Winter 2002

A Comparative Analysis of Two Course Delivery Models Through the Telequiz Protocol, a Study of Web-Based Distance Assessment Modalities

Patrick Michael O'Shea
Old Dominion University

A COMPARATIVE ANALYSIS OF TWO COURSE DELIVERY MODELS

THROUGH THE TELEQUIZ PROTOCOL, A STUDY OF WEB-BASED

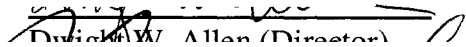# DISTANCE ASSESSMENT MODALITIES
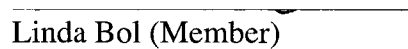
By

Patrick Michael O'Shea

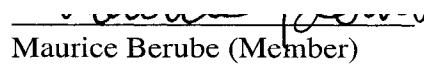B.A. December 1994, Old Dominion University

A Dissertation Submitted to the Faculty of

Old Dominion University in Partial Fulfillment of the

Requirement for the Degree of

DOCTOR OF PHILOSOPHY

URBAN STUDIES

OLD DOMINION UNIVERSITY

December 2002

Approved by:

Dwight W. Allen (Director)

Linda Bol (Member)

Maurice Berube (Member)

Abstract

Distance education and distance assessment have become the focus of many institutions of higher learning, and there is a need to know how these tools compare with those used in the traditional classroom setting. This study was designed to compare online and traditional students utilizing a mixture of quantitative and qualitative strategies in a quasi experimental model. This research was conducted at Old Dominion University using a sample of online and traditional students enrolled in an Introduction to Education course (ECI 300). Both versions of this course utilize an online quizzing protocol known as Telequiz. Quiz scores, final exam scores and final course scores were collected for each student and a Multiple Analysis of Variance (MANOVA) was conducted to compare the academic achievement of traditional and online students. The results indicate that traditional students outperform their online counterparts academically. The results of this analysis indicate that there is no difference between students who participate in an optional initial quiz and those students who do not. Qualitative analysis was performed on mid term and end of term student open ended evaluations to study perceptions of Telequiz and the course and to explore differences in perceptions on these two topics based on course delivery methodology. The results indicate that the students in both courses appreciate the content that they are learning, but have difficulty with the technology involved with the course. With a greater emphasis placed on the use of distance education and assessment tools, this research serves the purpose of attempting to judge the efficacy of these tools.

To my family,

Vania and Finn

For seeing me through the process, you have my love, always

Acknowledgements

I would like to take this opportunity to thank Dr. Dwight Allen. Without your guidance and support throughout the years, I would never have reached this point. I feel honored and privileged to have worked with you, and look forward to continuing our friendship.

I would also like to thank Dr. Linda Bol. Your feedback and support have made this research much more meaningful and relevant. I don't know what I would have done without your remarks and revisions. This is a higher quality product due to your insights and assistance.

Dr. Maurice Berube provided tremendous insight, and interacting with you through conversations and coursework has provided a unique perspective on the human condition. Your views of education have helped to shape and mold my own.

Barbara Webb was there to help me whenever I didn't know what to do. Your assistance with paperwork and deadlines is the only reason that I am actually finishing this process.

Tremendous thanks go to Simon Richmond, Daniel Curry-Corcoran, and Jennifer Kidd. Each of you helped with this research in your own way, but mostly by being there to help sound ideas out. Your suggestions were invaluable. Thanks also to all of the people in the office at ODU. Matt Dunleavy, Kamilla Bahbahani, Lee Vartanian, Ken Panko, Jonathon Higgins, and the rest of the crew maintained a mentally exciting and academically interesting work environment that added a great deal to my enjoyment of this process.

I would also like to thank my parents, Bev and Mike O'Shea. Your support throughout this process has been fantastic. I wouldn't be half the man that I am without your guidance and love.

Finally, I want to thank my wife, Vania O'Shea. Because of you I stuck with this process whenever it would have been easier to quit. Maybe now I'll be able to build you some shelves.

Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction

Institutes of higher education, especially public institutions, have found it advantageous to incorporate distance education into their curriculums to attract and keep diverse student populations. Lewis, Snow, Farris and Levin (1999) found that about one third of the nation's 2 year and 4 year institutes offered distance education courses during the 97-98 academic school year, with another one fifth planning to offer courses within the next three years. The numbers are even more dramatic when public institutions are the focus, where they found that 78 percent of public 4 year institutions and 62 percent of public 2 year institutions offered distance education courses. This is compared with 19 percent of private 2 year and 4 year institutions (Lewis, et al. 1999).

The technology that is used to deliver these distance education courses has advanced rapidly to allow greater communication and interaction between instructor and student. What started with correspondence courses has evolved into interactive courses that incorporate technologies as diverse as video broadcasting, email, chat rooms, and electronic bulletin boards. The largest growth recently has been in courses utilizing the Internet for delivery of content. Although the percentage of institutions using video presentation of material, whether two way or one way, was static between 1995 and 1998, the percentage of institutions utilizing the Internet grew nearly three fold from 22 percent to 60 percent (Lewis et al. 1999).

With such an emphasis on incorporating distance education into the educational environment, it is important to discuss this methodology in relationship to traditional classroom instruction. Many comparisons between distance education and traditional face to face education settings have been done based on a wide range of variables, such

as academic achievement, student attitudes, and student characteristics, with mixed results. Academically, distance education students have been found to perform comparably to traditional students (Souder, 1993; Biner, Dean & Mellinger 1994; Stone, 1988; McCollum, 1997; Hodsen et al, 1998). The major differences between the two delivery models become apparent when students are compared on attitudes. Ryan, in 1999, found that distance education students tend to experience more technical and communication difficulties than traditional students, and that, due to these difficulties, the content is covered more completely in traditional classrooms (Ryan, et al 1999). In looking at the methodologies that have been used to make these comparisons, however, it becomes clear that the majority of these comparisons are made based on traditional face to face tools such as surveys, questionnaires or interviews. Rarely are these comparisons made utilizing the technological advantages seen in distance education tools (e.g. asynchronous chat rooms) to their fullest potential.

Regardless of the methodology utilized in order to make these comparisons, some interesting results have been found. Distance education delivery models offers concrete benefits to the students that are not seen in the traditional classroom setting. Chief among these benefits is the possible asynchronous nature of distance education. The ability that technology brings to the educational setting, which allows students and teachers to function in a course while working on separate schedules, has allowed an expansion of interactions and a diversification of student populations (Phillips & Santoro, 1989; Berg, 1999; Ryan, et al, 1999; Cragg, 1994; Hodsen, et al, 1998). This capability has opened educational opportunities to numerous students who would not be able to fit school into their already hectic lives, and has been taken advantage of by Old Dominion University.

The Educational Curriculum and Instruction (ECI) department at Old Dominion University (ODU) includes the foundations course for the educational degree at ODU, Social and Cultural Foundations of Education (ECI 300). Most students wishing to become a teacher through ODU enroll in this course. This course has used distance education tools for delivery of content and assessment of learning for the past four years. The Internet based assessment tool that is used, Telequiz, was designed and developed by the instructional staff of the course, and has been implemented in the course since 1996.

By utilizing the Telequiz Quizzing Protocol to deliver quizzes over the web in both the online and regular face to face sessions of ECI 300 (now ECI 301), the instructional staff has integrated distance education tools into the regular class setting. This serves several purposes. In a purely functional sense, having the quizzing done through the Internet allows the students to take quizzes at their own pace. It also allows the instructional staff to more fully use the course meeting times for delivery of content. With the face to face students using the same quizzing protocol as the distance education students, comparisons between the two groups can be based, at least in part, on a distance education tool.

This study compares the two delivery methods for the course on student achievement and student attitudes. Utilizing the Telequiz quizzing protocol, the comparison of distance education students with their traditional education counterparts can be made for quiz results and end of course results. With this comparison, it is possible to see how course delivery methodology affects student achievement.

Two course evaluation tools were used to compare the online students with their traditional counterparts on their impressions of the course delivery methodologies and

overall course success. These two tools are the form developed by ODU, administered at the end of each semester, and the form developed by the instructional staff, administered at the mid point of each semester. Both of these forms consist of Likert scale responses to various course related questions as well as open ended questions intended to provide students the opportunity to provide more in depth and personal reflections on the course.

In addition to these two comparisons, this research determined whether a preliminary practice test affected subsequent course achievement measures. The initial quiz taken through the Telequiz protocol is a practice test that does not count toward the final grade. It is highly recommended that each student take this quiz, however, it is left to the discretion of the student to complete the first quiz. Using the data that is available, it was possible to study if taking this initial quiz correlates with academic achievement on quizzes and final course score, where final course score was calculated as a percentage of available credit earned. It was also possible to see if this relationship differs depending on course delivery methodology.

Another element of the course that was studied involves the changes in quiz grades over time. With six quizzes, including the initial practice quiz, in each semester, it is possible to see how grades change over a semester. This research analyzed the data in order to determine how these grades change over the course of the semester, and if course delivery methodology has any affect on this change.

Problem Importance

There are several different methods of content delivery used in distance education including correspondence courses through the mail, CD Rom delivery of material, televised courses (either through videotaped or satellite delivery) and Internet based

content delivery models among others. Many students in distance education courses chose the particular delivery model they do for the scheduling flexibility that it offers (Phillips & Santoro, 1989; Berge, 1999; Ryan, et al, 1999; Cragg, 1994; Hodsen, et al, 1998). Since the technology of the delivery is advanced enough to allow asynchronous completion of content, even if the course is offered synchronously (i.e. through tape availability in the case of Teletechnet courses), students have the flexibility to participate in a course regardless of scheduling conflicts. However, if assessment is simply transplanted from regular classroom techniques to distance education, much of the scheduling flexibility is negated.

Using traditional assessment tools in a distance education setting is an important issue for research because it is not necessarily effective or efficient (Mello, 1997). Students completing a quiz/test and then submitting it through campus mail or by personal delivery to the professor's office will have the assignment get to the destination (more than likely), but this is something that could be completed much more quickly and efficiently through the Internet. This method of assessment also calls for the gathering of students at one location (even if it is a satellite location) to complete the assessment, which effectively negates one scheduling advantages of offering courses through distance education.

Aside from the issues of assessment, there is also the issue of content delivery methodology. As has been mentioned, the distance education delivery of content has both advantages and disadvantages. In order to effectively design a course for delivery through a distance education medium it is important that these advantages and disadvantages be taken into consideration (Hodsen, et al, 1998; Cole-Gomolski, 1999). The distance

education field will never reach its full potential until the course designers better understand and accept the limitations, while at the same time maximizing the benefits.

Implications for Urban Education

Old Dominion University, located in the urban center of Norfolk Virginia, serves a student population consisting of 34% minority enrollment and drew 1,400 international students from 108 countries worldwide during the Fall of 2001(Old Dominion University, 2001). These demographics indicate a diverse student body, with corresponding diverse economic and social needs, and by extension indicate the urban nature of the University. Thus, in this context, all of the traditional students, who attend classes on campus, would be seen as urban students. In addition, there has been a shift from the traditional student experience in the University setting, in which a student starts in the fall semester after high school and finishes in four years. The shift can be seen by increases in alternative enrollments and lengthened educational careers (Urban University Statistical Portrait Project, 2001) and greater need to be employed throughout this educational process (Stern, 1997). Due to the pressures of this shift, urban Universities have found it advantageous to utilize distance education tools that attract and cater to students who tend to be older, married (often with young children) and working (Thompson, 1998).

The strength that distance education has for scheduling flexibility has allowed ODU to offer classes to an urban population that may not have been able to take them under other circumstances. Although the delivery of content to these populations has continued to expand, the same cannot be said of distance assessment tools. If the assessment tools commonly used in distance courses do not take advantage of the

strengths inherent in asynchronous education, they, in effect, become a hindrance to the education of this urban population (Hodsen, et al, 1998; Cole-Gomolski, 1999).

Context for Study

ECI 300, Social and Cultural Foundations of American Education, taught by Dr. Dwight Allen, became the first course at ODU to offer content solely through the Internet in the fall of 1997. Like the traditional face to face version of this course, the online version is the introductory foundation course for many students who are pursuing degrees in education. Many of the students who intend to become teachers through ODU must take ECI 300 (now ECI 301). The online course follows the same content and assessment schedule as the face to face version of the course. There are three synchronous course meetings during the semester. The first is used as an introduction and question and answer discussion near the beginning of the semester. There is a second meeting at the end of the semester where students take their final exam in a proctored environment. Even these sessions are offered through televised instruction, and if necessary can be viewed by videotape, or in the case of the final examination, alternate times for the proctored final examination can be arranged. No content is covered during these sessions. They are dedicated to making sure that the students understand the technical aspects of the course and are able to handle the technological requirements.

Both versions of the ECI 300 course consist of various lectures ranging from the history and philosophy of education in America to the barriers to effective education and the need for a global and multicultural context for education. The content is the same, the only difference is the method for delivery. The online course takes advantage of the Telequiz testing protocol, which had been in place for the regular classroom version of

ECI 300 since the spring of 1996. Telequiz is an Internet based testing program that allows for the random assignment of multiple choice questions to students upon demand. After completion of the quiz, Telequiz immediately returns results to the student providing real time feedback on performance measures.

Research Questions

This study compared the two offerings of the ECI 300 course in the delivery of course content and assessment of student learning. Since the Telequiz protocol has been used for both delivery methods of the course, it is the natural choice for a comparison. Telequiz scores for each of the quizzes, along with the final grade in the class, were compared. Taking quizzes over the Internet is a new experience for most students in the course. For this reason, the initial quiz has been designated as optional and is not scored. Even though the initial quiz does not count toward the final grade in the class, it is recommended that the students take it, as the content will be covered on the proctored final exam. The optional nature of the introductory quiz provides an additional research opportunity because it allows exploration of how taking this initial quiz correlates with the overall score of individual students.

This study addressed several research questions.

1. How does taking the optional first quiz affect the overall achievement of students in either the online or the face to face versions of the course?

2. How does taking the optional first quiz affect how student quiz scores change over the course of the semester?

3. Does course delivery methodology affect student achievement in the course as measured by final exam score and final course score?

4. How does course delivery methodology affect how student quiz scores change over the course of the semester?

In addition to using the Telequiz data to answer these questions, this research also studied feedback forms given each semester. There are two types of feedback forms that are available for study, the official ODU forms that are administered at the end of each semester, and a form designed specifically for the course and administered at the mid point of each semester by the instructional staff. These forms were analyzed to address the following questions:

5. What are students' impressions of the course overall and do they differ depending on course delivery format?

6. What are students' impressions of the Telequiz assessment methodology and do they differ depending on course delivery format?

Chapter 2: Literature Review

Introduction

Distance education is seen as an alternative method of course delivery that allows greater interaction between the students and the instructional staff, and brings education to larger populations through the use of technology in new and innovative ways (Kerka, 1996). Although the American Council of Education defines distance education as "a system and a process that connects learners with distributed resources" (Filipczak, 1995, p114), an analysis of the benefits of the distance education delivery method in comparison to face to face delivery shows that there is no clear cut "right" choice for education purposes.

Although the literature indicates that, academically, students in distance education courses can perform as well as, if not better than, their traditional education counterparts (Souder, 1993; Stone, 1998; McCollum, 1997; University of Idaho Engineering Outreach, 2000a), the communications and technical issues that can arise through education at a distance can be substantial (Ryan, et al, 1999; Cragg, 1994; Berge, 1999; Phillips & Santoro,1989; McCollum, 1997; Filipczak, 1995). The Innovations in Distance Education (IDE) program at Penn State has developed a set of guiding principles and practices for the design and development of distance education courses, which emphasize the importance of understanding when one delivery methodology is appropriate in place of the other, and when it is appropriate to mix the delivery methods in order to achieve desired results. They state that, just as it is important to understand the appropriate use of distance education technology, the effective use of distance assessment tools must also be investigated (IDE, 2000). The present study explored not only the literature concerning

distance versus traditional education designs, but also the effective use of distance assessment technology. Practice testing, which is an important element of the Telequiz Protocol, was also explored, along with the research on testing frequency.

Distance Education vs. Traditional Education

The Theory of Distance Education. Initially, the delivery of content in televised and computerized distance education was developed as a transplantation of face to face methodologies. However, the problem with this thinking is highlighted by Berge (1999), who argues that "(a) mismatch of the use of interaction, synchronicity, and technology can lead to loss of the student's attention, boredom, information overload and frustration" (Berge, 1999, p 9). In response to this need, Hiltz (1986) states that it is necessary to use this technology to create more effective and distinctive learning environments (Hiltz, 1986), and Clark and Lyons (1999) contend that the media does not cause learning, rather this is done by the design of the instruction (Clark & Lyons, 1999).

The idea that transplanting traditional education elements into distance education is not conducive to the distance education experience, is espoused by Filipczak (1995), who found that the introduction of distance education techniques into traditional settings can change the teaching style of the professor, in some cases making the delivery more student centered by necessity (Filipczak, 1995). King (1998) noted how important it is to realize that setting up distance education improperly can have disastrous effects. However, he also found that it is possible to magnify the positive aspects while minimizing the negative aspects. In order to accomplish this goal, it is necessary to know what the positive and negative aspects of distance education are, and how they can be

blended together to serve the needs of the students, instructional staff, administration and other involved parties (King, 1998).

With advances in distance education delivery methodologies, the incorporation of asynchronous delivery tools, such as videotaped lessons and Internet based content, has become more widespread. Asynchronous tools do not require all participants in a dialogue to be gathered at the same time to complete the interaction. Synchronous instruction, a main component of the traditional classroom setting, dictates that all participants be present and attentive at the same point in time and required to master any content or process in the arbitrary time allocated for successful completion of the learning process, and "forces a focus on teaching or facilitating, not learning. Such a focus on teaching is limited and often limiting" (Berge, 1999, p7). The very nature of the asynchronous classroom may make it easier for students to feel confident and comfortable making comments while interacting with peers and instructional staff (Phillips & Santoro, 1989; McCollum, 1997; Cragg, 1994).

The benefits of asynchronous instruction can even extend beyond the interactions in a course. Stone (1988), in a comparison of graduate students in distance and traditional education engineering courses, credited the asynchronous nature of the distance version with lowering dropout rates, and Phillips & Santoro (1989), in studying the effectiveness of computer mediated communication in the delivery of a traditionally face to face course, credited the asynchronous nature of the course with allowing shy students to more actively participate in the course discussion (Phillips & Santoro, 1989). This finding is expanded by McLester (2001), who states that distance education courses can work to the advantage of students who may hang back because of handicaps, shyness, lack of

confidence or a need for longer response time (McLester, 2001). This is particularly relevant to an urban education population, which is dominated by part time and non traditional students, many of whom may feel out of place and uncomfortable in the traditional classroom.

This is not to minimize the fact that one of the largest advantages of the traditional classroom setting is the interaction between students and instructional staff that comes from being in one place at the same time. The initial philosophy of transplanting traditional education to distance education effectively neutralized this advantage because it moved the participants away from each other without accounting for the ability to communicate between the participants. More recently, the design of distance education offerings, especially those using asynchronous technologies, allow for greater communication between participants. Interaction among students is a powerful catalyst for improving learning outcomes and computers have long been recognized as a means for fostering such collaborations (Ehrmann and Collins, 2001).

The interpersonal connections that must be made within a context of distance education now can be made utilizing a number of technologies ranging from traditional mail to email and on to the synchronous and asynchronous capabilities found on the Internet, such as bulletin boards or chat rooms. The goal of this connection is to create one of two types of interaction: 1) teacher with student or 2) student with student. Both can be synchronous or asynchronous. Sustained, two way interactions utilizing technology allow for explaining and challenging perspectives, however, the delivery system does not normally set the limitations on the instructional quality, this is normally done by the instructional design (Berge, 1999). This is an important distinction to make

because the focus on distance education tends to be on the technology that is used, rather than on the design of the course material. When the instructional design of the course is the focus, it is possible to understand what technology can be best used to get the content to the students (Berge, 1999).

Achievement in Distance and Regular Education. Academic achievement has been a popular measuring tool used to investigate differences between distance education and regular face to face education. In general, the research indicates that the academic achievement of distance education students is comparable to, if not better than, that observed in the face to face setting. The literature is replete with studies finding little if any difference between distance learners and traditional learners. Tucker (2001) found students enrolled in distance education versions of a business communications class performed as well as their traditional counterparts (Tucker, 2001), Redding and Rotzien (2001) found higher levels of cognitive learning in their online students (Redding, & Rotzien, 2001), and Gagne and Shephard (2001) found similar results when comparing online and traditional accounting students (Gagne, & Shephard, 2001). These findings support Machtmes & Asher (2000), who performed a meta analysis of the research on the effectiveness of distance learning and found that "there does not appear to be a difference in achievement between distance and traditional learners" (Machtmes, & Asher, 2000).

It must, however, be pointed out that there are questions concerning the veracity of these findings. Brennan, McFadden and Law (2001), through a review of the research, indicate several flaws in the methodology and analytic techniques incorporated in much of the research conducted on achievement in distance education. According to this review, "the gaps between the often rhetorical claims of 'effectiveness', and the reality of

well researched studies are not often bridged" (Brennan, McFadden, & Law, 2001). This being said, however, the vast majority of the research indicates that distance education can be as effective, in terms of student achievement, as traditional education.

The Engineering Outreach program through the University of Idaho (2000) has found that as long as the technology for content delivery is appropriate and all students have access to the same technology, the course delivery method has little effect on student achievement (University of Idaho Engineering Outreach, 2000). The importance of how a distance education course offering is designed, and the subsequent effect that design can have on student achievement is demonstrated through research conducted by Stepich, Ertmer, and Lane (2001). Students at three different levels (advanced undergraduate, introductory graduate and advanced graduate) in instructional design courses were assigned to analyze up to 10 instructional design cases in both in class and online settings. Qualitative analysis was performed on the student postings and comments to determine whether the comment was "expert" or "novice." After analyzing the data, the instructors found that students could answer as an expert in one category and as a novice in another category within the same question. This held true throughout the semester, and students were as likely to be in the novice level later in the semester as they were to be at the expert level early. Stepich, et al postulate that "the primary influences on their case analysis appeared more external than internal, including the way the case discussion was set up by the instructors" (Stepich, Ertmer & Lane, 2001). These findings would indicate that the design of the instructional experience has a significant impact on the academic achievement of students in courses delivered through distance education, and, further, emphasizes the importance of instructor understanding of this phenomena

while conceptualizing and designing the distance delivery methodologies for their courses.

Phillips & Santoro (1989) studied the effectiveness of computer mediated communication in the delivery of a traditional face to face course by having instructors from face to face courses rate the work submitted by online students. These instructors rated the work as similar or better than that turned in by their regular students (Phillips & Santoro, 1989). Souder (1993) supports this finding through a study of Master's Degree seeking students in three Management of Technology classes, that distance education students performed as well as their face to face counterparts on exams, papers and case study write ups (Souder, 1993). Smith, Smith and Boone (2000) built upon this research by studying 58 pre service teachers enrolled in an educational technology integration course by comparing academic achievement data on pretest and posttest for each of three delivery methods: lecture, guided instruction and collaborative discussion. Alternatives for each of these delivery models were offered in an online environment. Analysis of the academic achievement demonstrated by the pretest and posttest data showed that online learning environments are as effective in delivering teacher preparation content, and served as an effective alternative across all three delivery models (Smith, Smith & Boone, 2001).

Some research has shown that students involved with distance education delivery of content perform significantly better academically than their traditional education counterparts. Stone (1998), through research comparing engineering graduate students in on campus and video based off campus courses, found that the mean performance of off campus graduate students significantly exceeded that of their on campus counterparts

(Stone, 1998). McCollum (1997) further supports the notion through research that involve divided a college level statistics class into two groups, one of which received instruction through traditional methods, the other of which received content through online distance education methods. Through this research, McCollum found that the online students outscored the face to face students by 20% on end of year and midterm testing (McCollum, 1997).

Interaction in Distance and Regular Education. In general, the research suggests that distance education students have greater freedom to participate in the course discussion. McCollum (1997), through her comparison of online and traditional students in a statistics course, found that the intimidation that certain students feel in a face to face classroom was lacking, and thus the students were more willing to take part in the discussion (McCollum, 1997). Mitchell and Reed (2001) studied the collaborative effort of students at two separate Canadian Universities, and found that 85% of the students stated that the assignment effectively enabled participation through non conventional ways (Mitchell and Reed, 2001).

This being the case, the technology also has been found to create an atmosphere of isolation for individual students. Through their comparative study of online and face to face students, Ryan, et al. (1999), found that some participants expressed feelings of greater isolation from peers in the distance education course offering (Ryan, et al. 1999).

The literature is very specific about the types of gains in interaction that can be made with distance education as the delivery model for the content. Most of these gains can be seen through the asynchronous nature of the distance education courses. Hodsen Carlton, Ryan, & Siktberg (1988), while redesigning the nursing program at Ball State

University, used web based asynchronous bulletin boards to great advantage, and found that using such technology allowed greater participation by all students in the course (Hodsen Carlton, et al, 1998). Cragg (1994), who conducted her study in the field of nursing, found that students in her courses using computer mediated conferencing (CMC), an online asynchronous discussion forum, enjoyed the freedom and convenience that this technology offered. This asynchronous environment was found to be well adapted to learning in small groups and in interactive seminar environments (Cragg, 1994). Asynchronous delivery of content allows the participants, be they either instructional staff or other students, to interact on their own time, in their own setting and at their own pace (Phillips & Santoro, 1989; Berge, 1999; Ryan, et al, 1999; Cragg, 1994; Hodsen, et al, 1998).

Course Evaluation/Satisfaction in Distance and Regular Education. Ryan, Carlton, & Aki (1999) found, in their study of graduate students' perceptions of the two approaches to instruction, that the students appreciated the flexibility and increased technological awareness that comes with distance education, while bemoaning the problems with the technology and the need for greater self discipline that is called for by the medium. Although content was perceived as being covered more completely and adequately in the face to face sessions of the class, distance education was seen as a greater time saver (Ryan, et al, 1999). These types of results are echoed throughout the literature: Phillips and Santoro (1989), through their study of computer mediated communication as used in speech communication classes at Penn State found that students' ratings of computer mediated instruction were significantly higher than college and university means, however the user friendliness of the equipment used in the course

and the workload that distance education imposes on the instructional staff were important concerns of the participants (Phillips & Santoro, 1989). McCollum (1997), comparing distance education to traditional settings by splitting a statistics course into two groups, one of which received content through distance education delivery, takes this argument further by showing that students in the online version complained of an extremely heavy workload while outperforming the face to face students by an average of 20% (McCollum, 1997).

With all of the changes that are occurring in the methods of course delivery, one of the most powerful tools that instructional staff and administrators have for evaluating content delivery and efficacy is the satisfaction levels of the learners. Biner, Dean & Mellinger (1994), by surveying undergraduate and graduate student populations at Ball State University found that distance education students place a high priority on variables such as the instructor/instruction, the technology, course management, the at site personnel, the promptness of material delivery, support services and communication with the instructor (Biner, Dean and Mellinger, 1994).

Possibly the most telling statement found in the literature concerning why students sign up for distance education courses comes from Mood (1995) who found that students who sign up for distance courses, do so for reasons as varied as gaining promotion at work, to learn a particular job specific skill, or to sample an academic area, with the majority of students making the choice because it fits easily into their lives (Mood, 1995). In general, the evaluations of course delivery methods by students are impacted most by the support systems that are in place for the learner. Students who feel supported in their instructional endeavors, regardless of delivery model, provide positive

evaluations. If a distance education course is set up with a clear understanding of the procedures, guidelines and technology the chances are good that it will be received well by the students. Carnevale (2000) reinforces this viewpoint when he states that students value knowledgeable instructors who interact with their students and technology that allows the creation of a sense of community within the student population. This is in stark contrast to how administrators judge the success of online programs, which according to Carnevale is by the number of students enrolled or the number of courses created (Carnevale, 2000).

 Characteristic of Successful Student in Distance and Regular Education. Several studies have been performed in order to answer the question of what it takes to be successful at distance education courses. Ryan, et al (1999), in studying graduate students' perception of traditional classroom seminars and WWW electronic modules, found that students who have certain characteristics, such as high self motivation, best complete distance education courses (Ryan, et al, 1999). Biner, et al (1995) found that distance education students scored higher in personality traits such as intelligence (as measured by abstract thinking), emotional stability, trust, and self sufficiency, although traditional students scored higher on emotional stability, seriousness, shyness, imaginativeness, and liberalism (Biner, et al, 1995). In addition to these characteristics, The Engineering Outreach Program at the University of Idaho (2000) also found that successful distance education students tend to be older, have post secondary education goals, expect higher grades, and are voluntarily seeking further education. This same research found that successful learners are more willing to initiate calls to the instructional staff and are more serious in their attitude towards the course – regardless of

the instructional methodology (University of Idaho Engineering Outreach, 2000). How much these research results are influenced by the "early adopter" nature of distance education offerings in general will only be known in time.

Drawbacks to Distance Education. It is also important to mention that distance education has many drawbacks. Distance education is not a miracle cure for the ills of education and many of the advantageous elements also create serious counter effects. Ryan, et al (1999) found that students in the regular class setting felt content was covered more completely, there was greater interaction and participation, and that faculty expertise was a larger factor in success. However large these concerns are, Ryan also found that the main problem with distance education stems from the use of complex hardware and software, which tend to be the source of frustration for all parties involved – instructional and learner (Ryan, et al, 1999). Cragg (1994) and Berge (1999) both found that distance education courses tend to have a heavy emphasis on technology, although the student population and instructional staff of the classes may have limited technology skills (Cragg, 1994; Berge, 1999). In support of this, research performed by Phillips & Santoro (1989) and McCollum (1997) has found that this focus on technology, and the asynchronous nature of distance education courses, can exacerbate the heavy workload of the participants. This is due mainly to the fact that the unfamiliar nature of the technology and interactions cause a need to learn not only the content but the delivery tools as well (Phillips & Santoro, 1989; McCollum, 1997). The foreign nature of technology and the workload issues make it all the more important for the instructional staff to put into place tools to foster interaction. These tools attempt to force interaction at times, a process which many instructors find unnatural (Filipczak, 1995). A major ongoing issue which is

hard to quantify, but is related to the future reduction of technological frustration is the constant upgrading of the quality of the home computer (and the college lab) environment, allowing new strategies, delivery modes, and a dramatic reduction in access time required for graphic interfaces and other more advanced options.

Assessment in Distance Education

Since this research focuses on the use of computer based assessment tools as one of the means for comparing distance education to traditional face to face education, it is important that there be a discussion of what the literature says concerning the use of the computer as a medium for the delivery of assessment. Assessment is a difficult concept to pinpoint. In many cases the term assessment is used interchangeably with the term evaluation. Assessment has been defined as "the collection and interpretation, through systematic and formal means, of relevant information which serves the basis for rational judgment in decision situations" (Dressel, 1986, p6). No matter how formal the collection and interpretation of this relevant information is, however, as Bludau, Maddox, & Pounds (1998) point out, assessment is inherently a judgmental process meant to judge student progress (Bludau, et al, 1998).

This sentiment attempts to touch upon the purpose of assessment in an educational setting. However, it has been postulated that the purpose of classroom assessment, whatever tool is used, is to indicate to what degree certain performance objectives and goals have been mastered (Gomez, et al, 1998). Both of these statements from the literature show differing purposes for classroom assessment. The first would indicate that assessment is a tool for knowing where a student is along a path (formative evaluation), and the second would indicate that assessment is a tool for knowing if a

student has reached that path's end (summative evaluation). This difference shows how judgmental the assessment process can be.

There is yet an alternative purpose for assessment. "The primary aim of assessment is to foster learning of worthwhile academic content for all students" (Porter, 1991). This statement would indicate that assessment is actually one of the elements guiding the student down the path toward mastery of the course content. In an educational setting, this role allows an assessment tool to be seen as an instructional tool as well. In support of assessment as a part of the educational process, Hester (1999), found that a web based interactive sample test, used to supplement traditional instruction in a large lecture class, was perceived by students to be a valuable educational tool (Hester, 1999). This discussion of the theory behind assessment allows for a more useful discussion of the elements of distance assessment that more directly impact this research – computer testing, practice tests and test frequency.

Computer Testing. Understanding that there are numerous problems that can arise from the use of the computer for assessment, it is important to review the forms that assessments normally take in distance education. There are three general methods that are used in distance education to assess using the computer. The first option includes the use of a computer for the delivery of transplanted traditional classroom assessment methods, such as multiple choice quizzes and exams. Traditional assessments have many benefits, they are easy to administer and they have been used extensively in the past. However, Gomez, Moore, Mortera-Gutierrez, & Torres (1998) argue that this type of assessment tool has significant weaknesses such as a focus on factual recall, a promotion of only simple application of knowledge, and, in some cases, a teacher bias (Gomez, et al, 1998).

Regardless of these arguments the ease of use and relative user friendliness of this form of assessment has made it the choice for many distance educators.

Less frequently, technology is used to bring authentic assessment strategies to the distance education realm. In studying the development of constructivist assessment tools to be used in both the traditional and distance education environments, Bludau, et al (1998) state that this draws heavily on constructivism and its corresponding need for entirely new assessment tools for instructors to use in distance education. Proponents for authentic assessment and constructivist learning argue that:

> (t)echnology offers several advantages over traditional methods of student assessment. For example, multimedia technology expands the possibilities for more comprehensive student assessments that require students' active participation and application of knowledge. The immense storage capacity enabled by technology such as CD ROMs allows schools to develop electronic portfolios of students' work. A single CD can hold exact copies of students' drawings and written work, recordings of the child reading aloud, and video images of plays, recitals, or class presentations. By saving work samples on different subjects at different times during the year, teachers can display them in rapid succession to demonstrate and assess growth (Riley, 1996).

The major problem with this usage of the technology is that it is only organizational in nature. The instructor still must actively take a role in assessing the work. This can be a huge task for the instructors of distance education courses that enroll hundreds of students.

In addition to acting as an alternative method of delivering traditional classroom assessment tools or as a receptacle and organizer for portfolios, technology has also been used for adaptive testing. In adaptive testing the difficulty of a question a student receives is based on the answers provided on previous questions. Olsen (2000) states that adaptive testing offers various advantages over regular assessment, such as shorter test with no decrease in reliability and lower costs in the long run since they eliminate the need for test booklets and material handling (Olson, 2000). This supports Riley's (1996) assertion that adaptive testing has the additional benefit of administering tests more efficiently (Riley, 1996).

Regardless of what type of assessment tool is chosen, as Porter (1991) states, "unless the content of assessment (what schools assess) and the format of assessment (how schools assess) match what is taught and how it is taught, the results are meaningless, if not potentially harmful. The same is true if assessment tools are not of high quality " (Porter, 1991). Too often in distance education the reliance is completely on traditional tools of assessment, hard copy proctored quizzes and tests, and traditional papers and projects which are often changed only in the way in which they are submitted (in digital format) if at all.

With this background on the forms of distance assessment, it is now possible to better understand the issues that can arise through computer testing. Those studies that have been undertaken to explore the nature of assessing students at a distance have raised several issues that must be considered whenever computer based assessment tools are being explored as an option for student testing. King (1998), in his attempts to establish the foundation for computerized assessment at the University of Portsmouth in England,

found several variables that he deemed important. Time management and workload for the involved parties became the largest issue for review, and caused him to change his course delivery model at various stages throughout the three years of his study. These time management issues were especially important because they dictated the level of student preparedness. In addition, King found the support from the campus' central computer services was also problematic, and the feedback to students on scoring changed several times throughout the process (King, 1998). In discussing limitations of computer aided assessment tools, Mello (1997) was even more basic. Through a study of students utilizing computerized testing in an ESL course, she found that Internet speed and availability became problematic. She does state, however, that the benefits outweigh the costs, and that interactive quizzes can benefit and motivate students (Mello, 1997).

Practice Tests. The findings are mixed on the effectiveness of practice testing. In most cases, sample testing correlates positively with final grade, however, whether this relationship is causal or predictive is still unknown. Hester (1999) showed that students perceived a web based interactive sample test as being a valuable educational tool, even though 51% of the class did not take the sample test (Hester, 1999), and Balch (1998) demonstrated, through his experiments utilizing practice examinations, a relationship between self assessment accuracy and academic performance (Balch, 1998). Kulik, Kulik, Chen-Lin and Bangert (1984), find that practice tests allowed students to raise test scores based on three factors: whether the tests were identical or parallel in form, the number of practice tests and the ability of the student (Kulik, et al, 1984).

It is more difficult to draw conclusions when the goal of the practice test was to improve the ability of the students to predict their performance on subsequent graded

tests. Maki and Ruth (1992) found that taking practice tests similar in design and content to the graded tests did not help in prediction, although they did postulate that they may help students learn the information (Maki and Ruth, 1992). The literature also shows that practice testing can have negative impacts on instruction. Bol and Hacker (2001) found that the administration of practice test had a negative effect on student outcomes. This finding, although seemingly counterintuitive, may be explained through the difference in the items seen on the practice test and the midterm. The more alike the items on the pretest are to those on the posttest, the more likely the student will be able to predict the posttest score accurately. It is postulated that this is due to enhanced focus on studying the pretest items. This ability to accurately predict the score was also related to the student achievement and type of item on the tests (Bol & Hacker, 2001).

Even in studies that have difficulty drawing firm conclusions on how a pretest affects results on a posttest, it can be shown that the pretest demonstrated an ability to be a predictor of final grade although Soderberg (1971) recognized that having a small sample size limits the generalizability of the findings, he found that relative academic position on a practice test at the start of the semester was maintained throughout the rest of the semester. Soderberg (1971) postulates that pretest results could give students an indication of how they can be expected to perform throughout the course.

Test Frequency. Whenever assessment is done, regardless what form it takes, there is a question of how much is enough (Freilich, 1989). The answer to this question depends on many course specific variables, such as number of students, assessment methodology, and clarity of instructions, among others, but generally it is agreed that it is important to provide systematic feedback to students on performance. In fact, it has been

said, "(f)eedback is an essential element in the analysis and operation of any system" (Dressel, 1978, p 84). "We must invest time and resources to develop the materials, train teachers how to use them, develop easy access to the materials, provide support for interactive student participation and feedback, and keep records of student participation and success in using the materials" (Allen and Cosby, 2000, p 148).

Freilich (1989) found that student achievement can benefit from weekly quizzes and that frequent quizzes provide academic guidance and motivation for completion of assignments. Studies have been performed that show that daily or weekly assessment can have positive effects on outcomes. McDaris (1984) showed a significant improvement in end of course achievement and student attitude in those students who took more frequent tests. This result was supported by Negin (1981) who found, in his study of first year law students assigned to three experimental groups receiving differing numbers of examinations in a course, that those students who were tested more often retain more material (Negin, 1981), and Palmer (1974) who found that more frequently tested groups performed significantly higher than the non tested comparison group in his study of introductory psychology students (Palmer, 1974). Wesp (1986), in performing similar experimentation found that this improvement is most likely because of the effects that such schedules have on student procrastination (Wesp, 1986). These findings would support the assumption that frequent quizzes can effectively act as a deterrent to procrastination, as well as provide many other positive effects of continual feedback and encouragement.

Gaps in the Literature

Need for study. This research focused on comparative analysis of distance education with face to face instruction, an analysis of specific distance assessment tools, and the impact of practice testing. Traditionally, the comparisons between distance education students and their regular face to face counterparts are based on assessment tools that are fairly standard and traditional, whether paper and pencil tests, written evaluations, or project based work. This study utilized a protocol that is designed for distance education as the comparison tool rather than the more traditional tools common in face to face instruction. There is little literature that utilizes a distance education tool to compare the two groups, and comparing students in distance education with their face to face counterparts using a distance assessment tool as the measurement device allowed the comparative analysis of student achievement and efficacy of distance assessment tools.

Conclusion

This literature review has shown that there are many strengths and weaknesses inherent in the distance education and assessment processes. Students in distance education gain academically as much as their traditional face to face instruction counterparts, however, they encountering technological and communication issues that can derail the instructional process. The asynchronous nature of distance education can provide benefits that are not normally seen in the traditional classroom setting, including the ability to fit the instruction into the schedule of the participants, and if the support systems are in place to make sure that the instruction works smoothly, the students provide positive feedback for the distance learning environment.

Computer technology has been used to assess students in three general forms: transplanted traditional assessment techniques, storage and organizational methodologies, and adaptive testing. All three of these forms of computer based assessment offer strengths and weaknesses in the evaluation process, and depending on which technique is used, the student workload, preparedness and access to the technology became major issues in the success of the endeavor.

Although a correlation was found between performance on practice tests and overall performance on class evaluations, there is difficulty in stating the cause of this correlation. There was no such correlation when the purpose of the practice testing was to improve student prediction of performance on subsequent assessments. The literature on test frequency also demonstrates that there is a correlation between the overall course achievement and the frequency of assessment administration. Much as with the literature on practice testing, the literature on test frequency falls short of finding any correlation.

Overall, the literature on distance education and assessment shows that the technology allows a much more wide ranging approach to tools that can be used in the completion of instruction and assessment. However, the participants in distance education and assessment are at the beginning of this process, and that much work still must be done in order to assure successful learning using these mediums. The use of technology allows many activities and interactions that would not be possible without it, but it must be done carefully and with forethought and planning.

Overview of study

This research examined available data to perform an ex post facto comparative analysis of the two ECI 300 course methodologies in an attempt to answer several

questions concerning the nature of distance learning and assessment. These questions deal with the effectiveness of distance learning through the medium of the Internet, along with assessment of student learning through the Internet. Through an analysis of pre existing data gathered from students covering the same content utilizing different delivery models,

In order to address these questions, this research compared quiz scores with final grade based on several variables, such as course delivery methodology, completion of an initial practice quiz and individual quiz results. In addition, a qualitative analysis of student feedback was conducted to make further judgments on the delivery model and assessment tool.

Hypotheses

Hypotheses for each of the quantitative questions were posited based on the research literature.

- How does taking the optional first quiz affect the overall achievement of students in either the online or the face to face versions of the course?
  - o Those students who take the initial quiz will perform better on final exam and final course grade than those who did not.
- How does taking the optional first quiz affect how student quiz scores change over the course of the semester?
  - o Students who take the initial quiz will have significantly higher scores on subsequent quizzes taken over the semester compared to students who did not take the initial quiz.

- Does course delivery methodology affect student achievement in the course as measured by final exam score and final course score?
  - Students in the traditional class setting will perform better on final exam and final course score.
- How does course delivery methodology affect how student quiz scores change over the course of the semester?
  - The quiz scores for the students in the traditional classroom setting will be higher than those of the online students.

Chapter 3: Methodology

Research Design

This study addressed the effectiveness of distance learning through the medium of the Internet. Through an analysis of data gathered from students learning the same content utilizing different delivery models, this research examined the effect that these delivery models have had on student achievement in the course. Also, this research analyzed quiz results to study what effect Internet based assessment had on student achievement.

This research attempted to answer several questions concerning the nature of distance learning and assessment through the analysis of course data. These questions were:

1. How does taking the optional first quiz affect the overall achievement of students in either the online or the face to face versions of the course?

2. How does taking the optional first quiz affect how student quiz scores change over the course of the semester?

3. Does course delivery methodology affect student achievement in the course as measured by quizzes and the final examination?

4. How does course delivery methodology affect how student quiz scores change over the course of the semester?

In addition to using the Telequiz data to answer these questions, this research also analyzed feedback forms given each semester in an attempt to find out:

5. What are students' impressions of the course overall and do they differ depending on delivery format?

6. What are students' impressions of the Telequiz assessment methodology and do they differ depending on delivery format?

The Course

ECI 300, Social & Cultural Foundations of American Education, has been the introductory education course at Old Dominion University. The majority of students at ODU who wish to become teachers start by taking ECI 300.

This course is composed of 20 lectures designed to give the student an introduction to various aspects of the educational process, including an introduction to the history of, and barriers to, education in America. The course focuses on two main issues of education, multiculturalism and gaining a global perspective, and each of the lectures throughout the semester has specific components to illustrate the importance of these two issues.

Students can take ECI 300 for either 2 or 3 credits. Though assignments differ, the same assessment protocols were used for both groups. A list of these assignments is included here with a description of each assignment.

5 Internet base quizzes – All students in the class are required to complete 5 quizzes using the Telequiz Online Quizzing Protocol. There is one additional quiz that can be taken at the beginning of the semester, but is meant as a practice, and is, thus, not required for a grade.

5 group quizzes – Each member of the class is assigned to a group, and must complete a group quiz for each individual quiz they take. This quiz is made up of the content that is covered in the individual quizzes, but is completed as a group.

1 group charter – Each group in the class is required to write and submit a charter that explains the rules that their group will follow and function by throughout the semester.

2 2+2s – Each member of a group is required to complete two sets of feedback forms called 2+2s. This feedback takes the form of 2 compliments and 2 suggestions for improvements (thus the name 2+2). These assignments are completed via email and are done on the class as a whole and the other members of their group.

10 QQCs – Each member of the class is required to write 10 Quiz Question Contributions. These are 10 questions that take the format of the quiz questions, and can be added to the quiz question item database.

10 Links – Each member of the class is required to turn in 10 Internet links to educational web sites that they have found and reviewed.

1 Group Interview Paper – Each group is responsible for interviewing 12 people on 4 educational reform issues of their choosing. The results of these interviews are compiled into a paper, and are handed in as a group project.

1 Final Exam – Each member of the class is required to complete a paper and pencil version of a final exam. This 100 question exam is cumulative and covers all content – including the content from the initial practice quiz.

The 3 credit students in the course have two assignments in addition to those already listed. These assignments are:

3 journal critiques – Each of the 3 credit students is required to read and critique 3 journal articles. These critiques consist of one page single spaced summary and critical analysis of the article.

1 Group Final Exam – Each member of a group that is a 3 credit student is required to complete a group final exam. This exam takes the form of 6 multiple choice questions, to which the group members must designate the correct answer, and write a one sentence explanation of why that answer is correct. The group members are also required to write a one sentence explanation of why the other possible options are not correct.

Participants

The participants for this research were those students who enrolled in either the traditional face to face version or the online version of ECI 300 during the semesters between Fall 1998 and Fall 2000. This excludes the summer semesters, as there were no traditional versions of the ECI 300 course offered during those times. The student enrollments for each of these courses are represented in Table 1.

Table 1

ECI 300 Enrollment for Semester between Fall 1998 and Fall 2000

Semester	Traditional Course	Online Course
Fall 98	125	76
Spring 99	70	96
Fall 99	96	79
Spring 00	91	75
Fall 00	54	98

Before the introduction of the online version of this course, the content was delivered in large class lectures, at times attended by more than 200 students. With the creation of the online version of the course, the attendance at the traditional face to face version slowly dropped to 54 students per semester. The opposite has been the case for the online version of the course. Since its testing phase in the fall of 1997, where the attendance was capped at 20 students, the attendance in the online version has slowly risen to nearly 100 students depending on the semester.

Although the various aspects of the two course delivery methodologies can affect the student population that chooses to take the particular course offering, such as the asynchronous nature of the online course fitting some students' schedules better than the

traditional course setting, it was possible to assume that the two populations are comparable. Students were matched on their University GPA for the semester prior to enrolling in ECI 300. Table 2 shows that a comparison of the mean GPAs of the students in this study would indicate group equivalency.

Table 2

Comparison of Mean GPAs for Online and Traditional Students (Including Fall 1998)

Class	Mean	N	Standard Deviation
300	2.93	124	.64
Online	2.92	124	.65

Measures

Not all of the scores on assignments were used for the analysis of this research. The quantitative measures used for this research include grades on individual quizzes, final exam scores, and final course score. The qualitative measures used during this research included written comments on mid term instructor created feedback forms, and written comments on the institutional course feedback forms.

Quizzes. Each quiz is scored out of 20 points, however, one bonus question allows a student to score 21. Each of the 21 available multiple choice questions has 4 response options, three of which are incorrect. The quizzes, taken over the Internet, are generated

every time a student signs in for a quiz, and are comprised of a random sampling of the questions from a larger database.

Each item in the quiz database was created using one of three formats (1) written by the instructional staff using information from the text, Those Who Can, Teach (Ryan & Cooper, 2000), (2) written by the instructional staff using information taken from the class lectures, and (3) written by students on either a lecture or the book. If students submitted items, the instructional staff reviewed each question that was turned in for content and quality. Although each student in the course is assigned to write 10 questions for possible inclusion on the quiz, an extremely small number of questions in the quiz item database actually come from the students, the vast majority come from the instructional staff. Each quiz item in the database has face validity because they cover the content of the course.

Final Exam. The final exam consists of 100 multiple choice items, and, unlike the 5 required quizzes, is taken as a hard copy. The content of the test is a comprehensive sampling of the questions that are in the database for the online quizzes, and covers the content for the full semester. It is developed by randomly assigning 100 questions from the master question database in order to cover the content comprehensively. Administering the final exam in hard copy necessitates a class meeting for the online students at the end of each semester. This allows a comparison of non proctored individual quiz scores with the proctored final exam score, which highlights those students that perform significantly different on the individual quizzes and the final exam. If the grade on the final exam is one grade or more lower than the average of the individual quizzes, then the instructional staff is alerted to the possibility of cheating

represented by this disconnect and the student is contacted to discuss the difference. If the instructional staff are unsatisfied with the results of this contact, the student is given two options: retake all of the individual quizzes in a proctored environment or substitute the final exam grade for their individual quiz grades. In the time frame covered by this study, this situation arose twice out of a population approaching 1000 students. As with the individual quizzes, the final exam, by using the quiz item database as its source for content, has face validity.

Final Course Score. The grade that a student receives in this course is a combination of all of the assignments described earlier, depending on credit status of the student and delivery method. The quiz grades, including the final exam, cover approximately one half of the points that are available to be earned by a student. The grading scale that is employed in the ECI 300 course is shown in Table 3.

Table 3

Grading Scale for Both Versions of ECI 300

Percentage	Letter
93-100	A
85-92	B
75-84	C
68-74	D
67 & below	F

The majority of the students in the courses receive a "B" (85%) or better as their final grade, and emphasis is placed on giving every student an opportunity to receive an "A" (93%), however, as with any other course, there are students who do not achieve these standards. It is the policy of the instructional staff to allow the completion of alternative assignments for any assignment that a student can show does not foster their educational needs, including quizzes and other major assignments. The vast majority of students who have taken the class, regardless of delivery method, have completed the requirements as written in the syllabus, but there have been several cases over the years of students completing alternative assignments to earn their grade in the class. This situation occurs in less than 5% of the student population for any given semester. Any student that has taken the option of completing alternative assignments was removed from the study population.

Reliability and Validity. Quiz questions have been evaluated for validity through their inclusion in group quizzes, which are administered as a hard copy, open book assessment given to the members of a group. Each group turned in an identical group quiz. It was assumed that each group would receive full credit for the quiz due to their ability to use any resource available to them to answer the questions. Any question on a group quiz that was answered incorrectly by more than 10 percent of the groups was removed from the quiz item database. Through this process, the instructional staff was able to pare non valid quiz items from the database. The remaining items would, by extension, be valid. Thus, the quiz items on both the individual quizzes and the final exam have face validity.

Written Comments On Mid Term Instructor Created Feedback Forms. At the mid point of each semester, a feedback form created by the instructional staff is administered to the students of the course. This feedback form is meant to gauge the students' impressions of the course as a whole, the nature of taking quizzes on the Internet, and the interactions with the Teaching Assistants. These forms are returned anonymously, and are used by the instructional staff as formative evaluation to improve issues that might arise during the semester.

Written Comments On The Institutional Course Feedback Forms. At the end of each semester the instructional staff administers a feedback form created by the institution. As part of the institutional feedback form given at the end of each semester students are given the opportunity to make written comments concerning the nature of the course and the instruction. This feedback is collected by ODU and returned to the professor of the course. These written comments were used to analyze the student perceptions for each of the course delivery methods.

Data Collection

Quantitative data was gathered for the quizzes, the final exam score, and the final course score. The quizzing data is collected in a database composed of student grading information archived for the 5 semesters between fall 1998 and fall 2000, excluding summers. This data includes all of the grades for each student who has taken the course, including scores on all assignments for the course. The only scores from this database that were employed for analysis are those for the quizzes, the final exam and the final course score. Unique identifier information for each student also was exported in order to analyze the student performance over time during the semester, however, this identifier

does not allow for identification of individual students in any way other than for the purposes of this study.

In order to build the data set that was used in this study, initially all student records for the five semesters between fall 1998 and fall 2000 (excluding summer sessions, which only include online students) were collected. Any student who received an "Incomplete" for the semester of enrollment, any students who had a quiz grade changed by turning in additional work, and any student who received an "A" by assisting the instructional staff in the administration of the class was removed from the data set. In addition, it was necessary to omit all student records from the fall of 1998 from the data set used for evaluating the impact of the initial optional quiz on student performance due to a technical difficulty with the quizzing process that would not allow any student to complete this quiz during that semester. For the purposes of matching, it was necessary to find pre enrollment GPA data for the remaining students. Any student who did not have a pre enrollment GPA (due to students taking ECI 300 as entering freshmen or during their first semester after transferring to ODU) was removed from the data set.

Qualitative data was collected through the written comments provided by students when filling out the mid term and end of course evaluation forms. The course satisfaction feedback data was made up of two separate feedback forms that are gathered every semester: the mid term course evaluations, designed and administered by the instructional staff, that are completed during each semester, and the ODU evaluation forms that are administered at the end of each semester. The mid term evaluation form is composed of questions designated by the instructional staff of the course. The end of semester evaluation form is designed by ODU, and includes a qualitative component, where

students are allowed to write feedback for the instructional staff. Due to the anonymous nature of this feedback form, there was no unique identifier information for individual entries.

Data Analysis

This research utilized both quantitative and qualitative data analytic techniques. The analysis used to address each of the research questions is described below:

Research Questions #1 & #3

1. How does taking the optional first quiz affect the overall achievement of students in either the online or the face to face versions of the course?

3. How does taking the optional first quiz affect how student quiz scores change over the course of the semester?

In order to answer the two questions concerning the administration of the optional first quiz an analysis was performed in order to compare how the score on the initial practice test correlates with the final course score. In order to determine the effect that taking the initial optional quiz had on the overall achievement of students in the course a Multiple Analysis of Variance (MANOVA) was performed. The independent variable was status of initial quiz completion; which had two levels, completion or non completion of the initial quiz in the status of initial quiz variable. The dependent variables used to measure the differences between these groups are final exam scores and final grade for question #1 and subsequent quiz scores for question #3.

Research Questions #2 & #4

2. Does course delivery methodology affect student achievement in the course as measured by final examination and the final course score?

4. How does course delivery methodology affect how student quiz scores change over the course of the semester?

The study of how course delivery methodology correlates with student performance was accomplished by conducting a MANOVA. Course delivery methodology was used as the independent variable. This independent variable has two levels, distance education versus face to face. The dependent variables used to measure the differences between these groups are final exam scores and final grade for question #2 and subsequent quiz scores for question #4.

Research Questions #5 & #6

5. What are students' impressions of the course overall and do they differ depending on delivery format?

6. What are students' impressions of the Telequiz assessment methodology and do they differ depending on delivery format?

In order to answer the final two research questions a qualitative analysis was performed. Mid term course evaluation forms, designed by the instructional staff of the course, have been kept during the timeframe of this study, and end of course evaluation forms administered in each ODU course. Both the end of course evaluation forms and the

mid term evaluation forms were analyzed using qualitative coding techniques. These

coding techniques consisted of reading all of the comments multiple times to develop the

categories for coding, then reading each individual comment made by a student and

coding each based on the categories that were developed.

Chapter 4: Results

Impact of Optional Quiz Participation on Overall Achievement

The effect of taking the optional first quiz on the overall achievement of students in either the online or the face to face versions of the course was analyzed using a MANOVA. This analysis compared those students who had taken the optional first quiz with those students who had not on final exam and final course score. The records of all students who met these criteria were used for this analysis. This consisted of 142 students who had taken the first quiz and 58 students who had not.

A MANOVA (Pillai's Trace) test was used to measure the effect of taking the optional first quiz on the final exam score and final course score. There were no significant differences when comparing those students who took the optional quiz and those who did not on either the final exam or final course score. It would appear that having students take an optional quiz to introduce them to the process of online assessment has no effect on the outcome as measured by the final exam and course score.

Impact of Optional Quiz Participation on Subsequent Quiz Performance

How taking the optional first quiz affects quiz score changes over the course of the semester was examined by performing a Multiple Analysis of Variance (MANOVA). This analysis compared those students who had taken the optional first quiz against those students who had not on the scores from the other five quizzes. For the purposes of this analysis 200 student records were used. These consisted of 142 students who had taken the first quiz and 58 students who had not.

For the analysis, a two level independent variable indicating status of participation in the optional first quiz was used. The scores that a student received on quizzes 2 through 6 were used as the dependent variables in the MANOVA.

A MANOVA (Pillai's Trace) test was used to measure the effect of taking the optional first quiz on the scores of subsequent quizzes. There were no significant differences when comparing those students who took the optional quiz and those who did not. There also was no discernable trend across the quizzes. It would appear that having students take an optional quiz to introduce them to the process of online assessment has no effect on the outcome as measured by subsequent quiz performance.

Impact of Course Delivery Methodology on Overall Achievement

A MANOVA was conducted to determine how course delivery methodology affects overall achievement of students in either the online or the face to face versions of the course. This analysis compared those students in the traditional classroom setting against those students in the online version of the course on the final exam score and the final course score. For the purposes of this analysis 247 student records were used. These consisted of 124 traditional students and 123 online students.

The independent variable in this analysis was course delivery methodology. This variable had two levels, traditional delivery and online delivery. The final exam score & final course score were used as the dependent variables. A MANOVA (Pillai's Trace) test was used to measure the effect of course delivery methodology on the final exam score and final course score. Table 4 shows that for n=247, there was a significant difference $(F(1, 123) = 4.21, p = .04)$ when comparing traditional students to online students on final

exam score and a significant difference $(F(1, 123) = 28.84, p = .00)$ when comparing

traditional students with online students on final course score.

Table 4

MANOVA Statistics for Final Exam and Final Course Score Comparison

Dependent Variable	df	Sum of Squares	Mean Square	F	p
Final Exam Score	1	416.20	416.20	4.21*	.04
Final Course Score	1	2954.68	2954.68	28.84**	.00

*$p < .05$. **$p < .01$

Table 5 shows the descriptive statistics for this comparison. This data shows the

traditional students outperforming their online counterparts by more than 2.5 points on

the final exam and more than 7.1 points on the final course score.

Table 5

Descriptive Statistics for Final Exam and Final Course Score Comparison (by Course

Delivery Methodology)

	N	Mean	Standard Deviation
Traditional			
Final Exam Score	124	91.67	8.60
Final Course Score	124	91.94	5.79
Online			
Final Exam Score	123	89.07	11.13
Final Course Score	123	84.81	13.27

Impact of Course Delivery Methodology on Quiz Performance Over the Length of the

Semester

How course delivery methodology affects quiz score changes over the course of

the semester was studied by performing a Multiple Analysis of Variance (MANOVA) on

student records. This analysis compared online and traditional students using the scores

from the six quizzes taken over the semester. For the purposes of this analysis 135

student records were used. These consisted of 64 traditional students and 71 online

students.

The independent variable in this analysis was course delivery methodology. This

variable had two levels, traditional delivery and online delivery. The scores received on

each of the six quizzes administered throughout the semester were used as the dependent variables. A MANOVA (Pillai's Trace) test was used to measure the effect of course delivery methodology on the scores of subsequent quizzes. Table 6 shows a statistically significant difference for each of the first three quizzes (F=(1, 67) = 15..05, p = .00 for quiz 1, F=(1, 121) = 4.99, p = .03 for quiz 2 and F=(1, 119) = 4.02, p = .05 for quiz 3). The data indicate a declining significance starting from the first quiz. The comparison between traditional and online students becomes non significant by the fourth quiz.

Table 6

MANOVA Statistics for Quiz Score Comparison

Dependent Variable	*df*	Sum of Squares	Mean Square	*F*	*p*
Quiz 1	1	195.28	195.28	15.05*	.00
Quiz 2	1	39.69	39.69	4.99**	.03
Quiz 3	1	29.31	29.31	4.02**	.05
Quiz 4	1	13.99	13.99	2.90	.09
Quiz 5	1	8.57	8.57	1.20	.28
Quiz 6	1	8.19	8.19	.77	.38

*$p < .01$. **$p < .05$.

Table 7 shows the descriptive statistics for this comparison. This data shows the

traditional students outperforming their online counterparts on quiz one (by 2.28 points),

quiz two (by .37 points), quiz three (by .65 points), quiz four (by .61 points) and quiz five

(by .38 points), and only being outperformed on quiz six (by .53 points).

Table 7

Descriptive Statistics for Quiz Comparison (by Course Delivery Methodology)

Quiz	N	Mean	Standard Deviation	N	Mean	Standard Deviation
		Traditional			Online	
1	68	14.74	3.26	74	12.46	3.87
2	122	16.43	2.95	123	16.06	2.99
3	120	17.45	2.30	121	16.80	2.87
4	123	17.77	2.18	120	17.16	2.39
5	122	17.21	2.50	119	16.83	2.57
6	121	17.21	2.63	119	17.74	3.48

Figure 1 compares the quiz score means between the two delivery methodologies. It

demonstrates graphically the concept of the traditional students outperforming the online

students consistently on quizzes throughout the semester, however, it also shows that the

two groups of students had similar performance curves over the course of the semester.
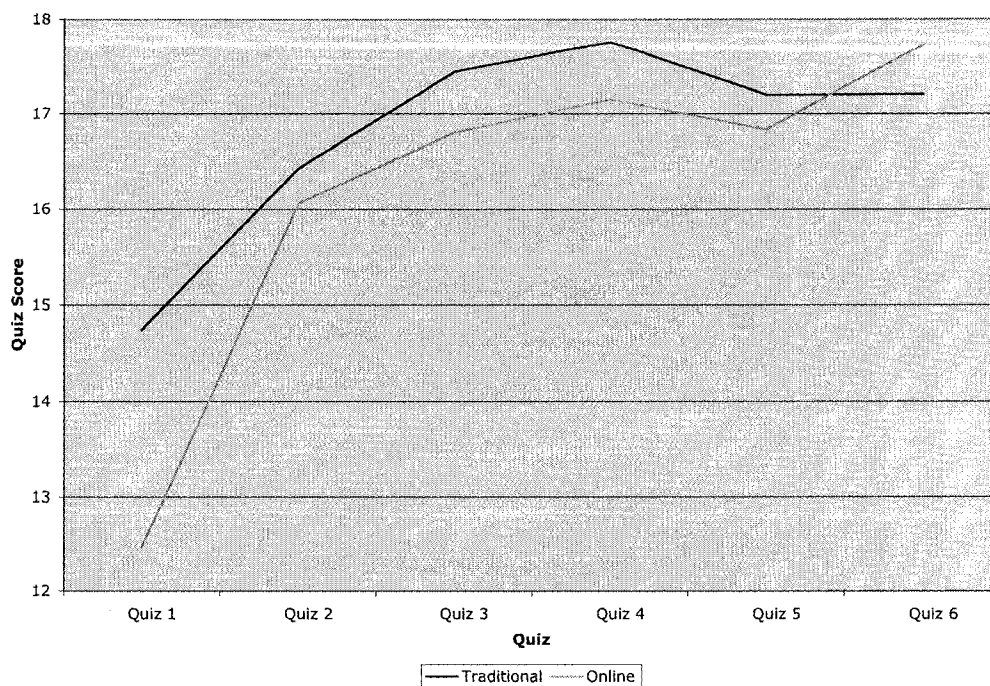
Figure 1. Comparison of Quiz Score Means between Course Delivery Methodology

Data Sources for Qualitative Questions

Student impressions of the course were studied using two separate student

feedback options, the mid semester and end of term feedback forms. The end of term

feedback form, developed by Old Dominion University, is administered at the end of

each course. For the purposes of this research, the section of the form allowing students

to write their own remarks and thoughts concerning the course was studied. Each of these

comments was labeled as being "End of Semester." The instructional staff of the course

developed the mid term evaluation. In order to study how course delivery impacted

student perceptions of course, two of the prompting questions on this form were studied.

These two questions concerned what the student perceived as the major strengths and

weaknesses of the course. In order to study how course delivery impacted student perceptions of the Telequiz process four of the questions on the mid semester form were studied. These four questions concerned what the student perceived as the major strengths and weaknesses of the course, what they would change about the class if they were the professor, and what they thought of the online quizzing.

Impact of Course Delivery Methodology on Student Perceptions of Course

Data Analysis. For the five semesters included in this research, a total of 640 student records were found. A student record is defined as a unique student response to one of the feedback options mentioned above. Of these 640 records, 283 (44%) were comprised of end of semester comments, and 357 (56%) included mid term records. Of the 357 mid term records, 181 (51%) answered the question "What do you feel are the major strengths of this class?," and 176 (49%) answered the question "What do you feel are the major weaknesses of this class?" This is a small sample, however, it provides ample feedback to draw conclusions concerning the student perceptions of the course.

Each record was examined to indicate the areas that were mentioned in individual comments. The twelve categories that emerged out of the analysis are; Professor, Support, Stories/Experience, Technology, Quizzes, Feedback, Convenience, Lectures/Content, Organization/Assignments, Textbook, Class Time/Size and Group Work

Student comments in each of these twelve categories were coded into two perception categories, Positive and Negative, according to the tone of the comment. For example, a student comment such as "The lectures are great, but I really hated the online quizzing" was rated positively in the lecture/content category, but negatively in the

quizzes category. An independent coding of 10 percent of the records done by another researcher showed an 82 percent rate of agreement for the procedure. This indicates a strong reliability in response coding.

Student Overall Perceptions of Course. Table 8 shows that student comments predominantly focus on the professor, lectures/content, support and technology. These four areas account for nearly 63% of all comments made by students in the online and traditional courses, and the remaining eight categories comprise the other 37%.

Table 8

Percentage of Total Comments

Category	Percentage of Comments
Professor	18.3%
Lectures/content	18%
Support	14.6%
Technology	11.8%
Organization/Assignments	9%
Quizzes	7.3%
Group work	5.4%
Stories/expertise	4.1%
Feedback	3.9%
Convenience	3.4%
Textbook	2.3%
Class time/size	2.1%

Table 9 shows the categories about which the students in both delivery methods

of the course felt predominantly positive and the percentage of comments designated as

positive. Of the four top categories mentioned by the students, three, the professor,

lectures/content and support, are viewed positively. In support of the professor and his support staff, students stated how "Dr. Allen and his staff were extremely helpful in their instruction of ECI 300. Their flexibility allowed more room for individuality and created one of the best atmospheres that I have experienced from 2 Universities and three years of instruction." In their discussions concerning the lectures and content, students "found this class very insightful. The ideas were passionately supported and conveyed," and stated that "Dr. Allen is very nice and the things he said will stay with me hopefully throughout my life."

Table 9

Percentage of Comments with Positive Focus

Category	Percentage of Positive Comments
Professor	91.4%
Lectures/Content	76.6%
Support	77.3%
Stories/experience	96.3%
Convenience	88.9%

Alternatively, the fourth of the top four categories, technology, is located on the list of categories about which the students in both delivery methodologies felt

predominantly negative. Students stated that "the major weaknesses (of the course) are anything that has to do with the computers and online," and this leads to frustrated comments that had students screaming, "I totally despise the Internet!!!!" These concerns are understandable considering the number of technical problems that were experienced. One student stated it well when they said, "I desired to do my best, but was hindered by technological changes that were beyond my control." Table 10 shows the categories that students viewed predominantly negatively and the percentage of comments designated as negative.

Table 10

Percentage of Comments with Negative Focus

Category	Percentage of Negative Comments
Technology	64.3%
Organization/Assignments	67.5%
Group work	63.9%

Comparison of Online and Traditional Student Perceptions of Course. Table 11 shows the number and percentage of all comments for both course delivery methodologies. Any comment made by a student was coded as part of a category (such as "Professor") and as being either positive or negative about that category. The percentage

indicated for each category is calculated out of the total number of comments in that

category, for example, 167 positive comments by the traditional students concerning the

professor comprises 27.9% of the positive comments that traditional students made.

Table 11

Number of Comments for Each Area (By Class Delivery Method)

Category	Traditional Students		Online Students	
	Positive	Negative	Positive	Negative
Professor	167 (27.9 %)	13 (4.4 %)	56 (22.5 %)	8 (4.3 %)
Support	102 (17.1 %)	20 (6.8 %)	48 (18.9 %)	24 (12.8 %)
Stories/Experience	37 (6.2 %)	2 (0.7 %)	15 (5.9 %)	0 (0 %)
Technology	39 (6.5 %)	51 (17.4 %)	17 (6.7 %)	50 (26.6 %)
Quizzes	40 (6.7 %)	41 (14 %)	9 (3.5 %)	7 (3.7 %)
Feedback	14 (2.3 %)	5 (1.7 %)	5 (2 %)	28 (14.9 %)
Convenience	10 (1.7 %)	0 (0 %)	30 (11.8 %)	5 (2.7 %)
Lectures/Content	133 (22.2 %)	42 (14.3 %)	50 (19.7 %)	14 (7.5 %)
Organization/Assignments	24 (4 %)	45 (15.4 %)	15 (5.9 %)	36 (19.2 %)
Textbooks	6 (1 %)	14 (4.8 %)	6 (2.4 %)	5 (2.7 %)
Class Time/Size	2 (0.3 %)	22 (7.5 %)	1 (0.4 %)	3 (1.6 %)
Group Work	24 (4 %)	38 (13 %)	2 (0.8 %)	8 (4.3 %)

This table shows that traditional and online students share positive impressions concerning the professor (27.9% of traditional & 22.5% of online student positive comments), lectures/content (22.2% of traditional & 19.7% of online student positive comments) and support (17.1% of traditional & 18.9% of online student positive comments). In both courses, these three categories accounted for more than 60% of all positive comments (67.2% of traditional & 61.1% of online student positive comments). This type of agreement would indicate that these three areas are a major strength of the course.

The only other area that received more than 10% of the positive comments was the online students perception of the convenience (11.9% of online student positive comments). Unlike their traditional counterparts, online students tended to focus on the convenience of the course. Students in the online version of the course appreciated the ability "(t)o work at your own pace/time," and the "(a)bility to work from home or work." The convenience of the course was repeatedly noted. The appreciation of the convenience was indicated by one student, who stated that the course "gave me a lot of freedom but also forced me to take my own initiative." This would indicate that successful completion of the course also requires a great deal of self motivation. The research shows that convenience is one of the main elements of asynchronous education that students find beneficial (Berge, 1999; Ryan, et al., 1999). Contrast this with an 8:00 am on campus course, and it is not surprising that the online students would place more emphasis on this area.

The area most commonly commented on negatively is also shared by the students in both courses. The students in both courses commented negatively about technology

most frequently (17.4% of traditional & 26.6% of online student negative comments). This trend is also apparent in the comments that students in both courses made concerning the organization and assignments (15.4% of traditional & 19.2% of online student negative comments). These results would indicate a strong need to improve these two aspect of the course. One possible way to improve these elements of the course would be to limit the quantity of assignments, and by doing so, clarify the organization of the course.

Interesting trends appear when the next few areas of negative comments are examined for each course delivery method. This is where the students from the two courses begin to differ. In the only other categories receiving more than 10% of the negative comments for the traditional group, the students comment negatively about the lectures/content (14.3% of traditional student negative comments) and the quizzes (14% of traditional student negative comments).

These results are interesting considering the fact that the traditional students consider the lectures/content a major strength of the course as well. The fact that the comments indicate that the traditional students view the lectures/content as a major weakness of the class would imply a bipolar split in the traditional class. In effect, it would appear that traditional students either love the lectures and content or they hate them. The traditional student perceptions of quizzes is understandable when considering the fact that the quizzes make up the main focus of the technology integration in the course for the traditional students, whereas it is only one of many technology application incorporated into the online course. Since the traditional students feel negatively about

the technology in the course, it would stand to reason that the traditional students would feel negatively about the quizzes.

In the only other categories receiving more than 10% of the negative comments for the online group, the students comment negatively about the feedback (14.9% of online student negative comments) and support (12.8% of online student negative comments).

These results are important due to the fact that the online students viewed the support as a major strength of the class. Just as with the traditional students' perceptions of the lectures/content, it would appear that the online students have a similar bipolar reaction to the support, they either love it or hate it. The negative perception that the online students have about the feedback would seem to explain why they would also feel negatively about the support. If a student does not receive any feedback, he or she would be unlikely to feel supported.

Although the number of responses is limited, overall, it would appear that the students view this course as beneficial to their overall educational experience and tend to enjoy their interactions with the instructional staff. The technological focus of the course, however, causes difficulties. The students in the course viewed the professor, lectures/content and support positively, however, the technological aspects of the course were viewed negatively.

Impact of Course Delivery Methodology on Student Perceptions of Telequiz

Data Collection Techniques. For the five semesters included in this research, a total of 1005 student records were found. A student record is defined as a unique student response to one of the feedback forms. Of course, only those records that discussed the

quizzes in particular were of interest in answering this question. In order to facilitate this process, all of the records were coded into two general categories; those records that mentioned quizzes specifically, and those that did not. The records that did not contain a mention of the quizzing were not used further. Of the 1005 total records, 353 (35.1%) were found to specifically contain comments mentioning quizzing and were thus retained for further study.

Each record was examined to indicate the areas that were mentioned in individual comments. The six categories that arose out of the analysis are; Technology, Content, Support, Convenience, Feedback, and Theory.

Student comments in each of these six categories were coded into two perception categories, Positive and Negative, according to the tone of the comment. For example, a student comment such as "The idea of online quizzes is great, but some of the questions didn't match what was taught in the unit" was rated positively in the theory category, but negatively in the content category. An independent coding of 10 percent of the records done by an outside researcher showed an 83 percent agreement rate for the procedure. This indicates a strong reliability in response coding.

Student Overall Perceptions of Telequiz. Table 12 shows that student comments predominantly focus on the technology, content, and convenience. These three areas account for nearly 77% of all comments made by students in the online and traditional courses, and the remaining three categories comprise the other 23%.

Table 12

Percentage of Total Comments

Category	Percentage of Comments
Technology	31.2%
Content	24.1%
Convenience	20.4%
Support	7.4%
Feedback	8.2%
Theory	8.8%

Table 13 shows the categories about which the students in both delivery methods of the course felt predominantly positive. Of the three top categories mentioned by the students, one, convenience was viewed positively. Students in both versions of the course commented about the convenience of the quizzing by making statements such as, "(w)hat I really like about this course is the ability to take quizzes online. It's cool to take a quiz on your time rather than during class time" and "I like being able to take the quizzes on 'my' time and have the results posted quickly...(t)his is a 'jump in the deep end and learn to swim approach'." Of course, this issue also leads students in the opposite directions, as can be seen by requests that "(a)llowances should be made for those students who are not just students and who do not own computers. I believe I would have learned more

taking tests the traditional way." This, however, was a minority opinion, with the

majority of the comments (66.7%) focusing positively on the convenience of the quizzes.

Table 13

Percentage of Comments with Positive Focus

Category	Percentage of Positive Comments
Convenience	66.7%
Feedback	79.3%
Theory	74.2%

Alternatively, Table 14 shows that the other two of the top three categories,

technology and content, are located on the list of categories about which the students in

both delivery methodologies felt predominantly negative. Comments such as, "I wouldn't

use all the new systems on computer until I know (a little more for sure) that it's going to

work. I know you have to take risks to try something new, but this time we had to pay too

much (too much confusion to so many of us) for it" indicate a willingness on the part of

the students to accept risks and change, however, demonstrate an even stronger feeling

that the quizzing process was "frustrating. I do think we need this requirement, but wish

we could get hard copies of quizzes instead of wasting time getting on the 'net, getting

kicked off, waiting, dealing with bad server...etc." These technological frustrations lead

many students to request that quizzes "be done on hard copy. Although on line is more convenient, hard copy has less chance of incorrectly being graded or being lost due to computer error"

In addition to the technological frustrations, many students expressed a need for greater clarity where the content of the quizzes is concerned. Students mentioned that they found it "(h)ard to know what to focus on for quizzes. I find them somewhat unpredictable – and find many choices for answers too similar to effectively choose" and also thought that "the fact that not everyone receives the same quiz individually takes away from the overall fairness."

Table 14

Percentage of Comments with Negative Focus

Category	Percentage of Negative Comments
Technology	73.6%
Content	67.1%
Support	76.9%

Comparison of Online and Traditional Student Perceptions of Telequiz. Table 15 shows the number and percentage of all comments for both course delivery methodologies. Any comment made by a student was coded as part of a category (such as "Technology") and as being either positive or negative about that category. The

percentage indicated for each category is calculated out of the total number of comments

in that category, for example, 25 positive comments by the traditional students

concerning the technology comprises 20% of the positive comments that traditional

students made.

Table 15

Number of Comments for Each Area (By Class Delivery Method)

Category	Traditional Students		Online Students	
	Positive	Negative	Positive	Negative
Technology	25 (20%)	67 (42.1%)	4 (12.5%)	14 (37.8%)
Content	15 (12%)	39 (24.5%)	13 (40.6%)	18 (48.7%)
Support	5 (4%)	18 (11.3%)	1 (3.1%)	2 (5.4%)
Convenience	43 (34.4%)	22 (13.8%)	5 (15.6%)	2 (5.4%)
Feedback	15 (12%)	5 (3.2%)	8 (25%)	1 (2.7%)
Theory	22 (17.6%)	8 (5.%)	1 (3.1%)	0 (0%)

Whereas traditional and online students agreed on the areas of the course which

they felt positive about, the students tend to agree on the aspects of Telequiz about which

they felt negative. This table shows that traditional and online students share strong

negative impressions concerning the technology of the quizzing (42.1% of traditional &

37.8% of online student negative comments) and the content found on the quizzes (24.5% of traditional & 48.7% of online student positive comments). In both courses, these two categories accounted for more than 65% of all negative comments (66.6% of traditional & an astounding 86.5% of online student negative comments). This type of agreement would indicate that these two areas are in need of major improvement. The only other areas of either course that received more than 10% of the negative comments came from the traditional students perception of the convenience (13.8% of traditional student negative comments) and support (11.3% of traditional student negative comments).

Understanding what the students perceive positively about Telequiz is more difficult. For the traditional students, five of the six categories received at least 10% of positive comments, however, the majority of the positive comments centered on the convenience of online quizzing (34.4% of traditional student positive comments), the technology (20% of traditional student positive comments) and the theory of online quizzing (17.6% of traditional student positive comments). Of these three areas, the traditional students also saw technology and convenience as a weakness of Telequiz. The fact that the traditional students saw the technology and convenience of the quizzing process positively and negatively would indicate that there is a division in the traditional students' perception of the Telequiz process. The perception that traditional students either loved the technology and convenience or they hated them is likely the result of initial student comfort levels with technology. If a student is comfortable with the technology when they begin the class, then they will have fewer problems with the technology used in the quizzing process, and thus would find the process more convenient.

There are similar issues with the online students, who saw the content (40.6% of online student positive comments) and feedback (25% of online student positive comments) as strengths of Telequiz. The students of both courses commented positively on feedback, as a feature of Telequiz, and this would seem to make sense considering the immediate feedback and score that is provided. The online students, however, saw content as both a major strength and weakness of Telequiz. This would seem to indicate a similar split. Either the student loved the way the content was presented, or they hated it.

Again, although the sample size is small, overall, it would appear that the students as a whole view the concept of online quizzing positively, however, the implementation of the quizzing protocol has caused problems with the ability of the students to successfully master the process. The students as a whole viewed the convenience of the quizzes positively, however, the technology and content, which both groups viewed negatively, were stumbling blocks to the students' ability to perform.

The differences between online and traditional students did not deviate tremendously from the findings for the course as a whole. Both groups were positive about the concept of quizzing online but were negative about the overall implementation. The differences seem to stem from the priorities that each group of students has when participating in the course and the quizzing process. Although both groups are focused on the technology, which they both view negatively, the traditional students focus on the convenience of the quizzes and the online students focus on the feedback. It would appear that the traditional students have more interest in the convenience of the quizzing process because it allows them to accomplish a task, on their own schedule, that they normally would undertake during class. They thought that the quizzes were "cool," and

liked the ability "to take a quiz on your time rather than during class time." This is one of the few course tasks that deviates significantly, in terms of scheduling, from what traditional students regularly encounter. The novelty alone could cause the traditional students to place greater emphasis on the convenience, and lead to students stating that the online quizzes are "something that I have never experienced before, and I love it." Likewise, the online students would appear to have more interest in the feedback of a quiz because that is a difficulty they have encountered with the class as a whole. Students stated that they "like the computerized quizzes because of the grading system and the prompt ability to get it," and thought it was "(v)ery helpful to immediately see results." Online students have asked for more feedback in general, and thus it is no wonder that the immediate feedback that the quizzes provide is applauded.

Chapter 5: Discussion

Two major areas of comparison have been the focus of this research: Telequiz and Course Delivery Methodology. Both qualitative and quantitative data have been collected from the ECI 300 students in these two areas. For the purposes of the discussion, the quantitative and qualitative findings for each of these two areas will be included in two sections, which will allow a more comprehensive discussion of the findings.

Telequiz

This study addressed two quantitative questions concerning the effect of the administration of an optional practice test, using the Telequiz online testing protocol, on course outcomes. In both cases, the researcher hypothesized that the act of taking an optional first quiz would raise the performance of the students in the courses on subsequent quizzes, their final exam and the course in general. The findings did not support these hypotheses. Participation in an optional first quiz had no significant effects on scores for subsequent quizzes, scores on final exam or scores in the course.

These results correspond with research into the effects of practice testing, which state that the connection between practice testing and course outcomes is tenuous and unproven. Maki and Ruth (1992) found that practice tests had no effect on the ability of students to predict subsequent score. Likewise, Kulik, Kulik, Chen-Lin and Bangert (1984) found that students were only able to raise test scores after a practice test by maintaining an identical or parallel form, and even then, the results were contingent upon the ability of the students. Additionally, Bol and Hacker (2001) found that the administration of practice test had a negative effect on student outcomes. This being the case, it might be prudent to re-envision further research into this field and focus on other

variables that might impact the performance of students on assessments subsequent to any practice test. In addition, without a statistical advantage to taking the first quiz, maintaining the optional nature of the initial quiz is not necessary. Also, since the students have stated dissatisfaction with the assignments in the course, removing the first quiz altogether could have a positive effect on the students' perception of the organization of the course.

This research does, however, indicate that students overall were positive about the convenience of taking quizzes over the Internet, which would support research into distance education as a whole done by Mood (1995), Biner, Dean & Mellinger (1994), Phillips & Santoro (1989), and McCollum (1997), all of whom found that convenience is one of the top priorities for distance learners. The students in ECI 300, however, were negative about the technology used in the assessment process and the content presented for assessment. These findings also mirror research into distance education performed by Souder (1993), Stone (1998), McCollum (1997) and the University of Idaho Engineering Outreach Program (2000a), all of whom found that technical issues involved with distance education can cause substantial difficulties with student performance. Because the students in ECI 300 indicated that the idea of taking online quizzes is appealing, maintaining this requirement is appropriate, however, much technical design work must be done to assure that technical problems cannot derail the process. Additionally, the questions used in the Telequiz database must be studied to make sure that they are reliable and valid. Performing this research will alleviate some of the problems that the students mentioned with the content of the quizzes not matching their expectations.

In addition to the student focus on the convenience, technology and content, this research also indicated that traditional students placed more emphasis on the convenience and theory of the tool than their online counterparts and that online students placed more emphasis on the content and feedback present in the tool than their traditional counterparts. Very little research has been performed to pinpoint student perceptions of online testing tools. However, Hester (1998) did find that students indicated an online sample test was a valuable educational tool, even though nearly half the class did not take the assessment. Further research into this area is needed in order to better understand the strength and weaknesses of the technology and the impact that this process is having on the educational attainment of the students.

Implications for Practice. Because the current findings indicated no significant differences in performance on final exams, course scores and subsequent quiz scores based on participation in the optional quiz, there may be no reason to maintain the optional status of the first quiz. This might, in fact work towards improving scores on the final exam and the final course scores as well. Since the material present on this initial quiz is also part of the assessment for the final exam, having students mandated to take this quiz could introduce the concepts and ideas to those students who otherwise would not have gotten this introduction. In this case, the students who take this quiz because it is mandatory would at least have some contact with the content that is presented on the final exam.

In addition, studies by McDaris (1984), Negin (1981), and Palmer (1974) indicated that more frequent assessment have a positive impacts on course achievement. Changing the status of the optional quiz would, in effect, mandate more frequent quizzing

through the course duration. At the very least, having more frequent quizzes formalized as part of the process could affect student procrastination, as Wesp (1986) found.

This being said, it is extremely important that greater emphasis be placed on assuring that the technology works properly and that the quiz contents are based on the content that has been taught, and work must be done to assure the highest quality of the test items in the Telequiz database. The qualitative research into student perceptions of Telequiz indicate that students like the idea of online testing, however, the implementation of the assessment tool is of utmost importance. A natural starting point would be to perform reliability and validity studies on the quiz items. After the quiz items have been determined to be reliable and valid, technical problems can be resolved easily with a redesign of the Telequiz database in an attempt to limit technical difficulties.

Suggestions for Future Research. Further research should be performed in order to determine if a change in the status of the first quiz from optional to mandatory is required, or if it would be preferable to drop the first quiz altogether. The current status has been demonstrated to have no significant impact on further quizzes; however, there could be other variables, such as quiz item quality, that could account for the lack of results. Further research should be completed on the validity and reliability of the quiz items found in the Telequiz database in order to assure the students a quality assessment process.

Also, as discussed above, further research is needed on how students perceive online and distance assessment tools in general. This theme of research appears to be almost unexplored, and research along these lines will allow for the development of

higher quality tools and better assessment processes. Gathering feedback on the assessment process from the students who are participating in the process strengthens the efficacy of the tools. The inclusion of student feedback into the development of more effective and efficient assessment tools will assist each individual student in taking ownership of the process.

Course Delivery Methodology

It was hypothesized that traditional students would perform better than their online counterparts as measured by their scores on quizzes, the final exam and final course score. In the case of almost all of these measurements, this research supported the hypothesis. Students in the traditional course outperformed their online counterparts significantly on the quizzes. This statistical advantage on the quizzes started out tremendously marked, and faded consistently until disappearing on quiz four.

One would think that the online students would have an advantage when taking quizzes; after all, these students deal with technology as their sole means of getting the content of the course, thus they should be better prepared to deal with technological issues pertaining to the online quizzing process. Since this research does not bear this out, it is necessary to look at this dynamic more closely and attempt to discover what is occurring. One possible answer concerns the technological problems that the online students have in getting the content of the course, especially early in the semester. Phillips & Santory (1989) and McCollum (1997) both found that distance education students were at a disadvantage due to the need to learn delivery tools as well as content. This could account for the fading difference in significance levels. In this case, the traditional students are not exhibiting an advantage in terms of the technology, but rather

have an advantage in getting access to the content. As online students become more comfortable with the delivery methodology, they begin to catch their traditional counterparts in content delivery.

The traditional students also outperformed the online students on final exam and in the course. This advantage indicates that the format that has been chosen for the delivery of content for the online version of ECI 300 is flawed in some way, a finding that is supported by the fact that the online students needed time to acclimate to the learning environment. The research indicates that the academic achievement of students in distance education can be comparable to that seen in students attending traditional class setting. Phillips and Santoro (1989) and Souder (1993) both found that students in distance education can perform as well academically as their traditional counterparts, and Stone (1998) found that distance education students can even exceed the performance of their on campus counterparts. This, however, is not the case for the online students in ECI 300. The next step must be to find out what is wrong with the model of course delivery in the ECI 300 course.

A starting place would be to look at the design of the course. As Berge (1999) contends, improper matching of technology with student skills can cause boredom and frustration, and the online students are most definitely frustrated with the technology. It is no surprise that difficulties with technology would impact the perception of the course by the involved students. Ryan, Carlton, & Aki (1999) found that students bemoan the technological problems of online learning while, at the same time, lauding the flexibility if allows. This research would support these finding, considering the vast majority of the concerns with the course stemmed not from the content, but rather from the students'

inability to access this content due to technological problems. As Clark & Lyons (1999) discussed, the media doesn't create learning, the design of the instruction does, and with this understanding, it is possible to envision solutions that could make the online version of ECI 300 viable over the long term. For example, it is probable that training on how to participate in an online course, including an introduction to the technology and the processes separate from any academic content, would alleviate some of these frustrations.

It is, however, important to state that the online version of the ECI 300 course is meeting the needs of the participating students in other ways. Many unexpected benefits have been found through distance education, Phillips & Santoro (1989), McCollum (1997) and Cragg (1994) all credited distance education with fostering greater participation by those students who normally wouldn't be vocal in a traditional setting, and Stone (1988) even credited distance education with lowering his drop out rate. Valuable benefits of distance education, such as convenience, which is a major concern for those who take the course and is seen as a major strength of the online version of ECI 300, must not be ignored. This research indicates that overall the students were tremendously positive about the convenience, along with the professor, support and content of the course, which would support findings by Ryan, Carlton, & Aki (1999) that students appreciate the flexibility and increase technological awareness of the distance education medium.

Further research should be performed on the organization and assignments of the ECI 300 course delivery methods to correct flaws that cause difficulties, but also special care must be taken to emphasize those elements that are successful. Only by doing both can ECI 300 hope to provide the students every opportunity to succeed.

Implications for Practice. This research would indicate that the format chosen for the delivery of content for ECI 300 through the Internet is not serving the academic needs of the students as well as traditional classroom delivery. The Engineering Outreach program at the University of Idaho (2000) found that the course delivery method has little effect on student achievement as long as the technology for content delivery is appropriate and all students have access to the same technology (University of Idaho Engineering Outreach, 2000). This notion is taken one step further by King (1998), who stated that setting up distance education improperly can have disastrous results. Inadequacies in available technologies (for example, students using slow dial up Internet connections) and training might explain some of the problems that are seen by the online students in ECI 300. Modifications should be made to the course delivery tools to assure online students have every option to learn and succeed in the class. With this thought in mind, and placing emphasis on the beliefs of King (1998), it is important to clarify the content delivery procedures for online students early in the semester. A greater focus on the training of students to use the technology involved in the course, regardless of delivery methodology, and also more emphasis on clarifying the requirements of the course, could go a long way towards improving the performance of students in both versions of the course. The positive feelings that students have about the content and instructional staff will only be maintained if the students are able to get to the content in a meaningful and expedient manner.

Suggestions for Future Research. Further research would be highly recommended in order to ascertain what changes are needed to assure the online students the opportunity to be successful in the class. This research found that online students were

outperformed by their traditional counterparts; however, this need not be the case. A line of research into how to improve the ECI 300 online course should focus more precisely on the issues that students encounter with the technology (for example, server crashes) and organization of the course (for example, the perception that the course is disorganized) that act as a barrier to successful completion of the coursework. This research is necessary in order to facilitate the improvement of these areas.

Another area of research could be developed to understand the nature of the initial statistical advantage seen by the traditional students in taking their quizzes. It is important to get a clearer picture of this dynamic because it may lead to a better understanding of the technological issues that students in both course delivery methods face.

Limitations

There are some threats to the internal validity of this study. Selection could be considered a problem since there was no attempt made to randomize the groups that participated in this research. The participants in the online version and the traditional version are both drawn from the same body of students, and if there were no online offering, the vast majority of these students would be in the traditional face to face version. Since this is an ex post facto design, it is difficult to minimize the effects of selection, because attempting to match on too many categories would greatly limit the population sample. However, matching on pre enrollment GPA data helped assure equality of groups without limiting the population size too greatly.

Since there was no randomization involved in the development of the groups to be studied, there could have been possible interaction effects between selection and treatment. This must be accepted as a limitation since the study is not truly experimental

in nature. This problem is not rare in real world educational situations, which rarely allow for randomization of subjects.

Chief among the issues of internal validity that might have played a part in this research is repeated testing. The fact that the analysis of this research is based on repeated testing indicates that the initial testing could have an impact on the comfort level of students on subsequent testing, thus affecting the outcomes on these subsequent administrations. In this case, the presence of a control group (those students who did not take the initial test) mitigated this issue.

An additional issue to be considered is that of ecological validity, which raises the question of whether the setting of the test administration influences the results. If the students have not selected a comfortable or natural setting, the quiz results could be affected. By administering the final exam in a controlled environment, and having a comparison group made up of students who did not take the initial practice quiz, this research accounted for some of the differences that setting can create.

The qualitative analysis involved issues of self reporting and social desirability. The fact that the students provided individualized and personalized feedback on both the mid term and end of term feedback forms could cause them to misrepresent their own feelings. This issue was minimized to an extent by having the feedback anonymous, however, it is impossible to know for sure that these issues do not play a role in the outcomes from the feedback.

Conclusions

The results of this study indicate that traditional students outperform their online counterparts academically, however, there is no difference between students who

participate in an optional initial quiz and those students who do not. Qualitative analysis performed on student evaluations indicates that the students in both courses appreciate the content that they are learning, but have difficulty with the technology involved with the course. With a greater emphasis placed on the use of distance education and assessment tools, this research serves the purpose of attempting to judge the efficacy of these tools, and for outlining the direction that further research may take to assure the successful inclusion of distance assessment tools into the educational process. In addition, this research sets the stage for subsequent improvements to the delivery methodologies utilized in the ECI 300 courses.

References

Allen, D., & Cosby, W. (2000). *American schools: The 100 billion dollar challenge.* New

York: iPublish.com at Time Warner Books.

Balch, W. (1998). Practice versus review exams and final exam performance. *Teaching of*

Psychology, 25(3), 181-185.

Berge, Z. (1999). Interaction in post-secondary web-based learning. *Educational*

Technology, 39(1), 5-11.

Biner, P., Bink, M., Huffman, M., & Dean, R. (1995). Personality characteristics

differentiating and predicting the achievement of televised-course students and

traditional-course students. *American Journal of Distance Education, 9*(2), 46-60.

Biner, P., Dean, R., & Mellinger, A. (1994). Factors underlying distance learner

satisfaction with televised college-level courses. *The American Journal of*

Distance Education, 8(1), 60-71.

Bludau, H., Maddox, E.M., & Pounds, S. (1998). *Constructivist evaluation in*

telecommunications learning environments. Retrieved May 26, 2001,

from http://www.coe.tamu.edu/~kmurphy/classes/telecom98s/constructivist/index

.htm

Bol, L., and Hacker, D. (2001). A comparison of the effects of practice tests and

traditional review on performance and calibration. *The Journal of Experimental*

Education, 69(2), 133-151.

Carnevale, D. (2000). Study assesses what participants look for in high-quality online

courses. *The Chronicle of Higher Education, 47*(9), A46

Clark, R. C., and Lyons, C. (1999). Using web-based training wisely. *Training, 36*(7), 51-56.

Cole-Gomolski, B. (1999). Web training requires different educational approach. *Computerworld, 33*(8), 44.

Cragg, C. (1994). Nurses' experiences of a post-RN course by computer mediated conferencing: Friendly Users. *Computers in Nursing, 12*(5), 221-226.

Dressel, P. (1986). *Handbook of Academic Evaluation.* San Francisco: Jossey-Bass, Inc.

Ehrmann, S. and Collins, M. (2001). Emerging models of online collaborative learning: Can distance enhance quality? *Educational Technology, 41*(5), 34-38

Filipczak, B. (1995). Putting the learning into distance learning. *Training, 32*(10), 111-118.

Freilich, M. (1989). Frequent quizzing, the final exam and learning: Is there a correlation? *Journal of Chemical Education, 66*(3), 219-223.

Gagne, M., & Shepherd, M. (2001). Distance learning in accounting: A comparison between a distance and a traditional graduate accounting class. *T.H.E. Journal 28*(9), 58-60.

Gomez, A., Moore, B., Mortera-Gutierrez, F., and Torres, L. (1998). *Evaluation and assessment in telecommunications environments.* Retrieved May 26, 2001 from http://disted.tamu.edu/classes/telecom98f/evaluation.htm

Hiltz, S. (1986). The "virtual classroom": Using computer mediated communication for university teaching. *Journal of Communication, 36*(2), 95-104.

Hester, J. (1999). Using a web-based interactive test as a learning tool. *Journalism and Mass Communication Educator, 54*(1), 35-41.

Hodsen Carlton, K., Ryan, M., Siktberg, L. (1998). Designing courses for the internet: A conceptual approach. *Nurse Educator, 23*(3), 45-50.

Hoogstraten, J. (1979). Pretesting as determinant of attitude change in evaluation research. *Applied Psychological Measurement, 3*(1), 25-30.

IDE: Innovations in Distance Education (2000). *An emerging set of guiding principles and practices for the design and development of distance education.* Retrieved September 17, 2001 from

http://www.outreach.psu.edu/DE/IDE/guiding_principles/

Kerka, S. (1996). *Distance learning, the internet, and the world wide web.* Retrieved September 4, 2001 from

http://www.ed.gov/databases/ERIC_Digests/ed395214.html

King, T. (1998). *Issues arising during the continuous computer aided assessment of large groups.* Retrieved September 3, 2001 from

http://www.dis.port.ac.uk/~kingtr/research/dublin.html

Kulik, J., Kulik, C., and Bangert, R. (1984). Effects of practice on aptitude and achievement test scores. *American Educational Research Journal, 21*(2), 435-437.

Lewis, L., Snow, K., Farris, E., and Levin, D. (1999). Distance education at postsecondary education institutions: 1997 – 98. *National Center For Education Statistics Statistical Analysis Report.* Executive Summary [Electronic version]. Retrieved September 17, 2001 from

http://nces.ed.gov/pubs2000/qrtlyspring/5post/q5-7.html

Machtmes, K., and Asher, J. W. (2000). A meta-analysis of the effectiveness of telecourses in distance education. *The American Journal of Distance Education* *14*(1), 27-46.

Maki, R., and Serra, M. (1992). Role of practice tests in the accuracy of test predictions on text material. *Journal of Educational Psychology, 84*(2), 200-210.

McCollum, K. (1997). A professor divides his class in two to test value of on-line. *Chronicle of Higher Education, 43*(24), 23.

McDaris, M. (1984). Test frequency revisited: A pilot study. Presented at Annual Meeting of the International Communication Association. (ERIC Document Reproduction Service No. ED 265 175)

McLester, S. (2001). Convergent learning: Redefining the education experience. *Technology & Learning, 22*(1), 30-32

Mello, V. (1997). Online quizzes – Are they worthwhile? *The Internet TESL Journal, 3*(7). Retrieved September 3, 2001 from http://www.aitech.ac.jp/~iteslj/Articles/Mello-Quizzes.html

Mitchell, B., and Reed, M. (2001). Using information technologies for interactive learning, *Journal of Geography, 100*(4), 145-153

Mood, T. (1995). *Distance Learning: An Annotated Bibliography*. Englewood: Libraries Unlimited, Inc.

Negin, G. (1981). The effects of test frequency in a first-year torts course. *Journal of Legal Education, 31*(3-5), 673-676.

Old Dominion University (2001). *Institutional research and assessment.* Retrieved November 1, 2002 from

http://www.odu.edu/ao/upir/FactBook/HC_Enrollment/hc_by_university/hcdemof
ilefall01_5.htm

Olson, A. (2000). Computerized testing. *American School Board Journal, 187*(3), 31.

Palmer, E. (1974). Frequency of tests and general subject-area mastery. *Psychology
Reports, 35*(1), 422.

Phillips, G.. & Santoro, G. (1989). Teaching group discussion via computer-mediated
communication. *Communication Education, 38*(2), 151-161.

Porter, A. (1991). *Videoseries, schools that work: Videoconference #4 alternatives for
measuring performance.* Retrieved May 26, 2001 from
http://www.ncrel.org/sdrs/areas/issues/methods/assment/as500.htm

Redding, T., &Rotzien, J. (2001). Comparative analysis of online learning versus
classroom learning. *Journal of Interactive Instructional Development 13*(4), 3-12.

Riley, R. (1996). *Benefits of technology use.* Retrieved May 26, 2001 from
http://www.ed.gov/Technology/Plan/NatTechPlan/benefits.html

Ryan, K., & Cooper, J. (2000). *Those Who Can, Teach Ninth Edition.* Boston: Houghton
Mifflin Company.

Ryan, M., Hodson Carlton, K., and Aki, N. (1999). Evaluation of traditional classroom
teaching methods versus course delivery on the world wide web. *Journal of
Nursing Education, 36*(6), 272-277.

Smith, S., Smith, S., and Boone, R. (2000). Increasing access to teacher preparation: The
effectiveness of traditional instructional methods in an online learning
environment. *Journal of Special Education Technology, 15*(2), 37-46

Soderberg, L. (1971). An exploratory study of the relationship between cognitive

   pretesting and course achievement. *California Journal of Educational Research,*

   22(2), 64-67.

Souder, W. (1993). The effectiveness of traditional vs. satellite delivery of three

   management of technology master's degree programs. *The American Journal of*

   Distance Education, 7(1), 37-53.

Stepich, D., Ertmer, P. & Lane, M (2001). Problem-solving in a case-based course,

   strategies for facilitating coached expertise. *Educational Technology Research*

   and Development, 49(1), 53-69.

Stern, D. (1997). *Learning and earning: The value of working for urban students.*

   Retrieved September 15, 2001 from http://icdl.uncg.edu/ft/062100-03.html

Stone, H. (1988). Variations in the characteristics and performance between on-campus

   and video-based off-campus engineering graduate students. *Journal of Continuing*

   Higher Education, 36(1). 18-23.

Thompson, M. (1998). *Distance learners in higher education.* Retrieved September 4,

   2001 from http://wbweb4.worldbank.org/disted/Teaching/Design/kn-02.html

Tucker, S. (2001). Distance education: Better, worse, or as good as traditional education?

   Online Journal of Distance Learning Administration 4(4), Retrieved November

   11, 2002 from http://www.westga.edu/~distance/ojdla/winter44/tucker44.html

University of Idaho Engineering Outreach (2000a). *Distance education at a glance: An*

   overview. Retrieved September 17, 2001 from

   http://www.uidaho.edu/evo/dist1.html

University of Idaho Engineering Outreach (2000b). *Distance education at a glance: research*. Retrieved September 17, 2001 from

http://www.uidaho.edu/evo/dist9.html

Urban University Statistical Portrait Project (2001). *Portrait of universities with metropolitan alliances (PUMA)*. Retrieved September 4, 2001 from

http://www.imir.iupui.edu/urban/

Wesp, R. (1986). Reducing procrastination through required course involvement. *Teaching of Psychology, 13*(3), 128-130.