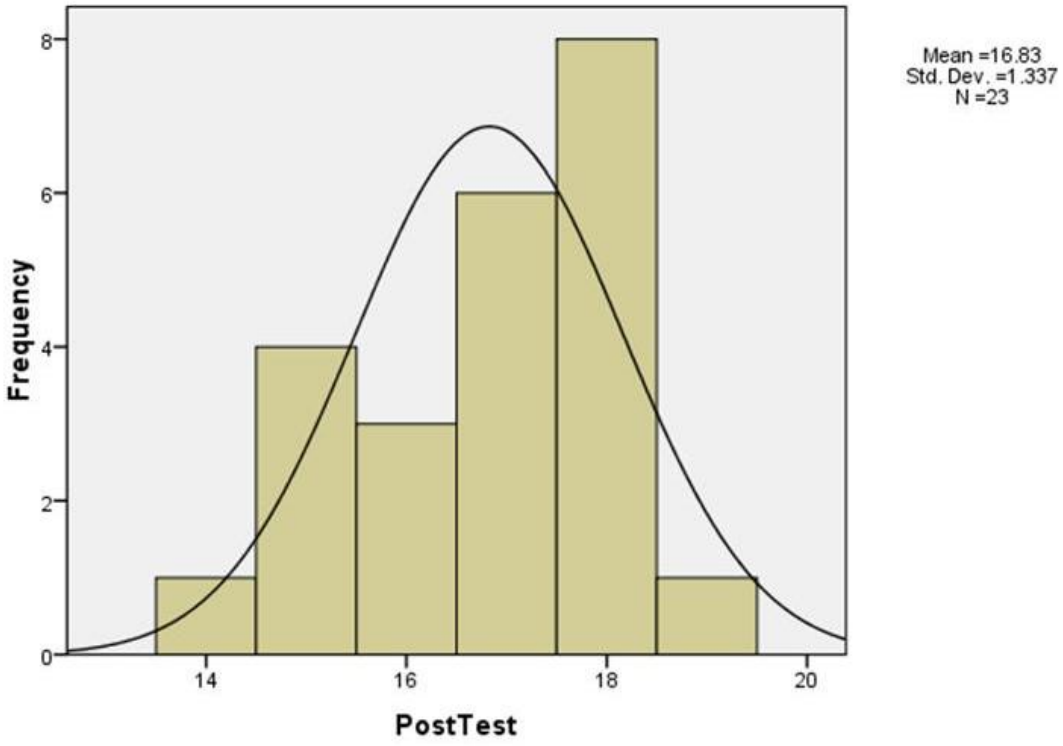
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	8	1	4.3	4.3	4.3
	10	1	4.3	4.3	8.7
	11	1	4.3	4.3	13.0
	12	3	13.0	13.0	26.1
	13	5	21.7	21.7	47.8
	14	2	8.7	8.7	56.5
	15	4	17.4	17.4	73.9
	16	1	4.3	4.3	78.3
	17	2	8.7	8.7	87.0
	18	2	8.7	8.7	95.7
	19	1	4.3	4.3	100.0
	Total	23	100.0	100.0	



Appendix 10 - Post-Test Frequency Table and Histogram (Blended Course)

PostTest

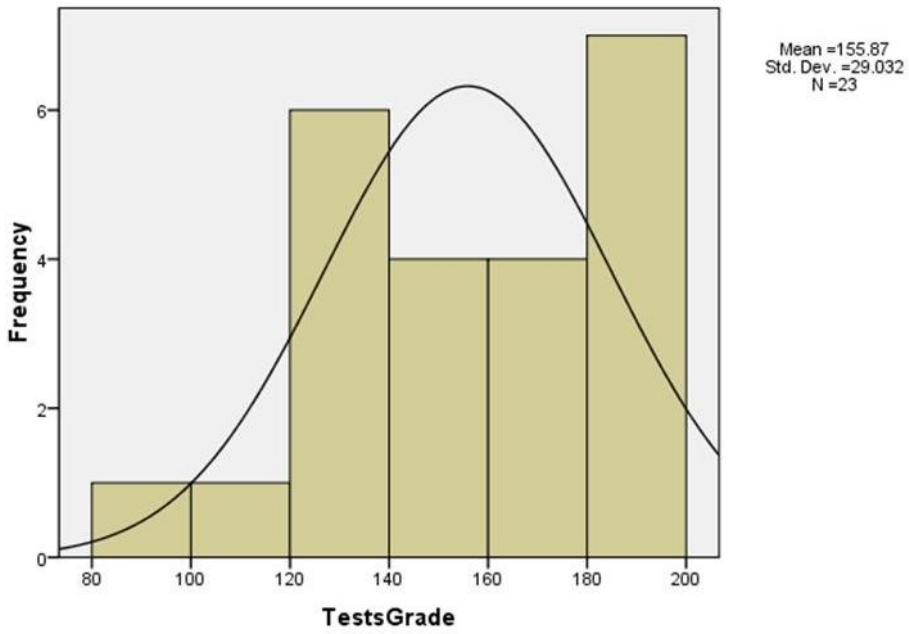
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	14	1	4.3	4.3	4.3
	15	4	17.4	17.4	21.7
	16	3	13.0	13.0	34.8
	17	6	26.1	26.1	60.9
	18	8	34.8	34.8	95.7
	19	1	4.3	4.3	100.0
	Total	23	100.0	100.0	



Appendix 11- Test Grade Frequency Table and Histogram (Blended Course)

TestsGrade

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	90	1	4.3	4.3	4.3
	116	1	4.3	4.3	8.7
	124	1	4.3	4.3	13.0
	128	1	4.3	4.3	17.4
	129	1	4.3	4.3	21.7
	131	1	4.3	4.3	26.1
	135	1	4.3	4.3	30.4
	138	1	4.3	4.3	34.8
	148	2	8.7	8.7	43.5
	149	1	4.3	4.3	47.8
	152	1	4.3	4.3	52.2
	163	1	4.3	4.3	56.5
	165	1	4.3	4.3	60.9
	174	1	4.3	4.3	65.2
	175	1	4.3	4.3	69.6
	181	1	4.3	4.3	73.9
	183	1	4.3	4.3	78.3
	186	1	4.3	4.3	82.6
	188	1	4.3	4.3	87.0
	189	1	4.3	4.3	91.3
	195	1	4.3	4.3	95.7
	198	1	4.3	4.3	100.0
	Total	23	100.0	100.0	

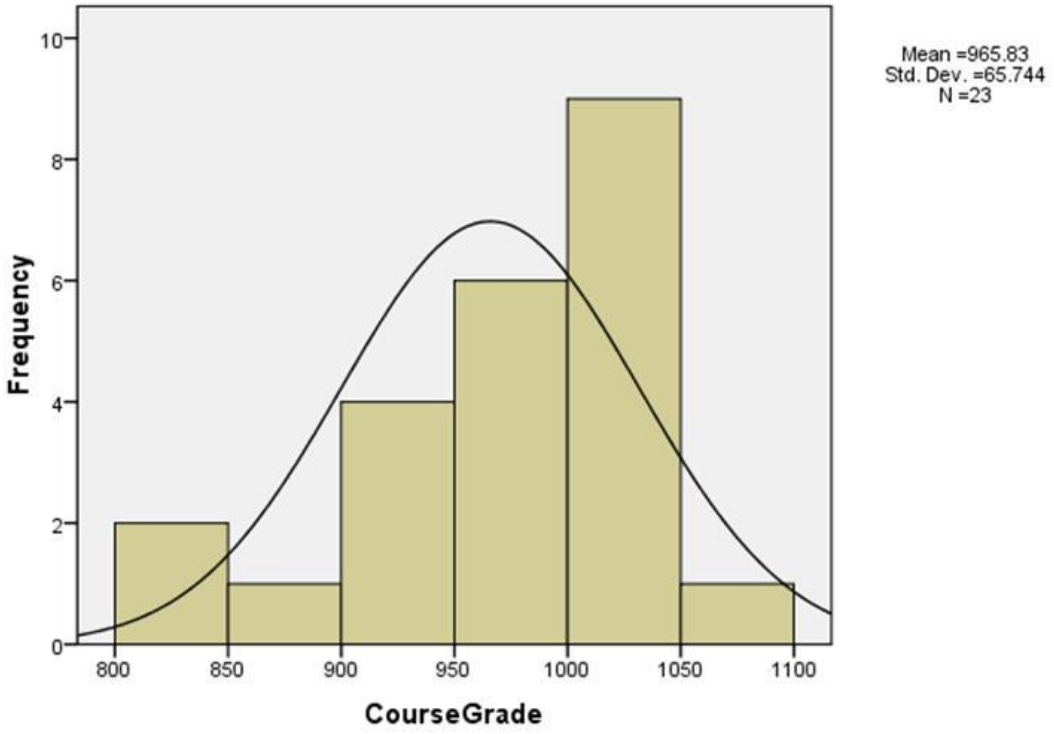


Continuation of Appendix 10

Appendix 12- Course Grade Frequency Table and Histogram (Blended Course)

CourseGrade

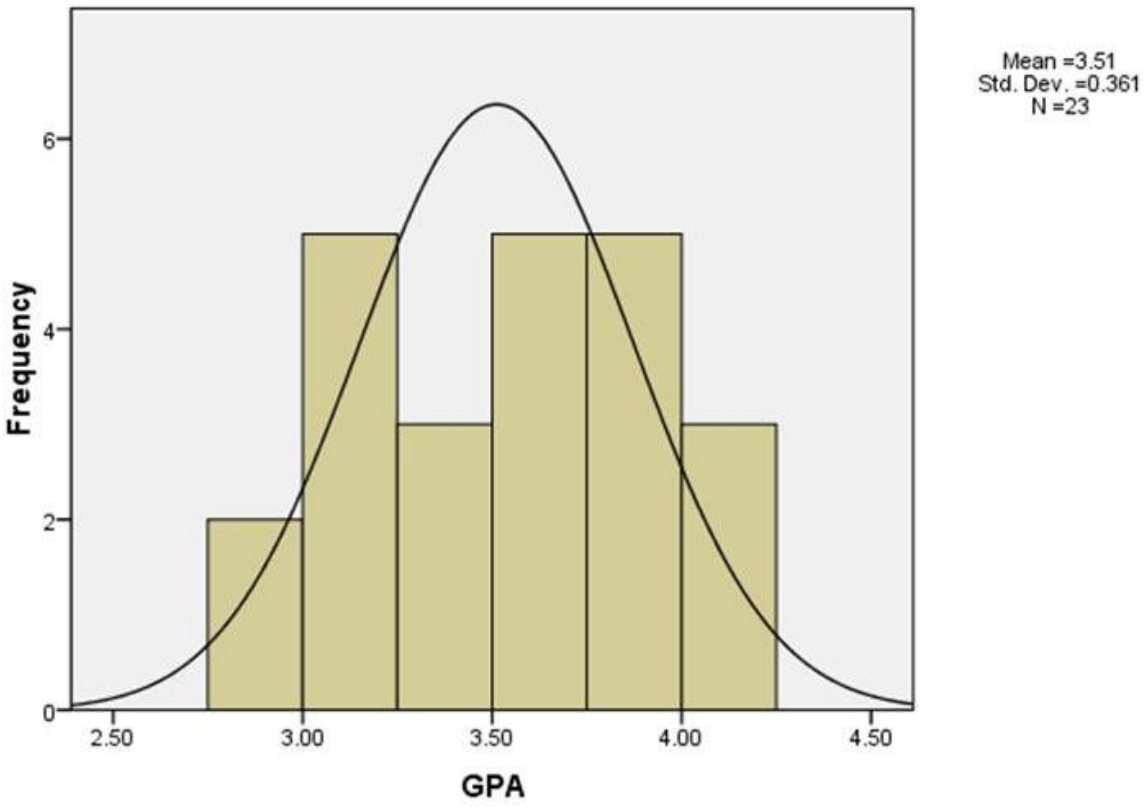
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	800	1	4.3	4.3	4.3
	831	1	4.3	4.3	8.7
	860	1	4.3	4.3	13.0
	914	1	4.3	4.3	17.4
	917	1	4.3	4.3	21.7
	937	1	4.3	4.3	26.1
	945	1	4.3	4.3	30.4
	951	1	4.3	4.3	34.8
	955	1	4.3	4.3	39.1
	964	1	4.3	4.3	43.5
	970	1	4.3	4.3	47.8
	987	1	4.3	4.3	52.2
	996	1	4.3	4.3	56.5
	1000	1	4.3	4.3	60.9
	1006	2	8.7	8.7	69.6
	1014	1	4.3	4.3	73.9
	1015	1	4.3	4.3	78.3
	1017	2	8.7	8.7	87.0
	1022	1	4.3	4.3	91.3
	1038	1	4.3	4.3	95.7
	1052	1	4.3	4.3	100.0
	Total	23	100.0	100.0	


Mean =965.83
Std. Dev. =65.744
N =23
Frequency
0
2
4
6
8
10
800
850
900
950
1000
1050
1100
CourseGrade

Appendix 13 - GPA Frequency Table and Histogram (Blended Course)

GPA

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2.794	1	4.3	4.3	4.3
	2.942	1	4.3	4.3	8.7
	3.045	1	4.3	4.3	13.0
	3.107	1	4.3	4.3	17.4
	3.163	1	4.3	4.3	21.7
	3.17	1	4.3	4.3	26.1
	3.228	1	4.3	4.3	30.4
	3.356	1	4.3	4.3	34.8
	3.4	1	4.3	4.3	39.1
	3.482	1	4.3	4.3	43.5
	3.5	1	4.3	4.3	47.8
	3.531	1	4.3	4.3	52.2
	3.573	1	4.3	4.3	56.5
	3.597	1	4.3	4.3	60.9
	3.731	1	4.3	4.3	65.2
	3.801	1	4.3	4.3	69.6
	3.814	1	4.3	4.3	73.9
	3.818	1	4.3	4.3	78.3
	3.84	1	4.3	4.3	82.6
	3.875	1	4.3	4.3	87.0
	4	3	13.0	13.0	100.0
	Total	23	100.0	100.0	



Continuation of Appendix 13

Appendix 14 - Survey Item-Total Statistics

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Q1	52.48	33.028	.022	.	.753
Q2	52.52	28.259	.664	.	.688
Q3	52.81	28.003	.589	.	.692
Q4	53.30	32.370	.414	.	.718
Q5	53.11	32.487	.197	.	.728
Q6	53.19	31.387	.395	.	.715
Q7	53.04	31.652	.450	.	.714
Q8	53.19	31.541	.434	.	.714
Q9	51.74	27.046	.408	.	.716
Q10	52.56	28.949	.524	.	.700
Q11	53.30	29.217	.534	.	.700
Q12	53.04	30.268	.480	.	.707
Q13C1	54.04	32.268	.424	.	.718
Q13C2	53.67	32.077	.349	.	.719
Q13C3	53.74	33.199	.149	.	.730
Q13C4	53.74	32.892	.202	.	.727
Q13C5	53.67	32.385	.294	.	.722
Q13C6	53.78	33.795	.048	.	.735
Q13C7	53.48	32.721	.277	.	.723
Q13C8	53.78	33.487	.101	.	.732
Q14C1	53.26	34.276	.009	.	.733
Q14C2	53.52	35.567	-.261	.	.749
Q14C3	53.37	34.473	-.064	.	.737
Q14C4	53.37	34.396	-.046	.	.737
Q14C5	53.26	34.353	-.025	.	.733
Q14C6	53.37	34.858	-.153	.	.741
Q14C7	53.44	33.718	.089	.	.732
Q14C8	53.26	34.123	.077	.	.731

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
55.22	34.333	5.859	28

Appendix 15- Item Statistics for Pre- and Post-Tests

Item Statistics			
	Mean	Std. Deviation	N
Q1	1.17	.378	36
Q2	1.64	.487	36
Q3	1.31	.467	36
Q5	2.97	.291	36
Q6	3.39	1.153	36
Q7	1.58	1.052	36
Q8	3.03	.609	36
Q9	1.08	.500	36
Q10	2.03	.560	36
Q11	1.25	.439	36
Q13	1.36	.487	36
Q14	3.11	1.282	36
Q15	2.92	1.461	36
Q16	1.92	.368	36
Q17	3.69	.889	36
Q18	1.06	.232	36
Q19	1.17	.378	36
Q20	1.06	.232	36

Summary Item Statistics							
	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	1.985	1.056	3.694	2.639	3.500	.862	18
Inter-Item Correlations	.497	.059	1.000	.941	16.965	.044	18

Appendix 16 - Item Analysis for Pre- and Post-Tests

Inter-Item Correlation Matrix																		
	Q1	Q2	Q3	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
Q1	1.000	.336	.674	.303	.437	.754	.600	.378	.383	.775	.595	.373	.595	.308	.156	.542	1.000	.542
Q2	.336	1.000	.499	.330	.816	.423	.420	.127	.247	.434	.565	.889	.880	.464	.464	.182	.336	.182
Q3	.674	.499	1.000	.274	.516	.731	.472	.255	.294	.870	.882	.514	.708	.318	.231	.366	.674	.366
Q5	.303	.330	.274	1.000	.543	.427	.810	.605	.880	.279	.274	.467	.397	.776	.628	.445	.303	.445
Q6	.437	.816	.516	.543	1.000	.561	.635	.239	.425	.479	.557	.897	.850	.751	.733	.344	.437	.344
Q7	.754	.423	.731	.427	.561	1.000	.554	.557	.554	.727	.748	.480	.664	.424	.196	.799	.754	.799
Q8	.600	.420	.472	.810	.635	.554	1.000	.274	.584	.508	.447	.508	.581	.648	.650	.393	.600	.393
Q9	.378	.127	.255	.605	.239	.557	.274	1.000	.910	.293	.225	.253	.244	.504	.059	.697	.378	.697
Q10	.383	.247	.294	.880	.425	.554	.584	.910	1.000	.320	.276	.394	.352	.704	.362	.647	.383	.647
Q11	.775	.434	.870	.279	.479	.727	.508	.293	.320	1.000	.768	.457	.657	.309	.201	.420	.775	.420
Q13	.595	.565	.882	.274	.557	.748	.447	.225	.276	.768	1.000	.574	.766	.332	.262	.323	.595	.323
Q14	.373	.889	.514	.467	.897	.480	.508	.253	.394	.457	.574	1.000	.905	.625	.582	.266	.373	.266
Q15	.595	.880	.708	.397	.850	.664	.581	.244	.352	.657	.766	.905	1.000	.517	.464	.351	.595	.351
Q16	.308	.464	.318	.776	.751	.424	.648	.504	.704	.309	.332	.625	.517	1.000	.880	.389	.308	.389
Q17	.156	.464	.231	.628	.733	.196	.650	.059	.362	.201	.262	.582	.464	.880	1.000	.085	.156	.085
Q18	.542	.182	.366	.445	.344	.799	.393	.697	.647	.420	.323	.266	.351	.389	.085	1.000	.542	1.000
Q19	1.000	.336	.674	.303	.437	.754	.600	.378	.383	.775	.595	.373	.595	.308	.156	.542	1.000	.542
Q20	.542	.182	.366	.445	.344	.799	.393	.697	.647	.420	.323	.266	.351	.389	.085	1.000	.542	1.000

Appendix 17 - Item Analysis for Online Survey

Inter-Item Correlation Matrix

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13C 1	Q13C 2	Q13C 3	Q13C 4	Q13C 5	Q13C 6	Q13C 7	Q13C 8	Q14C 1	Q14C 2	Q14C 3	Q14C 4	Q14C 5	Q14C 6	Q14C 7	Q14C 8
Q1	1.000	-.101	.036	-.051	.222	.017	.101	.237	.269	-.060	.071	-.149	-.162	-.231	-.268	-.194	-.231	.305	.184	-.140	.145	-.006	.204	-.212	.145	-.004	-.227	.145
Q2	-.101	1.000	.461	.310	-.086	.532	.255	.316	.410	.497	.534	.472	.562	.337	.570	.375	.337	-.239	.103	.152	-.334	-.146	-.299	-.025	-.076	.112	.026	.181
Q3	.036	.461	1.000	.542	.120	.044	.355	.050	.419	.347	.378	.379	.215	.418	.145	-.110	.162	.181	.276	.095	.092	-.348	.195	.195	.092	-.044	.352	.092
Q4	-.051	.310	.542	1.000	.191	.183	.283	.014	.226	.160	.621	.494	.346	.219	-.204	-.007	.022	.175	.331	-.417	-.038	-.127	.194	-.082	-.038	-.358	.131	-.038
Q5	.222	-.086	.120	.191	1.000	.295	.552	.103	.346	.072	.171	-.049	-.084	-.079	-.406	.066	-.079	.316	-.164	-.158	.035	-.014	.074	-.092	.035	-.424	.236	.035
Q6	.017	.532	.044	.183	.295	1.000	.517	.375	.226	.577	.510	.271	.300	-.072	.195	.324	.057	-.316	-.255	-.187	-.328	.042	-.516	-.154	-.328	.027	.034	.013
Q7	.101	.255	.355	.283	.552	.517	1.000	.125	.279	.446	.445	.242	.015	.192	.093	-.064	.035	.122	.053	-.192	.077	-.260	-.277	-.057	-.337	-.057	.021	.077
Q8	.237	.316	.050	.014	.103	.375	.125	1.000	-.027	.476	.293	.307	.341	.065	.076	.222	.359	-.065	.210	.375	.014	.047	-.175	.236	.014	.030	-.136	.014
Q9	.269	.410	.419	.226	.346	.226	.279	-.027	1.000	.294	.111	.241	.118	.045	-.073	.043	-.187	.129	.024	-.045	-.079	-.135	.156	-.249	.226	.075	.200	.226
Q10	-.060	.497	.347	.160	.072	.577	.446	.476	.294	1.000	.316	.520	.311	.274	.303	.121	.183	-.274	.173	.183	-.080	-.265	-.426	-.043	-.320	.085	.000	.160
Q11	.071	.534	.378	.621	.171	.510	.445	.293	.111	.316	1.000	.533	.419	.303	.093	.190	.303	-.011	.163	-.205	-.019	-.063	-.176	-.040	-.275	-.312	-.052	-.019
Q12	-.149	.472	.379	.494	-.049	.271	.242	.307	.241	.520	.533	1.000	.296	.136	.177	.177	.136	-.025	.290	-.025	.054	-.063	-.196	-.196	-.239	-.040	.015	.054
Q13C	-.162	.562	.215	.346	-.084	.300	.015	.341	.118	.311	.419	.296	1.000	.235	.113	.113	.235	-.043	.064	.149	-.411	.309	-.070	.199	.093	-.070	.025	.093
Q13C	-.231	.337	.418	.219	-.079	-.072	.192	.065	.045	.274	.303	.136	.235	1.000	.414	.265	.700	-.100	.321	.200	.219	-.580	.256	.047	-.175	.047	.060	-.175
Q13C	-.268	.570	.145	-.204	-.406	.195	.093	.076	-.073	.303	.093	.177	.113	.414	1.000	.258	.414	-.414	.063	.182	-.204	-.186	-.433	-.015	-.204	.402	.158	-.204
Q13C	-.194	.375	-.110	-.007	.066	.324	-.064	.222	.043	.121	.190	.177	.113	.265	.258	1.000	.564	-.265	.063	.182	.189	-.024	-.015	-.224	-.204	-.015	-.020	-.204
Q13C	-.231	.337	.162	.022	-.079	.057	.035	.359	-.187	.183	.303	.136	.235	.700	.414	.564	1.000	-.100	.321	.500	.219	-.417	.047	.047	-.175	-.163	.060	-.175
Q13C	.305	-.239	.181	.175	.316	-.316	.122	-.065	.129	-.274	-.011	-.025	-.043	-.100	-.414	-.265	-.100	1.000	.529	.100	.175	.091	.373	.163	.175	-.466	-.060	.175
Q13C	.184	.103	.276	.331	-.164	-.255	.053	.210	.024	.173	.163	.290	.064	.321	.063	.063	.321	.529	1.000	.189	.331	-.199	.229	-.009	-.116	-.247	-.316	-.116
Q13C	-.140	.152	.095	-.417	-.158	-.187	-.192	.375	-.045	.183	-.205	-.025	.149	.200	.182	.182	.500	.100	.189	1.000	.175	-.073	-.047	.373	.175	-.047	-.060	.175
Q14C	.145	-.334	.092	-.038	.035	-.328	.077	.014	-.079	-.080	-.019	.054	-.411	.219	-.204	.189	.219	.175	.331	.175	1.000	-.127	.470	-.082	-.038	-.082	-.105	-.038
Q14C	-.006	-.146	-.348	-.127	-.014	.042	-.260	.047	-.135	-.265	-.063	-.063	.309	-.580	-.186	-.024	-.417	.091	-.199	-.073	-.127	1.000	-.042	.186	.302	-.042	.043	-.127
Q14C	.204	-.299	.195	.194	.074	-.516	-.277	-.175	.156	-.426	-.176	-.196	-.070	.256	-.433	-.015	.047	.373	.229	-.047	.470	-.042	1.000	.120	.470	-.174	.028	-.082
Q14C	-.212	-.025	.195	-.082	-.092	-.154	-.057	.236	-.249	-.043	-.040	-.196	.199	.047	-.015	-.224	.047	.163	-.009	.373	-.082	.186	.120	1.000	.470	-.174	.028	-.082
Q14C	.145	-.076	.092	-.038	.035	-.328	-.337	.014	.226	-.320	-.275	-.239	.093	-.175	-.204	-.204	-.175	.175	-.116	.175	-.038	.302	.470	.470	1.000	-.082	.367	-.038
Q14C	-.004	.112	-.044	-.358	-.424	.027	-.057	.030	.075	.085	-.312	-.040	-.070	.047	.402	-.015	-.163	-.466	-.247	-.047	-.082	-.042	-.174	-.174	-.082	1.000	.028	-.082
Q14C	-.227	.026	.352	.131	.236	.034	.021	-.136	.200	.000	-.052	.015	.025	.060	.158	-.020	.060	-.060	-.316	-.060	-.105	.043	.028	.028	.367	.028	1.000	-.105
Q14C	.145	.181	.092	-.038	.035	.013	.077	.014	.226	.160	-.019	.054	.093	-.175	-.204	-.204	-.175	.175	-.116	.175	-.038	-.127	-.082	-.082	-.038	-.082	-.105	1.000

Appendix 18 - Syllabus for the Blended Course

COURSE NUMBER & TITLE: *Math 141 (Elementary Statistics)*
CREDIT: Four (4) credits
PRE-REQUISITE/S: Math 117 – College Algebra
(at least a grade of "C")
MEETING: Alternating Mondays, 6:00 – 8:50 p.m.
LOCATION: Main Campus, Reid 2318
Elementary Statistics, A Brief Version, 4th Edition By Allan G. Bluman, McGraw-Hill

COURSE DESCRIPTION AND OBJECTIVES

This course is an introduction to the basic tools and elementary methods of statistics. This course will lay emphasis on data collection, sampling techniques ; describe and analyze data using descriptive and inferential statistics which includes principles of probability; frequency distribution, measurements of central tendency & variations; normal distribution, testing hypothesis; and correlation and regression.

METHODS OF INSTRUCTION

This class will be delivered using a hybrid format where 6 sessions will be conducted in the classroom and 2 sessions will be delivered online using Desire2Learn (D2L) course management systems. This will include lectures, discussion of key concepts and working on the solution of illustrative examples with take home chapter assignments; online discussions, in-class and online testing, and projects (see weekly course outline for details). A final project is required for this course where application will be built on the key principles of descriptive and inferential statistics. The class will be using Microsoft Excel and/or SPSS to enhance student learning to approach problem solving and analysis. Students may use the computer labs in Reid Hall (main campus) or any of the weekend college sites. Students will need access to the Internet for class materials and related resources for this class.

INDEPENDENT LEARNING EXPERIENCE

We will use Desire2Learn (D2L) course management systems to extend classroom activities including lecture, class notes and group discussions. D2L is available 24/7 (note: the instructor is NOT!) Students will be engaged in online threaded discussion or group discussion focusing on classroom materials presented in class. D2L will be used for distribution of related class materials, submission of homework, practice tests, and for class communication. This will be discussed in detail during the first class meeting. The availability of D2L as a major learning resource will allow students to work on their course work independently as well as conduct group work.

EVALUATION AND GRADING CRITERIA

Course Requirements	Points	% Weight	Grade Point Equivalent (GPE)
2 Tests @100 points each	200	20%	*GPE= Total Earned Points/10*
6 Assignments @50 points each	300	30%	
6 Online Discussions @50 points each	300	30%	
2 Reflections/Essay @25 point each	50	5%	

<table>
<tr><td>Final Project (Presentation=150)</td><td>150</td><td>15%</td><td>>95</td><td>A</td></tr>
<tr><td>TOTAL POINTS</td><td>1000</td><td>100%</td><td>90-95</td><td>A-</td></tr>
<tr><td colspan="3" rowspan="8">HOMEWORK & TEST REQUIREMENTS
<u>LATE homework will NOT be accepted for any reason</u>. A student is given enough lead time to finish the homework. There will be no make-up arrangement for a missed quiz/exams or assignments except on meritorious cases which will be dealt with on case-to-case basis. Proper documentation may be required in case of sickness or other related issues. The student is responsible for any material missed in class during his/her absence.</td><td>87-89</td><td>B+</td></tr>
<tr><td>84-86</td><td>B</td></tr>
<tr><td>80-83</td><td>B-</td></tr>
<tr><td>77-79</td><td>C+</td></tr>
<tr><td>74-76</td><td>C</td></tr>
<tr><td>70-73</td><td>C-</td></tr>
<tr><td>60-69</td><td>D</td></tr>
<tr><td>below 60</td><td>F</td></tr>
<tr><td colspan="5">INCOMPLETE GRADE & LATE PROJECTS
Students are highly encouraged to complete all course work on time during the duration of the class term. With proper documentation, incomplete grade (INC) may be given to a student on meritorious cases to be determined by the instructor, provided the following conditions are met. The student must have taken at least 75% of the course requirement with a class standing or rating not less than 70%. Otherwise, the student is advised to drop from the course following the proper procedures. The student must complete the requirements within the period specified by the instructor. Late projects will constitute significant deduction which is 5% of the grade per day. (e.g. If project grade is 90%, actual grade will be 86.5%)</td></tr>
</table>

WEEKLY COURSE OUTLINE

Advanced Reading: *Read Chapter 1*

Session (2008)	Weekly Coverage	Learning Activities & Resources
1 – In Class 01/12	**INTRODUCTORY CONCEPTS: STATISTICS** Discussion of the Course Syllabus Accessing D2L Discussion of Final Project (proposal due by Session #2) In-Class Group Exercise	Advanced Reading: Chapter 1 Internet Access – Statistical Data from related links, visit sites Assignment#1 (due Session #2)- Access D2L, sample postings
2– In Class 01/26	**FREQUENCY DISTRIBUTION & GRAPHS** Q & A: Previous Lessons Hands-On: Creating Graphs Using Excel In-Class Exercise	Advanced Reading: Chapter 2 Assignment #2 (due Session #3) Extended Learning Experience: Using SPSS/Excel Final Project Proposal due Online Discussion #1, post by 02/08 midnight
3 – Online 02/09	**DATA DESCRIPTION** Online Lecture: How to Describe Statistical Data Measurement of Central Tendency Measurement of Variations Measurement of Positions	Advanced Reading: Chapter 3 Assignment #3 (due Session #4) Test #1 - Part 1(online)- available in D2L, Chapters 1, 2, & 3-concepts Online Discussion #2, post by 02/22 midnight
4 – In Class 02/23	**THE NORMAL DISTRIBUTION** Q & A: Previous Lessons Discussion and Illustration of Sample Problems In-Class Group Exercise	Advanced Reading: Chapter 6 Assignment#4 (due Session #5) Test#1 – Part 2 (In-class)- Coverage: Chapters 1, 2, & 3-problem solving Online Discussion#3, post questions on Chapter 8 by 03/08 midnight Reflection #1 (due end of Session 5)
5 – In Class 03/09	**HYPOTHESIS TESTING** Q & A: Previous Lessons Discussion and Illustration of Sample Problems In-Class Group Exercise	Advanced Reading: Chapters 8 Assignment #5 (due Session #6) Online Discussion#4, post 3 questions on Chapter 9 by 03/22 midnight
6- In Class 03/23	**MORE ON HYPOTHESIS TESTIN** Q & A: Previous Lessons Discussion and Illustration of Sample Problems In-Class Group Exercise Discuss Final Project	Advanced Reading: Chapters 9 Online Discussion#5, post questions on Chapter 10 by 04/05 midnight Test#2 – In Class (Chapters 6 & 8)
7- Online 04/06	**CORRELATION AND REGRESSION** Online Lecture: Correlation and Regression	Advanced Reading: Chapter 10 Assignment #6 (due Session #8) Reflection #2 (due end of Session 8) Online Discussion #6, post by 04/19 midnight
8- In Class 04/20	Q & A: Previous Lessons Presentation of Final Project	Final Presentation (oral presentation)

REQUIRED ACCESS TO TECHNOLOGY RESOURCES:

A thumb drive (512 MB/1GB); Access to the Internet; Microsoft Excel; Microsoft Word; Microsoft PowerPoint; SPSS**,** and printing**. Regular access to D2L site is required in this course for class updates and group collaboration.**

COMPUTER LAB ACCESS

Maryville University has open computer labs located at the main campus and at Southwest and St. Charles campuses. Each computer have access to the Internet and are installed with Microsoft Office (Word, Excel, PowerPoint, Access, FrontPage), SPSS,

and other related software programs that will support and enhance your learning in this class.

Main Campus: 314.529.9647 **Southwest Campus:** 636.343.0300 **St. Charles Campus:** 636.978.4277

PRESENTATION OF THE FINAL PROJECT (150 points)

Depending on class size, each student will conduct a 5 to 10-minute presentation in class during the last session. ***A HARD copy of the slide presentation will be submitted to the instructor during the presentation for final grading.*** Presenter may distribute handouts to the class during the presentation.

Scope of Final Project

Each student will propose a topic of their choice that will use application of the statistical principles covered in class. This proposal is due during session #2. Prior approval must be obtained before starting your project. *Please consult with the instructor before you start your project.* The final project will include but not limited to the following:

1. Information about the sample or population (survey respondents);
2. Discussion of the methodology and procedures how data are collected, organized and presented.
3. Data analysis will include measurement of differences and/or determination of the strength of the relationship between variables using descriptive and/or inferential statistics.
4. Write conclusion and recommendation based on the analysis of data and findings.

ASSIGNMENTS (300 points)

There are 5 homework/assignments required in this class. Most homework will include problems from each chapter and discussions covered in class. All assignments are to be submitted in D2L using the assignment drop box. ***IMPORTANT: LATE WORK IS HIGHLY DISCOURAGED. POINTS WILL BE DEDUCTED ON A DAILY BASIS.***

TESTS (200 points)

There are 2 tests required in this course. Each test will either be conducted in 2 parts, i.e., given in class and online. The online part will include terminologies, concepts, and applications. The in-class part will include problem solving or related applications. Test will cover topics discussed in class. Please see the weekly course outline for details.

ONLINE DISCUSSION (300 points)

A total of 6 online discussions are posted in D2L. There are 2 "topical" online discussions students will be required to contribute scholarly ideas using at least 75 words. Cite references if you use other resources. The other 4 discussions will require reflections through Q&A on the materials covered during that session where you will post 3 questions from the chapters indicated for each discussion in D2L. These questions will be used in the lecture and class discussions. Evaluation is based on the quality, substance, and timeliness of your postings.

REFLECTIONS/ EXPLORATORY ESSAY (50 points)

Each student will write 2 reflections or set of questions/inquiry on what was covered in class summarizing their learning experiences, including suggestions and ideas to improve instructions and learning.

COMMUNICATION

In order to streamline communication in this class, you can post your questions in the online discussion in D2L. Each session will have its own Q&A that covers the lecture, learning activities, and other relevant class work for that particular session. If you need to privately discuss issues with your instructor, send a personal email, jocuaman@maryville.edu.

ACADEMIC ACCOMMODATIONS

Maryville University provides accommodations and supports for students with disabilities as defined by the Americans with Disabilities Act. If you have a documented disability and wish to discuss academic accommodations, please contact the course instructor and/or the Director of the Academic Success Center located in the University Library (314-529-*6850)*

This syllabus is subject to change at the discretion of the instructor to accommodate instructional and/or student needs. Two absences will constitute withdrawal from the course regardless of reason

Appendix 19 - Syllabus for Traditional Course

COURSE NUMBER & TITLE: Math 141 (Elementary Statistics)
CREDIT: Four (4) credits
PRE-REQUISITE/S: Math 117 – College Algebra (at least a grade of "C")
MEETING: WEC Dates, Alternating Saturdays, 9:00-11:50 a.m. (first 2 meetings back-to-back)
LOCATION: Fenton/Southwest Campus
TEXTBOOK: *Elementary Statistics, A Brief Version, 4th^d Edition* By Allan G. Bluman, McGraw-Hill

COURSE DESCRIPTION AND OBJECTIVES

This course is an introduction to the basic tools and elementary methods of statistics. This course will lay emphasis on data collection, sampling techniques ; describe and analyze data using descriptive and inferential statistics which includes principles of probability; frequency distribution, measurements of central tendency & variations; normal distribution, testing hypothesis; and correlation and regression.

METHODS OF INSTRUCTION

This class will be delivered in a face-to-face environment. It will include lectures, discussion of key concepts and working on the solution of illustrative examples with take home chapter assignments; individual seatwork, in-class testing, and projects (see weekly course outline for details). A final project is required for this course where application will be built on the key principles of descriptive and inferential statistics. There will be a very limited use of technology in this class. The use of technology will include using Microsoft Excel and/or SPSS to enhance student learning to approach problem solving and analysis. Students may use the computer labs in Reid Hall (main campus) or any of the weekend college sites.

EVALUATION AND GRADING CRITERIA

Course Requirements	Points	% Weight	Grade Point Equivalent (GPE)	
2 Tests @100 points each	200	20%	*GPE= Total Earned Points/10*	
6 Assignments @50 points each	300	30%		
6 In-class Seatwork @50 points each	300	30%		
Attendance /Participation	50	5%		
Final Project (Presentation=150)	150	15%	>95	A
TOTAL POINTS	1000	100%	90-95	A-
HOMEWORK & TEST REQUIREMENTS			87-89	B+
LATE homework will NOT be accepted for any reason. A student is given enough lead time to finish the homework. There will be no make-up arrangement for a missed quiz/exams or assignments except on meritorious cases which will be dealt with on case-to-case basis. Proper documentation may be required in case of sickness or other related issues. The student is responsible for any material missed in class during his/her absence.			84-86	B
			80-83	B-
			77-79	C+
			74-76	C
			70-73	C-
			60-69	D
			below 60	F

INCOMPLETE GRADE & LATE PROJECTS

Students are highly encouraged to complete all course work on time during the duration of the class term. With proper documentation, incomplete grade (INC) may be given to a student on meritorious cases to be determined by the instructor, provided the following conditions are met. *The student must have taken at least 75% of the course requirement with a class standing or rating not less than 70%. Otherwise, the student is advised to drop from the course following the proper procedures. The student must complete the requirements within the period specified by the instructor. Late projects will constitute significant deduction which is 5% of the grade per day. (e.g. If project grade is 90%, actual grade will be 86.5%)*

WEEKLY COURSE OUTLINE

Advanced Reading: *Read Chapter 1*

Session (2009)	Weekly Coverage	Learning Activities & Resources
1 01/17	**INTRODUCTORY CONCEPTS: STATISTICS** Discussion of the Course Syllabus Discussion of Final Project (proposal due by Session #2)	Advanced Reading: Chapter 1 Assignment#1 (due Session #2)
2 01/24	**FREQUENCY DISTRIBUTION & GRAPHS** Q & A: Previous Lessons Lecture on Frequency distribution Hands-On: Creating Graphs Using Excel In-Class Exercise#1	Advanced Reading: Chapter 2 Assignment #2 (due Session #3) Extended Learning Experience: Using SPSS/Excel Final Project Proposal due
3 02/07	**DATA DESCRIPTION** Q & A: Previous Lessons Lecture on: Measurement of Central Tendency Measurement of Variations Measurement of Positions In-Class Exercise#2	Advanced Reading: Chapter 3 Assignment #3 (due Session #4) Test #1 - Part 1- Chapters 1, 2, & 3-concepts
4 02/21	**THE NORMAL DISTRIBUTION** Q & A: Previous Lessons Discussion and Illustration of Sample Problems In-Class Exercise#3	Advanced Reading: Chapter 6 Assignment#4 (due Session #5) Test#1 – Part 2 (In-class)- Coverage: Chapters 1, 2, & 3-problem solving Reflection #1 (due end of Session 5)
5 03/07	**HYPOTHESIS TESTING** Q & A: Previous Lessons Discussion and Illustration of Sample Problems In-Class Exercise#4	Advanced Reading: Chapters 8 Assignment #5 (due Session #6)
6 03/21	**MORE ON HYPOTHESIS TESTING** Q & A: Previous Lessons Discussion and Illustration of Sample Problems In-Class Exercise#5 Discuss Final Project	Advanced Reading: Chapters 9 Test#2 – In Class (Chapters 6 & 8)
7 04/04	**CORRELATION AND REGRESSION** Lecture on Correlation and Regression In-Class Exercise#6	Advanced Reading: Chapter 10 Assignment #6 (due Session #8) Reflection #2 (due end of Session 8)
8 04/18	Q & A: Previous Lessons Individual Presentation of Final Project	Final Presentation (oral presentation) paper due

REQUIRED ACCESS TO TECHNOLOGY RESOURCES:

A thumb drive (512 MB/1GB); Access to the Internet; Microsoft Excel; Microsoft Word; Microsoft PowerPoint; SPSS**,** and printing**.**

COMPUTER LAB ACCESS

Maryville University has open computer labs located at the main campus and at Southwest and St. Charles campuses. Each computer have access to the Internet and are installed with Microsoft Office (Word, Excel, PowerPoint, Access, FrontPage), SPSS, and other related software programs that will support and enhance your learning in this class.

Main Campus: 314.529.9647 **Southwest Campus:** 636.343.0300 **St. Charles Campus:** 636.978.4277

PRESENTATION OF THE FINAL PROJECT (150 points)

Depending on class size, each student will conduct a 5 to 10-minute presentation in class during the last session. ***A HARD copy of the slide presentation will be submitted to the instructor during the presentation for final grading.*** Presenter may distribute handouts to the class during the presentation.

Scope of Final Project

Each student will given to chose from a pre-determined data set. Students are given specific instruction on how to analyze the data using the principles discussed in class. Students must inform the instructor which data set they will use to manage equal assignment of data. There were 5 different data sets provided. Prior approval must be obtained before starting your project. *(Please consult with the instructor before you start your project. A sample project from previous class will be presented in class to give students ideas on how to proceed with this project.)* The final project will include but not limited to the following:

1. Information about the sample or population;
2. Discussion of the methodology and procedures how data are collected, organized and presented.
3. Data analysis will include measurement of differences and/or determination of the strength of the relationship between variables using descriptive and/or inferential statistics.
4. Write conclusion and recommendation based on the analysis of data and findings.

ATTENDANCE AND PARTICIPATION (50 points)

Attendance is mandatory in this class. Students are responsible to whatever they missed in class during their absence. Students are encouraged to participate in class discussions and in other learning activities.

ASSIGNMENTS (300 points)

There are 5 homework/assignments required in this class. Most homework will include problems from each chapter and discussions covered in class. ***IMPORTANT: LATE WORK IS HIGHLY DISCOURAGED. POINTS WILL BE DEDUCTED ON A DAILY BASIS.***

TESTS (200 points)

There are 2 tests required in this course. Each test will either be conducted in 2 parts, i.e., given in class with word problems/applications and concepts. The concept part will include terminologies, concepts, and basic principles. The other part will include problem solving or related applications. Test will cover topics discussed in class. Please see the weekly course outline for details.

IN CLASS EXERCISE - INDIVIDUAL (300 points)

A total of 6 inc-class seatwork will be given during the class session usually towards the end of the lecture. The exercise problems will include application problems covered during the lecture. This is done individually by the students during class periods.

COMMUNICATION

A communication telephone and email tree is provided to the each student in the class. If you need to privately discuss issues with your instructor, send a personal email, jocuaman@maryville.edu.

ACADEMIC ACCOMMODATIONS

Maryville University provides accommodations and supports for students with disabilities as defined by the Americans with Disabilities Act. If you have a documented disability and wish to discuss academic accommodations, please contact the course instructor and/or the Director of the Academic Success Center located in the University Library (314-529-*6850).*

Appendix 20 - Online Survey Questionnaire (Blended Course)

SURVEY QUESTIONNAIRE FOR 09MATH1411M (Blended Course)

Dear Survey Participants,

Welcome and thank you for participating in this survey. The purpose of this survey is to determine the level of satisfaction and attitudes of students towards blended learning based on their learning experiences in this course. Your responses will be treated will high level of confidentiality. Your responses will not be considered in the evaluation of your course grade. This is not a course evaluation or evaluation of your instructor.

Once again, thank you for your participation in this survey.

Sincerely,
Dr. Carl Hoagland
choagland@umsl.edu

IMPORTANT INSTRUCTION: You must complete all the questions below to be able to submit your answers.

----------Start of Survey----------

A. DEMOGRAPHIC INFORMATION

Please select the option that best describe your situation or status.

Your age group:
___below 18 years old
___ 18 to 22 years old
___ 23 to 27 years old
___ 28 to 32 years old
___ 33 to 37 years old
___38 to 42 years old
___43 to 47 years old
___ 48 to 50 years old
___ above 50 years old

School/Academic Department
___ School of Business
___ School of Education
___ School of Health Professions
___College of Arts and Sciences

Current Occupation, please indicate
_____

Academic Level
___Freshmen
___Sophomore
___Junior
___Senior

Present Academic Status
___ Full-time with 13 credits or more
___ Part-time with less than 13 credits

Gender
___Male
___Female

Marital Status
___ Single
___Married
___Divorced
___Legally separated
___Widowed

Have previously taken an online or blended course?
___ Yes
____No

Your technology skills:
___No experience at all
___Novice user
___Experienced user
___Advanced user
___Expert user

B. SURVEY QUESTIONNAIRE

Please respond by marking the appropriate selection under each column for each question item.

Questions	Strongly Agree	Agree	Not Agree or Disagree	Disagree	Strongly Disagree
Q1. I communicated a lot with other students					
Q2. I had more communication with the instructor					
Q3. I had to work harder this course.					
Q4. I found that I learned a lot in this course.					
Q5. The learning activities (e.g. assignment and projects) I worked on deal with real life applications and information in this course.					
Q6. The availability of content course materials, communication, and assessment tools helped me improved my learning.					
Q7. I applied my out-of-class experience and learn from its practical applications.					
Q8. I explored my own strategies for learning.					
Q9. I needed technical assistance for this class.					
Q10. Availability and access to technical support and resources helped me improved my learning.					
Q11. I would choose to take another hybrid course.					
Q12. Overall, I considered taking this hybrid course.					
Q13. Which part of the course you liked most that helped you improved learning?					
__a. Availability and access to online content and course materials __b. Enhanced communication using email, online discussion, assignment dropbox __c. Online testing and evaluation __d. Evaluation, feedback using the quiz and grade tools. __e. Ease of use of the Web environment __f. In-class group discussion __g. Group collaboration __h. Working on the assignments and class work by myself. Others, please indicate _____					
Q15. Please provide suggestions for improvement or comments about the delivery of the course using hybrid format.					

Appendix 21 - Online Survey Questionnaire (Traditional Course)

SURVEY QUESTIONNAIRE FOR 09MATH1411S (Traditional Course)

Dear Survey Participants,

Welcome and thank you for participating in this survey. The purpose of this survey is to determine the level of satisfaction and attitudes of students towards blended learning based on their learning experiences in this course. Your responses will be treated will high level of confidentiality. Your responses will not be considered in the evaluation of your course grade. This is not a course evaluation or evaluation of your instructor.

Once again, thank you for your participation in this survey.

Sincerely,
Dr. Carl Hoagland
choagland@umsl.edu

IMPORTANT INSTRUCTION: You must complete all the questions below to be able to submit your answers.

----------Start of Survey----------

A. DEMOGRAPHIC INFORMATION

Please select the option that best describe your situation or status.

Your age group:
___below 18 years old
___ 18 to 22 years old
___ 23 to 27 years old
___ 28 to 32 years old
___ 33 to 37 years old
___38 to 42 years old
___43 to 47 years old
___ 48 to 50 years old
___ above 50 years old

School/Academic Department
___ School of Business
___ School of Education
___ School of Health Professions
___College of Arts and Sciences

Current Occupation, please indicate
_____

Academic Level
___Freshmen
___Sophomore
___Junior
___Senior

Present Academic Status
___ Full-time with 13 credits or more
___ Part-time with less than 13 credits

Gender
___Male
___Female

Marital Status
___ Single
___Married
___Divorced
___Legally separated
___Widowed

Have previously taken an online or blended course?
___ Yes
____No

Your technology skills:
___No experience at all
___Novice user
___Experienced user
___Advanced user
___Expert user

B. SURVEY QUESTIONNAIRE

Please respond by marking the appropriate selection under each column for each question item.

Questions	Strongly Agree	Agree	Not Agree or Disagree	Disagree	Strongly Disagree
Q1. I communicated a lot with other students					
Q2. I had more communication with the instructor					
Q3. I had to work harder this course.					
Q4. I found that I learned a lot in this course.					
Q5. The learning activities (e.g. assignment and projects) I worked on deal with real life applications and information in this course.					
Q6. The availability of content course materials, communication, and assessment tools helped me improved my learning.					
Q7. I applied my out-of-class experience and learn from its practical applications.					
Q8. I explored my own strategies for learning.					
Q9. I needed technical assistance for this class.					
Q10. Availability and access to technical support and resources helped me improved my learning.					
Q11. I would choose to take another hybrid course.					
Q12. Overall, I considered taking this hybrid course.					
Q13. Which part of the course you liked most that helped you improved learning?					
__a. Availability and access to online content and course materials __b. Enhanced communication using email, online discussion, assignment dropbox __c. Online testing and evaluation __d. Evaluation, feedback using the quiz and grade tools. __e. Ease of use of the Web environment __f. In-class group discussion __g. Group collaboration __h. Working on the assignments and class work by myself. Others, please indicate _____					
Q15. Please provide suggestions for improvement or comments about the delivery of the course using hybrid format.					