AN ANALYSIS OF STUDENT PERFORMANCE IN INTERNET DELIVERED AND CLASSROOM-BASED INFORMATION TECHNOLOGY COURSES AT WAUKESHA COUNTY TECHNICAL COLLEGE

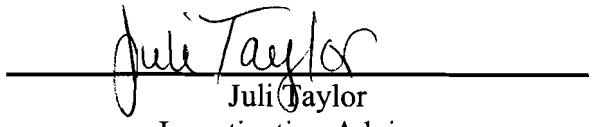
By

Todd M. Beidel

A Research Paper
Submitted in Partial Fulfillment of the
Requirements for the
Master of Science Degree
With a Major in

Career and Technical Education

Approved: 2 Semester Credits



Juli Taylor
Investigation Advisor

The Graduate School
University of Wisconsin-Stout
August, 2006

The Graduate School
University of Wisconsin-Stout
Menomonie, WI

Author: **Beidel, Todd M.**

Title: **An Analysis of Student Performance in Internet Delivered and Classroom-Based Information Technology Courses at Waukesha County Technical College**

Graduate Degree/ Major: **MS Career and Technical Education**

Research Adviser: **Julianne K. Taylor**

Month/Year: **August, 2006**

Number of Pages: **38**

Style Manual Used: **American Psychological Association, 5th edition**

ABSTRACT

As a result of more individuals gaining access to the Internet due to affordable connectivity options, technological progress and easier access to computers, a growing number of people are turning to online learning opportunities. While few may question the ability to deliver content in this fashion, many are critical of the quality of this alternative teaching method.

Online courses in the Business Information Technology Department at WCTC were first offered in 1998. As of the spring semester, 2006, research has not been conducted to determine the quality of any online courses offered within the department. The purpose of this study was to analyze the quality of online Information Technology courses at WCTC by determining whether statistically significant differences exists between student performance in traditional, classroom-led and non-traditional, online offerings of the Introduction to Microsoft Word course.

The first research question in this study sought to determine if WCTC students perform differently in an online class as compared to a traditional, classroom-led class. The results of this study showed that there was no difference in student performance for participants in either course delivery method. The second research question raised the matter of whether gender played a role with respect to student success in both online learning courses and traditional courses. Based on the findings of this study, it was determined that gender did not play a role in student performance. The third research question in this study sought to determine the role that age plays with respect to student success in both online and traditional courses. It was determined that younger students do not perform as well as their fellow older students. The final research question was designed to analyze the role that a student's cumulative GPA plays with respect to student success. It was discovered that students with higher GPAs are more likely to outperform students with lower GPAs.

Results of this study were consistent with findings discovered in the literature and shows that Information Technology students at WCTC perform equally well in the traditional and online delivery methods.

Table of Contents

Chapter I

Introduction

Background

Given the rapidly changing manner with which technology is altering the way that we live, it is only fitting that educational institutions would take advantage of various technological advances in order to reach a growing population of students interested in distance learning. As recent as the 2000–2001 academic year, there were an estimated 3,077,000 enrollments in all distance education courses offered by two-year and four-year institutions (U.S. Department of Education, 2003). Of these individuals, many are non-traditional students returning to school to complete educational studies they began as traditional-age students (Wagner, 2002). When used as a supplement to, and, in some cases, a complete alternative to classroom-led instruction, individuals are finding that they can acquire the knowledge and skill sets that previously eluded them in a way that conforms to their hectic lifestyles.

Dating back to the late nineteenth century, distance learning has taken on many forms. Initially introduced as a means of educating women and those in rural America, correspondence was achieved via printed materials sent through the mail as the main way of communication, teaching and learning (Nasseh, 1997). In keeping up with technological advances, distance learning course offerings during the twentieth century have been, at one time or another, made available through the use of such mediums as radio, television and videotape.

Embarking on the early stages of the twenty-first century, thousands of colleges and universities have embraced the use of high-tech multimedia presentations, computer-based training modules and the far-reaching effects of the Internet to reach out to a new market, the non-traditional student. According to the latest U.S. Department of Educations National Center

for Education Statistics regarding distance learning, 56% of two-year and four-year degree-granting institutions during the 2000-2001 academic year offered distance education courses with an additional 12% of institutions indicating that they planned to start offering distance education courses in the next three years. While this educational opportunity may, in fact, foster new relationships between students and institution, distance learning has become increasingly more popular with the traditional student who is exploring alternatives. In reality, whether students are attempting to finish their degree more rapidly or simply wish to enroll in more courses, many students taking distance learning courses are also taking at least one course on campus (Hyatt, 1998).

Online learning via the Internet and Computer-Based Training (CBT) modules, relative newcomers in the distance educational arena, have opened up a world of opportunity for single parents, physically disabled and those who, due to an already chaotic workweek, cannot or will not find the time to travel in order to assemble in a traditional instructor-led environment. In addition, an on-going trend indicates that the young and traditional students have increasingly begun to realize the new opportunities (Li, 2002).

At the same time, online learning satisfies a market-driven demand as numerous industries face a shortage of competent instructors able to deliver the necessary training to those in the workforce. By offering online learning, these industries can better position themselves to reach a larger, more diverse audience in order to remain competitive. With respect to faculty at two-year post-secondary institutions, the pool of qualified teacher candidates has dwindled precipitously as a result of retirements, increased enrollment, and class-size reduction initiatives (Association for Career and Technical Education, 2002).

While student perceptions are important, the ultimate indicator of course effectiveness is the degree to which students reach the objectives (Johnson, Aragon, Shaik & Palma-Rivas, 1999). This is no small feat as numerous roadblocks hinder students from meeting those objectives for the course. Among the barriers identified are a lack of experience with technology and a lack of support systems for the online learner (Miller & Lu, 2002).

Given the multitude of educational course offerings available to most individuals, one can only wonder how effective distance learning is at the post-secondary level. Are establishments of higher learning acting irresponsibly by offering entire degree programs by way of an educational delivery mechanism mired in controversy? While an abundance of research on the subject of online learning has been carried out over the last fifteen years, there is no clear-cut answer as to whether or not this non-traditional method is as effective from a student success standpoint when compared to its traditional, classroom-led counterpart. But, this much is true; research indicates that online education *can* be as effective as traditional face-to-face instruction when the methods and technologies used are appropriate to the instructional tasks, when there is student-to-student interaction, and when teacher/student feedback is timely (Verduin and Clark, 1991). A review of research literature comparing the effectiveness of online learning with that of face-to-face instruction finds that there is insufficient evidence to conclude that one method of course delivery is less effective than the other (Tucker, 2000).

Waukesha County Technical College (WCTC), one of the sixteen two-year technical colleges that comprise the Wisconsin Technical College System (WTCS), is located in Pewaukee, Wisconsin. WCTC was accredited in 2000 by the Higher Learning Commission (HLC) and is a member of the North Central Association (NCA) of Colleges and Schools. WCTC, through its commitment to quality and its philosophy of involving all stakeholders in

creating its future together, also subscribes to the Academic Quality Improvement Process (AQIP), an ongoing process of systemic quality improvement (Waukesha County Technical College, 2005).

During the past three decades, WCTC has incorporated various types of distance learning strategies into their course offerings. These include, but are not limited to, telecourses (both interactive television-based courses and videocassette courses), computer-based training modules and the Internet. Currently, a web-based instructional delivery tool called Blackboard is used to deliver online courses. For the spring semester of 2006, WCTC offered 95 different courses via online learning (Waukesha County Technical College, 2005).

The Department of Information Technology is the largest department within the Business Division at WCTC with respect to enrollment of students. Referred to as BIT, the department first offered online learning by way of the Internet in 1998 with the introduction of a course entitled Microcomputer Applications I (H. Smith, personal communication, June 5, 2005). For the fall semester of 2005, the BIT department offered 42 different courses via online learning (Waukesha County Technical College, 2005). Within the department, there are three two-year associate degrees that students may elect to pursue. These degrees are entitled Network Specialist, Computer Support Specialist and Programmer/Analyst. All students enrolled in one of these three programs are required to take and pass the Introduction to Microsoft Word course. This course has been offered in traditional (classroom-led) and non-traditional (online) versions since 1999.

While many students enrolled in one of the three degree programs within the BIT department at WCTC are taking advantage of courses offered in an online format, the effectiveness of this alternative delivery mechanism has not been evaluated. Moving forward,

this issue may have dire consequences as faculty make their own decisions as to whether or not they implement online learning strategies into their curriculum for individual courses and overall for the degree programs that they support. In addition, the manner with which adults learn and the various teaching and learning styles that WCTC instructors incorporate into their courses takes on a more important meaning.

Statement of the Problem

There is limited research regarding the effectiveness of online learning as a delivery mechanism at WCTC. As a result, educators at WCTC are ill-equipped to determine the legitimacy and appropriateness of implementing online learning strategies into their courses and programs.

Purpose of the Study

The purpose of this study is to determine the effectiveness (based on course grades and cumulative grade point average) of online learning as compared to its traditional, instructor-led counterpart for students enrolled in both types of course offerings of the Introduction to Microsoft Word class offered by the Business Information Technology department at WCTC.

Research Questions

This study will attempt to answer the following research questions:

1. How do WCTC students perform in an online class as compared to a traditional, face-to-face class of the Introduction to Microsoft Word class?
2. Does gender play a role with respect to student success in both online learning courses and instructor led courses?
3. Does age play a role with respect to student success in both online learning courses and instructor led courses?

4. Does current cumulative GPA play a role with respect to student success in both online learning courses and instructor led courses?

Importance of the Study

With an increasing number of educators attempting to remain on the leading edge with respect to alternative ways of reaching their students, it becomes imperative that they determine whether or not this instructional offering is a viable, successful substitute for the conventional classroom. In addition, instructors should be aware of whether or not students that enroll in an online course will have an equal opportunity to meet the course objectives, obtain a passing grade for the course and remain as a student in the course as compared to those students who opt to enroll in the traditional, classroom-led offering. Furthermore, with a growing population of adults aged 65 years or older expected to increase from 12 percent of the population in 1980 to more than 21 percent by the year 2030, adult educators need to understand both the uniqueness of these older adults and the barriers they face (Davis, 2001). This will be critical in deciding whether or not online learning is appropriate for this demographic.

Assumptions of the Study

The following are assumptions of this study:

1. This study assumes that data received from the Office of the Registrar at WCTC is accurate.
2. While the curriculum was identical for both the non-traditional and traditional offerings of the Introduction to Microsoft Word course (H. Smith, personal communication, June 5, 2005), this study assumes that all of the course material is covered, regardless of delivery mechanism used.

3. While the grading rubrics used to assess students was identical for both the non-traditional and traditional offerings of the Introduction to Microsoft Word course (H. Smith, personal communication, June 5, 2005), this study assumes that these rubrics were utilized appropriately, regardless of delivery mechanism used.
4. This study assumes that students who chose to enroll in the non-traditional course offering had previously filled out the "Independent Learner Profile" form located on WCTC's distance learning web site.
5. This study assumes that students who chose to enroll in the non-traditional course offering viewed the "Keys to Success in Online Learning", "Technical & Internet Experience" and "Computer & Software Requirements" links on WCTC's distance learning web site. A further assumption is made that students followed the recommendations and adhered to the minimum requirements necessary.

Limitations of the Study

The following are limitations of this study:

1. The study is limited to the inclusion of students who have completed a non-traditional or traditional offering of the Introduction to Microsoft Word course at WCTC during the 4-year span beginning in the 2001/2002 school year and ending with the 2004/2005 school year.
2. Various offerings of both non-traditional and traditional courses were taught by different instructors. As a result, the question as to whether or not an instructor implemented the grading rubric is a limitation (despite the fact that instructors *should be* making use of the same rubric).

3. Lack of comfort and motivation with non-traditional learning, lack of adequate support systems and failure of students to possess adequate prerequisite abilities associated with non-traditional learning may pose problems for those students taking the non-traditional course offering. This could lead to performance problems.
4. Failure of the student to manage their time accordingly with respect to meeting the objectives of the non-traditional course may cause them to perform at a lower level.

Definition of Terms

The following terms are defined for the purpose of this study:

1. Accreditation: To recognize an educational institution as maintaining standards that qualify the graduates for admission to higher or more specialized institutions or for professional practice (Merriam-Webster- online, 2005).
2. Student success: Receiving a passing grade for the course.
3. Telecourses: An alternative to on-campus classes whereby lectures are delivered via televised or video cassette programs that students can watch at home.
4. Information Technology program student: a student who has formally enrolled in one of the three associate degree programs found within the Information Technology department at WCTC.
5. Traditional offering: a course offered in an instructor-led capacity within the confines of a classroom.
6. Non-traditional offering: a course offered entirely in an online format.

Chapter II

Review of Literature

Introduction

This chapter will discuss the practice of non-traditional learning from a historical context and its subsequent evolution into an alternative means of educating students by way of online learning using the Internet and computer-based training modules. A review of the literature will provide an examination of this evolution of non-traditional learning and current research will be analyzed to determine the findings of the effectiveness of this educational strategy. This chapter will conclude with a discussion regarding the evolution of online learning opportunities offered within the Business Information Technology (BIT) Department at Waukesha County Technical College (WCTC) and a brief look at the course, Introduction to Microsoft Word, that is the focal point of this study.

History of the Internet

The origins of the Internet date back to 1969. The United States DoD (Department of Defense), seeing a need to protect national security by maintaining global communications between governmental and military entities, developed the first packet-switching network and added the first host computer on the UCLA campus in September of that year. The DoD's Advanced Research Projects Agency (better known as DARPA) was based on work previously performed by researchers at MIT, the RAND Corporation and the National Physical Laboratory (NPL). This early communications network became known as the ARPANET and would continue to evolve to the present day. Four host computers, referred to as "nodes", comprised the initial ARPANET. These were located at four major U.S. universities- the University of California at Los Angeles, the University of California at Santa Barbara, the University of Utah,

and the Stanford Research Institute (Moschovits, Poole, Schuyler & Senft, 1999). It should be noted that even at this early stage, the networking research incorporated both work on the underlying network and work on how to utilize the network. This tradition continues to this day (Internet Society, A Brief History of the Internet, 2005).

While the Internet began as a project initiated by the United States military, the ramifications that resulted from the communications possibilities among universities drove its evolution to greater heights. During the tumultuous 1960s, with thousands of teenagers seeking out new paths as hippies, activists, and anarchists, computer networking in the 1960s went through an adolescent rebellion of its own. Originally a spawn of the establishment, ARPANET was turned over to universities, where it was forever transformed by the counterculture (Moschovits, Poole, Schuyler & Senft, 1999). Largely the result of work performed by the Network Working Group, a self-named group of sixty-eight graduate students from major universities, the Internet continued to evolve as a result of Requests for Comments (RFCs), the foundational documents that define existing and developing Internet standards. By deviating from the centralized control that was typical within most computing circles during that time, RFCs provided a more non-threatening, open forum that perpetuated the viewpoint of the ARPANET as an open "club" that all individuals were able to join. Contrary to the limitations that proprietary vendors must deal with, it is largely through this innovative, open initiative that the Internet was able to thrive and evolve as it has over the past thirty-five years.

Paramount to the success of the Internet have been four distinct aspects: (1) the technological evolution and continual expansion of the infrastructure; (2) operations and management; (3) the social aspect; and (4) commercialization (Kahn, Leiner, Cerf, Clark,

Kleinrock, Lynch, Postel, Roberts & Wolff, 1997). It is the social aspect that will be analyzed with respect to the effectiveness of online learning by way of the Internet.

Distance Learning

As an alternative to traditional classroom-based learning, distance learning has been employed historically via a wide variety of strategies including correspondence through mail and communications through the use of mediums such as radio, television and videotape. With the introduction and subsequent evolution of the Internet as a means to communicate with students, educational faculty and administrators should take care in determining the legitimacy of an online education. Although distance learning environments may provide convenient and cost-effective course offerings, the conditions for promoting effective learning experiences have not been fully researched (Quitadamo, Ian & Brown, 2001). At the center of much of the debate regarding distance learning environments is the absence of regular, face-to-face interaction of professor to student, as well as students to other students (Arant, Coleman & Daniel, 2002). As a result, the question of the effectiveness of online learning is cause for concern among educators.

Although this alternative means of receiving an education is growing in its popularity, it is certainly not void of criticism. Online instruction threatens to commercialize education, isolate students and faculty, reduce standards and devalue university degrees (Gallick, 1998). It is therefore in the best interests of educators to expand their knowledgebase regarding the outcomes, procedures and overall effectiveness of online learning. This will help educators make more informed decisions about future online course development and implementation (Johnson, S.D., Aragon, S.R., Shaik, N. & Palma-Rivas, N., 1999).

The convenience of receiving an online education lends itself to a growing population of retirees who, due to mobility and travel during their retirement years, are looking for alternative

means of learning new skills. With the percentage of adults aged 65 years or older expected to increase from 12 percent of the population in 1980 to more than 21 percent by the year 2030 and with many adults staying involved with learning activities well into their 80s and 90s, educational organizations have a great opportunity to supply learning activities to this population (Davis, 2001).

Evolution of Online Learning at WCTC

Waukesha County Technical College first offered online learning courses via the Internet in 1996 through the use of the HyperText Mark-up Language (html) and FrontPage running on a web host. This initial online offering marked the first of three versions of this alternative learning method. In 1998, the second iteration of online learning was made available at the college by way of a software package called TopClass. It was in 2000 that the third and current implementation of distance learning via the Internet was made possible by way of a Web-based course delivery tool called BlackBoard. The use of Blackboard is at the discretion of the instructor teaching the course and consists of several key components. Blackboard offers the ability to deliver course content, communicate expectations of students in the course via announcements and allows for students to communicate with one another using an online discussion format.

Document distribution, online testing, gradebook capabilities and student feedback in the form of surveys are just some of the additional components that can be utilized in BlackBoard. As a result of what BlackBoard has to offer, its mission of allowing students to "stay connected" when not physically congregating in a classroom is serving its purpose. In addition, as part of the college's initiative to migrate towards a single sign-on with respect to accessing services for faculty and students alike, BlackBoard is linked to the Student Information System (SIS)

database as well as student's email accounts, offering a "one-stop shop" online experience (R. Rodee, personal communication, September 12, 2005).

As of the fall semester, 2005, all course offerings supported within a degree program at WCTC have one or more BlackBoard components associated with them. While the use of Blackboard is strongly encouraged by WCTC management, its use for a specific course is at the discretion of the lead instructor responsible for that course. This applies to class sections that are offered entirely in an online format as well as those that consist of a blended format whereby traditional classroom-led instruction is combined with an online learning component. The number of courses available in the fall semester of 2005 that can use Blackboard totals just over 1,500 with approximately 9,000 students enrolled. With respect to courses that are offered entirely online (i.e. lacking a classroom component and delivered 100% via BlackBoard), there are currently 60 courses offered per semester with just over 1,100 students enrolled.

WCTC Information Technology Online Offerings

The Wisconsin Technical College System (WTCS) consists of 16 technical colleges throughout the state. Waukesha County Technical College, located in Pewaukee, Wisconsin, has an overall student enrollment of more than 32,000 students, with over 9,000 of these students enrolled in degree programs (Waukesha County Technical College, 2005a). Offering over 100 different areas of study, WCTC has found it increasingly important to implement various forms of online learning in order to reach its students.

The BIT Department offers a variety of courses available in both traditional classroom-led and online formats. Among these courses are Introduction to Microsoft Word, Introduction to Microsoft Excel, Introduction to Microsoft Access, Computer Concepts and Web Page Development. The Introduction to Microsoft Word course is aimed at getting students acquainted

with the fundamentals of word processing and the use of microcomputer hardware and software. The primary outcome is for students to become proficient users of the Microsoft Word application (H. Smith, personal communication, September 23, 2005). This course is viewed as a basic introductory course for all IT professionals and is a required class in all three of the associate degrees that are offered in the BIT department. Typically, students enrolled in this course are students that are already enrolled in one of the following programs: Network Specialist, Computer Support Specialist, or Programmer/Analyst.

The Information Technology department at WCTC started offering Internet-based online sections of the Introduction to Microsoft Word course during the fall semester of 1999 with six students enrolled (H. Smith, personal communication, September 23, 2005). From that time to the current semester (spring, 2006), one or two online offerings of the Introduction to Microsoft Word course have been offered each semester with enrollment holding steady at between 15 and 20 students.

Chapter III

Methodology

Introduction

The purpose of this study was to analyze the effectiveness of an online information technology course at WCTC by determining whether there were statistically significant differences between a classroom-based course and online offering with respect to student outcomes. This chapter will discuss the causal-comparative study that was conducted for a sample of students as well as both the independent and dependent variables involved. The research design will be shown to include quantitative statistical procedures.

Selection and Description of Sample

Participants in the study consisted of students who had successfully enrolled in and completed classroom-led or online Information Technology courses at WCTC between the fall semester of 2001 and the spring semester of 2005. For the time period analyzed in this study, students had the option of enrolling in either the online or classroom-led format of the course. The selected courses were offered at least once in both online and classroom-led formats during each semester and had at least fifteen students enrolled in each section offered.

Instrumentation

To determine the effectiveness of each method of instruction, data in the form of final course grade, cumulative grade point average (GPA), gender and age of each student was obtained from the Registrar at WCTC. The scoring rubric rating scale used to determine grade achieved in the course is numerical and was developed by the lead instructor for the course. It is implemented by all instructors who teach the course regardless of delivery mechanism used (H. Smith, personal communication, September 27, 2005). Assuming all instructors, regardless of

delivery mode, used the rubric, course grades are reliable. No measures of validity have been documented.

Data Collection

The data that used in this study was from the Registration Department at WCTC. The course number and name of the course (107-007: Introduction to Microsoft Word) were given to the registrar with instructions on providing the following information: identifier to uniquely represent each student, age of student, gender of student, semester that the course was taken by student, method of course delivery, course grade, current cumulative GPA at the time the course was taken and section number for the course. In the event that a student took the course more than one time during different terms, that participant would be represented by more than one data record. The Registration Department produced a total of 809 data records. Of those data records, 581 were from students who had finished the course and had complete data records. The study consisted of 332 male participants and 249 female participants.

Data Analysis

The data in this study was analyzed to determine the differences in student performance (the dependent variable) while the method of instruction (the independent variable) was manipulated. Student grades were examined based on whether the student was enrolled in the classroom-led offering of the selected course or the online offering. Listed below are the research questions for the study and the statistical techniques used to answer them.

1. Research question #1: How do WCTC students perform in an online class as compared to a traditional, face-to-face class of the Introduction to Microsoft Word class? An independent groups t-test against course grades was implemented using method of instruction as the independent variable to determine if a statistically

significant difference exists with respect to student grade earned relative to delivery mechanism.

2. Research question #2: Does gender play a role with respect to student success in both online learning courses and instructor led courses? A two-way analysis of variance against student grades was used with method of delivery and gender acting as the independent variables while course grade acted as the dependent variable. This was done to ascertain if differences in students' grades exist due to gender.

3. Research question #3: Does age play a role with respect to student success in both online learning courses and instructor led courses? A two-way analysis of variance against student grades was used with method of delivery and age acting as the independent variables while course grade acted as the dependent variable. This was done to ascertain if differences in students' grades exist due to differences in students' ages.

4. Research question #4: Does current cumulative GPA play a role with respect to student success in both online learning courses and instructor led courses? A two-way analysis of variance against student grades was used with method of delivery and cumulative GPA acting as the independent variables while course grade acted as the dependent variable. This was done to ascertain if differences in students' grades exist due to differences in students' cumulative GPAs.

Limitations

The following are limitations of this study relative to the methodology used:

1. The study is limited to the sample of students who have completed an online or classroom-based offering of the Introduction to Microsoft Word course at WCTC during the 3-year span beginning in the 2001/2002 school year and ending with the 2004/2005 school year.
2. Low grades earned in the course could be attributed to a student's slow and/or unreliable connection to the Internet, causing frustration and hindering motivation and therefore, lowering overall performance.
3. There was an unequal balance of participants in the online vs. traditional courses. The greater number of participants in the traditional offerings may have caused statistical variations.
4. Due to different instructors (both full-time and part-time faculty) teaching different offerings of the selected course, lack of coordination and control over students could cause students to lose sight of course goals (Auter & Hanna, 1996) and therefore, cause them to perform poorly or withdraw from the course.
5. Subjectiveness of grading individual assignments by different instructors is also a limitation. As a result of this, the way instructors calculate final course grades might be unequal.

Students that enroll in an online course at WCTC are expected to possess a minimum level of computer-related competencies. Through a learning style assessment offered on the WCTC distance learning page, students are encouraged to exhibit these necessary capabilities

prior to enrolling in an online offering. Since this is not a requirement, students may not "heed the warning" and may therefore encounter problems due to their lack of basic computer-related abilities. Students lacking these skills are more prone to performing poorly in the course or may drop the course altogether. The researcher had no way of determining whether or not a student enrolled in the online offering of the course possessed the minimum level of computer-related skills necessary to perform well in the class.

Students chose the type of delivery method based upon their own personal inclination. Random assignment of participants in each of the delivery methods was not performed. As a result, gender breakdown, age distribution, number of participants in each delivery method and cumulative GPAs for students enrolling in the courses was unequal.

Several limitations existed for this study which gave the researcher no choice but to make generalizations regarding the results of the study. Students may not have had adequate access to a computer and the appropriate technology necessary to properly complete an online course. Slow and/or unreliable Internet connectivity may have affected a student's performance causing them to underperform or, worse yet, drop out of the course. While WCTC provides documentation regarding the recommended minimum requirements necessary to take an online course, these are only recommendations. Students enrolling in an online offering at WCTC are not required to meet these minimum requirements.

Chapter IV

Results

Introduction

The purpose of this study was to examine the effectiveness of non-traditional, computer-based Information Technology courses offered at WCTC by determining whether a statistically significant difference exists between the grades earned in non-traditional, computer-based and those earned in traditional, classroom-led courses for students enrolled in both types of offerings of Introduction to Microsoft Word courses between fall 2001 and spring 2005. Analysis of data was also performed in order to determine if there exists a difference with respect to course grades achieved in non-traditional and traditional courses when students were categorized by age and gender. Data used to perform this study was provided by the Registrar's Office at WCTC, Pewaukee, Wisconsin.

Findings

Upon analysis of the 581 individuals that completed the Introduction to Microsoft Word course, 91 (15.7%) students took the non-traditional, computer-based offering and 490 (84.3%) students took the traditional, classroom-led offering. The breakdown of students based on gender and delivery mechanism for the period of the study is shown in Table 1.

Table 1

Breakdown of Students by Gender and Delivery Environment

Delivery Environment		Males	Females	Total
Traditional	N	284	206	490
	%	85.5	82.7	84.3
Online	N	48	43	91
	%	14.5	17.3	15.7
Total	N	332	249	581
	%	100	100	100

The average age of student at WCTC as of the 2005/2006 academic year was 37 years old (Waukesha County Technical College, 2005a). Through the Youth Options program at WCTC, existing high school students are allowed to enroll in WCTC courses. In addition, WCTC caters to working professionals and retirees. As a result, there was a broad range with respect to age of student for participants in this study. Participants in the study ranged in age from 17 to 67. Four distinct age groups were created to simplify the analysis of the data. The breakdown of participants by age group and course delivery mechanism are shown below in Table 2. The largest number of participants, 242 (41.5%), for this study comes from the $\leq$21 age group. The sheer number of those that most recently graduated from high school that enrolled in the course may not be surprising but it is rather shocking that only 20 (8.3%) of the 242 students in this age group chose to take the alternative offering of the course, given this demographics' relative comfort level with technology. It is not surprising that only 11 (10.6%) students in the $\geq$41 age group enrolled in the alternative offering of the course. This may be due to the lack of comfort level that "baby boomers" have with technology.

Table 2

Breakdown of Students by Age Group and Delivery Environment

Age Group		Traditional	Alternative	Total
≤21	N	222	20	242
	%	45.1	22.0	41.5
22-30	N	126	35	161
	%	25.6	38.5	27.6
31-40	N	51	25	76
	%	10.4	27.5	13.0
≥41	N	93	11	104
	%	18.9	12.1	17.8
Total	N	492	91	581
	%	84.4	15.6	100

In order to analyze differences in student grades earned based upon delivery mechanism, both descriptive and inferential statistics were used. The results of the analysis of earned student grade in both non-traditional and traditional environments based on the effect that gender and age contributed to observable performance differences between participants in both delivery environments is shown in tables 3 through 9. In order to more easily interpret the data, course letter grades have been translated into a four-point numeric scale. Table 3 displays the numeric values used and shows the distribution of course grades for all students enrolled in either the non-traditional or traditional delivery environment for the terms of the study. A total of 101 (17.3%) students achieved an "A" grade for the course and 102 (17.5%) students earned a solid "B" in the course.

Table 3

Student Grades Earned

Grade	Point Value Range	Frequency	Percent
A	4.00	101	17.3
A-	3.67 – 3.99	54	9.3
B+	3.33 – 3.66	42	7.2
B	3.00 – 3.32	102	17.5
B-	2.67 – 2.99	37	6.3
C+	2.33 – 2.66	32	5.5
C	2.00 – 2.32	56	9.6
C-	1.67 – 1.99	22	3.8
D+	1.33 – 1.66	8	1.4
D	1.00 – 1.32	25	4.3
D-	0.67 – 0.99	12	2.1
F/WF	0.00 – 0.66	92	15.8
Total		581	100

Table 4 shows the breakdown of course grades for all participants of the study based upon age groups. Participants in the study ranged in age from 17 to 67 years of age and divided into four distinct age groups to simplify the data analysis. Upon review of Table 4, it is interesting to note that a rather large number, 39 (16.1%), of those participants in the ≤21 age group failed the course or withdrew with a failing grade (as indicated by a "WF" grade). At the other end of the spectrum, the ≥41 age group saw a relatively low fail rate (5.8%). In addition, Table 4 indicates that as students grow older, their likelihood of earning a higher grade increases. The highest percentage of students that earned a grade of "A" came from the 31-40 age group.

Meanwhile, the highest percentage of students that earned a grade of "B" came from the ≥41 age group.

Table 4

Grade Distribution based on Age Group

Grade Earned		≤21	22 – 30	31 – 40	≥41	Total
A	N	41	23	16	21	101
	%	16.9	14.2	21.0	20.2	17.4
A-	N	16	17	13	8	54
	%	6.7	10.6	17.1	7.7	9.3
B+	N	18	13	5	6	42
	%	7.4	8.0	6.6	5.8	7.2
B	N	35	32	13	22	102
	%	14.4	19.9	17.1	21.1	17.6
B-	N	16	12	1	8	37
	%	6.6	7.5	1.3	7.7	6.4
C+	N	17	8	2	5	32
	%	7.0	5.0	2.6	4.8	5.5
C	N	20	14	10	12	56
	%	8.3	8.7	13.2	11.5	9.6
C-	N	16	1	1	4	22
	%	6.7	0.6	1.3	3.8	3.8
D+	N	3	1	1	3	8
	%	1.2	0.6	1.3	2.9	1.4
D	N	15	3	1	6	25
	%	6.1	1.9	1.3	5.8	4.3
D-	N	6	3	0	3	12
	%	2.5	1.9	0.0	2.9	2.0
F/WF	N	39	34	13	6	92
	%	16.1	21.0	17.1	5.8	15.8
Total	N	242	161	76	104	581

Using delivery method as the independent variable, an independent groups t-test against course grades was performed. As a result of the large number of data records (581), the results of this test were found to be reliable in detecting the presence of a statistically significant variance between the grades that students earned in both the traditional and online offerings. The 2-tail significance of 0.01 shows that there is no statistically significant difference in performance in either the traditional or online group (level = 0.01). In addition, the low F value of 7.967 in a sample of this size points to a small amount of variance between the two delivery mechanisms. The results are shown in Table 5.

Table 5

Grade Analysis by Traditional and Online Delivery Method

Delivery Method	n	Mean	Std. Dev.	2-tail Sig.	df	F
Traditional	490	2.53	1.272	0.010	1.577	7.967
Online	91	1.83	1.620			

In order to evaluate any differences in student performance, a two-way analysis of variance on grades was conducted. This test used delivery mechanism (traditional and online) and gender as the independent variables. Upon observing the descriptive statistics in Table 6, there is only a slight difference in grades earned between males and females when the traditional delivery method is used. Males earned a mean grade of 2.51 (on a 4.00 scale) while females earned a mean grade of 2.56. On the other hand, there is a more pronounced difference in grades earned between males and females when the online delivery method is used. Males earned only a 1.63 mean grade while females performed much better, earning a mean grade of 2.05. But, upon analyzing the ANOVA data (Table 7), there exists no statistically significant main effects. Additionally, there is no statistically significant interaction at the 0.01 level between delivery

mechanism and gender. As a result, this shows that the relationship between gender and delivery mechanism is not likely to be predictive of student performance. In other words, observed differences in student performance based upon gender might well be a chance observation.

Table 6

Breakdown of Grades by Delivery Method and Gender

Delivery Method		Males	Females	Total
Traditional	Count	284	206	490
	Mean	2.51	2.56	2.53
	Std. Dev.	1.31	1.22	1.27
Online	Count	48	43	91
	Mean	1.63	2.05	1.83
	Std. Dev.	1.60	1.63	1.62
Total	Count	332	249	581
	Mean	2.39	2.47	2.42
	Std. Dev.	1.39	1.31	1.36

Table 7

ANOVA of Grades by Delivery Method and Gender

Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
Main Effects (combined)	39.816	2	19.908	11.230	0.00
Main Effects (delivery mechanism)	38.741	1	38.741	21.855	0.01
Main Effects (gender)	1.623	1	1.623	0.915	0.339
2-Way Interactions (delivery mechanism* gender)	2.553	1	2.553	1.44	0.231

The next test performed was a two-way analysis of variance on grades with age category and delivery mechanism used as the independent variables. The purpose of this test was to assess student performance based on age of the student. Upon review of Table 8, there is a statistically significant difference in performance based on age category. Those students in the ≤21 age category displayed the lowest mean performance (2.31) among all groups, independent of delivery method used. The mean performance of students in the 31-40 age category was highest (2.86) when the traditional delivery method was used. Ultimately (and independent of the delivery method used), mean performance improved from the ≤21 age category (2.31) up to the ≥41 age category (2.64). Those in the 22-30 age category scored at 2.36 while those in the 31-40 age category scored at 2.61. These findings imply that the difference in how well a student

performs (based upon earned grade) is due to age and not a chance observation. It is, however, interesting to note that those participants in the ≥41 age category had a slightly lower mean score (2.61) than their 31-40 year old counterparts (mean score of 2.86) when taking the traditional offering but performed significantly better (2.97) than this other group (2.12) when taking the online offering. Additionally, those in the ≥41 age group performed better in the online course (2.97) than they did in the traditional course (2.61).

Table 8

Breakdown of Grades by Delivery Method and Age Group

Delivery Method		Age Group				
		≤21	22–30	31–40	≥41	Total
Traditional	Count	222	126	51	93	492
	Mean	2.43	2.54	2.86	2.61	2.54
	Std. Dev.	1.29	1.32	1.19	1.15	1.27
Online	Count	20	35	25	11	91
	Mean	1.03	1.71	2.12	2.97	1.83
	Std. Dev.	1.44	1.60	1.68	1.14	1.62
Total	Count	242	161	76	104	581
	Mean	2.31	2.36	2.61	2.64	2.42
	Std. Dev.	1.36	1.42	1.40	1.15	1.35

Table 9

ANOVA of Grades by Delivery Method and Age Category

Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
Main Effects (combined)	56.367	4	14.092	8.188	0.00
Main Effects (delivery mechanism)	19.895	3	6.632	3.853	0.01
Main Effects (age)	17.944	3	5.981	3.475	0.05
2-Way Interactions (delivery mechanism* gender)	44.961	1	44.961	26.124	0.00

A two-way analysis of variance on grades using delivery method and cumulative grade point average as the independent variables was implemented to determine differences in student performance. Table 10 shows that the ANOVA data displays a statistically significant difference between the grade that a student earns and the cumulative GPA for the student. The results of the study show that there are significant differences in the performance of the participants based upon cumulative GPA, $F(1 , 579) = 4.853$, $p < 0.08$. These findings show that the cumulative GPA for a student at the time that they take a course is predictive of student performance for both delivery methods.

Table 10

ANOVA of Grades by Delivery Method and Cumulative GPA

Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
Main Effects (combined)	13.167	2	6.583	4.853	0.08
Main Effects (delivery mechanism)	0.011	1	0.011	0.008	0.928
Main Effects (GPA)	13.124	1	13.124	9.674	0.002
2-Way Interactions (delivery mechanism* GPA)	0.084	1	0.084	0.062	0.804

Summary

The results of this study indicate that gender does not predict student performance for traditional and online delivery methods. Course grades earned by both male and female students were found to be statistically equivalent. On the other hand, a student's cumulative GPA (at the time they take the course) appears to be a factor in predicting student performance in a course. With respect to the age of a student, it is clear that performance levels improve with age for both types of offerings with the exception of students in the ≥41 age group performing slightly better online and not as well as those in the 31-40 age group when taking the traditional offering.

Chapter V

Summary, Conclusions and Recommendations

Introduction

The purpose of this study was to examine the quality of an online Information Technology course at WCTC by determining whether statistically significant differences existed between student performance in traditional and online offerings of the Introduction to Microsoft Word course. Student gender, age, earned grade, and cumulative GPA were all analyzed.

Summary and Conclusions

The participants in this study consisted of 581 students who completed the Introduction to Microsoft Word course between the fall semester of 2001 and the spring semester of 2005. There were 332 male students and 249 female students. Age of student ranged from 17 to 67 years. Both traditional, classroom-led and non-tradition, online offerings of the course were available for the duration of the study. Of the 581 participants, 84% (N=490) enrolled in the traditional offering while 16% (N=91) enrolled in the online offering.

In order to properly shed light on how the analysis of data answers each of the four research questions, research questions will be reiterated here along with the statistical tool used and analysis of the results explained.

1. How do WCTC students perform in an online class as compared to a traditional, face-to-face class of the Introduction to Microsoft Word class?

The first finding was that no statistically significant difference (2-tail significance = 0.01, F=7.967) exists between student performance in traditional and online delivery methods. Due to this fact, we determine that both delivery methods are of similar quality when evaluated with respect to student grades.

2. Does gender play a role with respect to student success in both online learning courses and instructor led courses?

The second finding that relates to research question #2 is that there is no statistically significant difference (F = 11.230) with respect to student performance based upon gender. This may be explained by the fact that there were a larger number of males (332) as compared to females (249) enrolled in the course. On the other hand, it may indicate that both males and females perform similarly in both delivery methods.

3. Does age play a role with respect to student success in both online learning courses and instructor led courses?

The third finding shows that there is a significant difference in performance with respect to a student's age. Mean performance overall improved with each increasing age group of student. This might be explained by an older student's propensity for various motivating factors. Older students may be embarking on a career change, hoping to earn a promotion in their current position or pursuing an industry certification within their current job. In addition, those students that have just graduated from high school may not have achieved the necessary maturity level to

succeed at the postsecondary level. Meanwhile, the older student has managed to gather years of real-world life experiences that may allow them to focus more energy on the learning process. On the other hand, the older student may also have more life challenges that present barriers to learning. These may include raising children, taking care of an ailing parent, and maintaining a job.

4. Does current cumulative GPA play a role with respect to student success in both online learning courses and instructor led courses?

The final finding of this study shows that there is a statistically significant difference between a participant's current GPA when they enroll in a course and the course grade that they earn. These findings suggest that cumulative GPA is predictive of student performance for both traditional and online offerings. Therefore, students who have higher cumulative GPAs upon entering a course would be expected to earn higher grades in the course than students with lower cumulative GPAs.

Additionally, the researcher had no way to determine why nearly 28% of students (N=226) originally enrolled in one of the two types of offerings failed to complete the course. Students that did not complete the course either withdrew from the course prior to the end of the semester or chose to audit the course and not receive a final course grade for the class. In either case, the researcher had no way to determine whether the students themselves willingly chose to not receive a grade for the course or if there were some underlying issue related to the course itself.

Recommendations

The findings of this study demonstrate that the quality of online course offerings, as it relates to student performance based on final course grades, is equivalent to traditional, classroom-led offerings. As a result, online course offerings should remain as an alternative delivery method within the BIT Department at WCTC. While this study was limited in scope to students that took either the traditional or online offering of the Introduction to Microsoft Word course at WCTC, the results cannot be universally applied to other courses either at WCTC or at other educational environments. Therefore, other institutions as well as the remaining departments at WCTC should consider assessing student performance in online courses as compared to their traditional counterparts.

While students are encouraged to determine on their own if they are an appropriate candidate for online learning, there have been no studies that provide evidence supporting the link between these readiness assessments and performance in the online course. Further research should be performed in BIT at WCTC to help determine the legitimacy of the self-assessment utilities that students use to help them decide whether or not online learning is appropriate for them.

Within a classroom setting the instructor is able to monitor student activities and facilitate the learning process in a hands-on manner. Online learning, on the other hand, insists that the student be self-motivated, more organized and possess better time management skills because of the relationship between student success and time-on-task (Shyu & Brown, 1992). As a result of this, educators need to be aware of how to better assist online students who tend to lose focus and get off track during the course. Education regarding online learning effectiveness and a continued understanding of adult learning theory and learning styles needs to be emphasized

among faculty (Aragon, Johnson & Shaik, 2000). This may help students remain on task and perform better in an online course. Researchers that perform this study in the future should ascertain whether a student failed the course or audited the course and, therefore, chose to not receive a grade.

As more and more courses are converted to online delivery, this study should be replicated both in other BIT courses and throughout WCTC and the WTCS to prove reliability.

References

Arant, M.P., Coleman, A.M. & Daniel, B.V. (2002). *Instructional Strategies for On-line Courses in Education.* Presented at the Annual Meeting of the Mid-South Educational Research Association, November 6-8, 2002, Chattanooga, TN. Retrieved July 17, 2005, from EBSCOhost database (Eric No. ED471350).

Auter, P. & Hanna, M. (1996). *The Challenge of Developing On-Line Courses.* Presented at the Annual Meeting of the Speech Communication Association, November 1996, San Diego, CA. Retrieved September 24, 2005, from EBSCOhost database (Eric No. ED406701).

Aragon, S., Johnson, S.D. & Shaik, N. (2000). *The Influence of Learning Style Preferences on Student Success in Online vs. Face-to-Face Environments.* University of Illinois at Urbana-Champaign. Retrieved June 1, 2005, from EBSCOhost database (Eric No. ED448745).

Davis, A. (2001). *The Impact of Aging on Education.* Adult, Career, and Vocational Education. Retrieved June 1, 2005, from EBSCOhost database (Eric No. ED458405).

Hyatt, S. (1998). *Distance Learning in the Millennium: Where is it Going?* Online Journal of Distance Learning Administration, Volume I, Number 1, State University of West Georgia, Distance Education.

Internet Society, (2005). *A Brief History of the Internet.* Retrieved September 22, 2005, http://www.isoc.org/internet/history/brief.shtml

Johnson, S.D., Aragon, S.R., Shaik, N. & Palma-Rivas, N. (1999). *Comparative Analysis of Online vs. Face-to-Face Instruction.* Retrieved September 13, 2005, from EBSCOhost database (Eric No. 448722).

Kahn, R., Leiner, B., Cerf, V., Clark, D., Kleinrock, L., Lynch, D., Postel, J., Roberts, L. & Wolff, S. (1997). *The Evolution of the Internet as a Global Information System.* Retrieved October 2, 2005, from EBSCOhost database (Eric No. EJ565404).

Li, H. (2002). *Distance Education: Pros, Cons, and the Future.* Presented at the Annual Meeting of the Western States Communication Association, March 2002, Long Beach, CA. Retrieved June 1, 2005, from EBSCOhost database (Eric No. ED461903).

Merriam-Webster online (2005). Retrieved June 4, 2005, http://www.m-w.com/home.htm

Miller, M.T. & Lu, M. (2002). *Barriers and Challenges to Serving Non-Traditional Students in E-Learning Environments.* San Jose State University. Retrieved June 2, 2005, from EBSCOhost database (Eric No. ED468117).

Moschovits, C., Poole, H., Schuyler, T. & Senft, T. (1999). *History of the Internet.* Retrieved September 14, 2005, http://www.historyoftheinternet.com

Nasseh, B. (1997), *A brief history of distance education*, Retrieved June 21, 2005, http://www.bsu.edu/classes/nasseh/study/history.html

Quitadamo, I.J. & Brown, A. (2001). *Effective teaching styles and instructional design for online learning environments.* National Educational Computing Conference, "Building on the Future", July 25-27, 2001, Chicago, IL. Retrieved July 20, 2005, from EBSCOhost database (Eric No. ED462942).

Shyu, H. & Brown, S.W. (1992). *Learner control versus program control in interactive videodisc instruction: What are the effects in procedural learning.* International Journal of Instructional Media, Retrieved June 26, 2005.

Tucker, S. (2000). *Assessing the Effectiveness of Distance Education versus Traditional On-Campus Education*. Presented at the Annual Meeting of the American Educational Research Association, April 2000, New Orleans, LA. Retrieved May 29, 2005, from EBSCOhost database (Eric No. ED443378).

United States Department of Education, National Center for Education Statistics. (2003). *Distance Education at Degree-Granting Postsecondary Institutions.* Retrieved June 2, 2005, http://nces.ed.gov/

Verduin, J. R. and Clark, T. (1991). *Distance Education: the foundations of effective practice*, San Francisco, CA: Jossey-Bass Publishers.

Wagner, J.G. (2002). *Teaching the Growing Population of Nontraditional Students*. National Business Education Association, Reston, VA. Retrieved June 1, 2005, from EBSCOhost database (Eric No. ED40799).

Waukesha County Technical College (2005). *Administration -Accreditation.* Retrieved July 9, 2005, http://www.wctc.edu/web/about/admin/accreditation.htm

Waukesha County Technical College (2005a). *Facts About WCTC* Retrieved August 25, 2005, http://www.wctc.edu/web/about/facts/facts.htm

Waukesha County Technical College (2005b). *Distance Learning Home Page*. Retrieved June 2, 2005, http://www.wctc.edu/web/register/distance/distance.htm

Wisconsin Technical College System, (2005). Waukesha County Technical College. Retrieved June 3, 2005, http://witechcolleges.com/wctc.htm