AN ASSESSMENT OF LEARNING OUTCOMES OF STUDENTS TAUGHT
A COMPETENCY-BASED COMPUTER COURSE IN AN
ELECTRONICALLY-EXPANDED CLASSROOM

DISSERTATION

Presented to the Graduate Council of the
University of North Texas in Partial
Fulfillment of the Requirements

For the Degree of

DOCTOR OF PHILOSOPHY

By

Mark H. Mortensen, B.A., M.S.
Denton, Texas
December, 1995
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This study sought to determine whether there was a difference in subject matter knowledge as measured by a pretest and posttest, a difference in final course grade as a numeric score, and a difference in attitudes toward computers between students in a competency-based ("hands-on") computer applications course taught in an electronically-expanded classroom compared to students taught in a traditional classroom setting. In addition, students taught in the electronically-expanded classroom completed a questionnaire assessing attitudes toward the presentation method.

Another purpose of this study was to evaluate the feasibility of applying distance education techniques to teach what was, in essence, an on-campus course. The vehicle for this investigation was an electronically-expanded classroom. The electronically-expanded classroom utilized distance education technology (video, audio, and computer networking) to connect two classrooms in the one building. Students in these two classrooms were the treatment group. Students taking the course in a traditional setting functioned as the comparison group. A total of 109 participants completed the study.

Results of the study revealed no significant difference in scores on the subject matter posttest, the final course grade as a numeric score, and attitudes towards computers posttest between students taught the course in an electronically-expanded classroom and students taught the course in the traditional classroom.
Results of the survey to measure satisfaction with the presentation method revealed that students in the receive room were slightly more satisfied than students in the send room with the presentation method, but the difference was not significant. The survey indicated that participants in the study were sensitive to technical problems, especially audio-related difficulties. While participants noted some dissatisfaction with audio quality, it had no apparent effect on learning outcomes and attitudes for this study.

The study concluded that students taking a course in an electronically-expanded classroom have learning outcomes and attitudes toward computers comparable to those students taking the course in a traditional classroom.
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# TABLE OF CONTENTS

LIST OF TABLES ................................................................. vi

LIST OF ILLUSTRATIONS ..................................................... ix

Chapter

1. INTRODUCTION ............................................................. 1
   - Statement of the Problem
   - Purpose of the Study
   - Research Hypotheses
   - Significance of the Study
   - Basic Assumptions
   - Limitations of the Study
   - Delimitations of the Study
   - Definition of Terms
   - Description of the Electronically-Expanded Classroom

2. REVIEW OF RELATED LITERATURE ........................................ 14
   - Introduction
   - Definitions of Distance Education
   - Research on Distance Education
   - Role of Remote-Site Facilitators
   - Research on Computer Attitudes and Anxiety
   - Summary

3. METHODOLOGY ............................................................. 35
   - Purpose
   - Research Participants
   - General Design
   - Comparison Groups
   - Treatment Groups
   - Instrumentation
Table

15. Living Arrangements and Number of Hours Worked During Study Period .............................................. 60

16. Frequency of Major Field of Study ................................................................. 61

17. Chi-Square Analysis of Study Population Academic Standing and Gender Using Pilot Study Population as Expected Frequency .................................................. 62

18. Group Means, Descriptive Statistics and T-Test for Pretest Scores of Subject Matter Knowledge .......................................................... 64

19. Group Means, Descriptive Statistics, and t-test for Posttest Scores of Subject Matter Knowledge .......................................................... 64

20. Results of ANCOVA for Posttest Scores on Subject Matter Test ............................ 65

21. Subject Matter posttest Group Means and Other Descriptive Statistics for De-Composed Study Groups .................................................................................. 66

22. T-test Analysis for Final Grade as a Numeric Score ............................................ 67

23. Means of Final Grades and Other Descriptive Statistics for De-Composed Study Groups .................................................................................. 68

24. ANOVA for Final Grade as a Numeric Score for De-Composed Study Groups .................................................................................. 68

25. Group Means, Descriptive Statistics, and T Test for Pretest Scores Of Attitudes Toward Computers .................................................................................. 69

26. Group Means, Descriptive Statistics, and T Test for Posttest Scores Of Attitudes Toward Computers .................................................................................. 69

27. Results of ANCOVA for Posttest Scores for Attitudes Toward Computers ....................... .................. 70
<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>28. Results of $t$-Test on Adjusted Means for Attitudes Toward</td>
<td>71</td>
</tr>
<tr>
<td>Computers ANCOVA</td>
<td></td>
</tr>
<tr>
<td>29. Group Means, Descriptive Statistics, and $t$ Test for Satisfaction</td>
<td>72</td>
</tr>
<tr>
<td>with Presentation Method</td>
<td></td>
</tr>
<tr>
<td>30. Group Means, Descriptive Statistics, and $t$ Test for Satisfaction</td>
<td>72</td>
</tr>
<tr>
<td>with Receive Room Teaching Assistant</td>
<td></td>
</tr>
<tr>
<td>31. Group Means and Other Descriptive Statistics by Individual</td>
<td>73</td>
</tr>
<tr>
<td>Treatment Rooms for Satisfaction with Presentation Method</td>
<td></td>
</tr>
</tbody>
</table>
# LIST OF ILLUSTRATIONS

<table>
<thead>
<tr>
<th>Figure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Diagram of Send Room (Matthews Hall Room 307)</td>
<td>11</td>
</tr>
<tr>
<td>2. Diagram of Receive Room (Matthews Hall Room 310)</td>
<td>12</td>
</tr>
<tr>
<td>3. Conceptual Diagram of Signal Flow</td>
<td>13</td>
</tr>
</tbody>
</table>
CHAPTER 1

INTRODUCTION

In *The Emerging Worldwide Electronic University*, Rossman (1992) predicted that a wide range of electronic communications will define the methods of instruction of colleges and universities in the future. Rossman envisioned a "world university" with educational processes that can either be distributed to or accessed from anywhere on the globe. The world university is far from a reality but institutions of higher education are starting to exhibit some of the characteristics (Rossman, 1992). Distance education systems, electronic mail, local area computer networks, and off-campus access of university references are all indications of the direction that institutions of higher education are traveling.

Technology is currently a driving factor in the development of innovative systems for instruction (Tompkins, 1993). Rapid development of information technologies and systems coupled with decreasing costs "continue to expand the range of choices, and new strides in interconnecting systems are being made regularly" (U. S. Congress, Office of Technology Assessment, 1989b, p. 8). Of particular interest is the ability to deliver real-time instruction to students in remote sites via two-way video and audio technology. Many services, including for-degree-credit courses, can be delivered to various groups without the need to build additional campus facilities or hiring new faculty (Jacobson, 1994). The cost of technology-delivered programs is decreasing as the electronic method of instruction is becoming more accepted (Wilkinson & Sherman, 1991).
Reaching large numbers of students, including students in rural and urban areas who would not have the opportunity to receive the instruction under traditional programs, is one of the benefits of distance education identified by Willis (1993). Another benefit of distance education is that students who are unable to attend on-campus classes at the university level can receive such courses via distance education. For example, a teacher who lives too far from a university would have the opportunity to work on an advanced degree by taking course work over the network. Curriculum in K-12 environments can be enriched by linking students in different geographic locales and providing opportunities for students of various social, ethnic, cultural, and experiential backgrounds to converse in an interactive fashion (Schlosser & Anderson, 1994; U. S. Congress, Office of Technology Assessment, 1989a).

One of the unique and challenging characteristics of distance education is that the learners and instructors are separated. This separation of teacher and students leads to concerns regarding the knowledge, skills, and attitudes transmitted within the distance education environment. Instructional methods need to be oriented to the special conditions of the distance education context. For example, instructors need to establish ways for students in the remote classrooms to feel comfortable contacting them and to consider issues such as advanced preparation, visual materials, student interaction, activities for independent study, and follow-up activities (Willis, 1993).

Research has indicated that student achievement, attitudes toward course material, and attitudes toward the instructor have not been negatively affected by distance education implementation when appropriate instructional practices are used (Keegan, 1990; Moore & Thompson, 1990; Willis, 1993). These findings have
been consistent over diverse systems such as audio teleconferencing, televised courses, one-way video with two-way audio, and two-way video with two-way audio. Also, research has found no significant difference between remote sites and on-campus sites measures of student achievement and attitudes across student groups with varying characteristics. Study groups for most distance education studies involved high-achieving high school students, college students enrolled in special course offerings or non-traditional students (Moore & Thompson, 1990).

Perhaps the most ubiquitous technology-based tool in education has been the personal computer. The U. S. Congress Office of Technology Assessment (1989b) estimated that over 95 percent of all public schools had computers in 1988 compared to 18 percent in 1981. In 1980 the Bureau of Labor Statistics estimated that by 1995, two million people will have jobs that are directly related to computers (Massoud, 1990). That prediction turned out to be shortsighted. Regardless of the number of people using computers, computer experience has become a critical component in a student's education (Ertmer, Evenbeck, Cennamo, & Lehman, 1994). Leso and Peck (1992) suggested that a basic skills course emphasizing a hands-on approach to word processing, spreadsheets, and databases can control anxiety in novice computer students.

Recent literature indicates that distant education is a viable teaching technique for various groups of learners. Most studies involving two-way interactive systems have utilized off-campus receive sites connected to an on-campus origination site. There was no conspicuous literature on the application of two-way video and audio distance education technology as an intra-institutional method of course distribution.
This study used an electronically-expanded classroom to teach students a competency-based ("hands-on") introductory computer course. The electronically-expanded classroom utilized distance education technology to teach the course to a more traditional, on-campus group of students.

The Problem

Will on-campus, traditional students enrolled in a course required for graduation (in most instances), taught in an electronically-expanded classroom, achieve at the same level as those students taught in a traditional classroom? Will students taught in an electronically-expanded classroom indicate a difference in attitudes toward computers and toward the course than those taught in a traditional manner? Will students in an electronically-expanded classroom react positively to the electronically-expanded classroom method of instruction?

Purpose of the Study

The purpose of this study was to determine whether there was a difference in subject matter knowledge as measured by pretest and posttest, a difference in final course grade as a numeric score, and a difference in attitude toward computers between students in a competency-based ("hands-on") computer applications course taught in an electronically-expanded classroom compared to students taught in a traditional classroom setting. In addition, students taught in the electronically-expanded classroom completed a questionnaire assessing attitudes toward the presentation method.

Another purpose of this study was to evaluate the feasibility of applying distance education techniques to teach what was, in essence, an on-campus course. The vehicle for this investigation was the electronically-expanded classroom described on page 8.
Research Hypotheses

This goal of this study was to test the following hypotheses:

1. There is no significant difference in cognitive ("paper and pencil") knowledge of course content, as measured by pretest and posttest, between students enrolled in a competency-based ("hands-on") computer applications course taught in an electronically-expanded classroom and students taught in a traditional classroom.

2. There is no significant difference in final grade, as a numeric score, between students taught in an electronically-expanded classroom and students taught in a traditional classroom.

3. There is no significant difference in attitudes, measured by pretest and posttest, toward computers between students taught in an electronically-expanded classroom and students taught in a traditional classroom.

4. There is no significant difference in satisfaction with the presentation method between the rooms (send and receive) that comprised the electronically-expanded classroom.

Significance of the Study

Simpson (1993) noted that recent decreases in funding for institutions of higher education have required educators to look at basic operating procedures, including the delivery of instruction. It may be necessary to change lecture, lab and discussion procedures, changes which may affect class size or the number of course offerings (Simpson, 1993). Jacobson (1994) pointed out that "virtual" classrooms, such as distance education systems provide, can reduce costs by not having to build
new buildings or hire additional faculty. Linking classrooms via electronic means on a campus may be an innovative approach to cost savings during the current fiscal crisis of higher education institutions. This technique may offer promise for the large-scale teaching of courses required of all students for graduation.

There was no apparent research describing classroom procedures in an electronically-expanded classroom. The electronically-expanded classroom (described on page 8) most resembles two-way video and audio distance education systems. There was no apparent research on either students taking a computer course via distance education or students taking an institutionally-required course via distance education.

Basic Assumptions

This study assumed that the measures of knowledge, achievement and attitudes toward computers were sufficient and appropriate to evaluate differences between students taking a competency-based computer applications class in an electronically-expanded classroom and students taking the same course in a traditional classroom. It was also assumed that the chosen instruments are reliable and valid and the instructors covered the required material of the course.

To demonstrate that an electronically-expanded classroom would be a feasible method of instruction, it was desirable for this study to retain the null hypothesis for the research questions. That is, alternative teaching systems or techniques must demonstrate that student outcomes such as achievement and attitude would not differ from (but could certainly exceed) those associated with traditional methods. It was assumed that no significant difference on the variables of interest was acceptable justification to demonstrate the feasibility of the electronically-expanded classroom as an alternative teaching method.
Limitations of the Study

Since this study was limited to students that had self-selected the class sections and the summer school sessions that were targeted for comparison in this study, results may not be generalizable to the larger CECS 1100 program, or introductory computer students in other programs at other institutions. The data may not be inferred to be representative of all areas of study at the university level.

Delimitations of the Study

The sample of students was from the population of students who enroll in the Computer Applications in Education course offered by the Computer Education and Cognitive Systems (CECS) program track in the College of Education of the University of North Texas. This study was conducted during two summer school sessions, and student subjects may not be representative of all students who enroll in the course during a long semester.

Definition of Terms

**Computer Applications in Education (CECS 1100).** An introductory, competency-based, computer course emphasizing the use of word processing, database, spreadsheet, and telecommunications software. Other topics include history of computing, hardware and software, computing security and ethics, information management, and advanced computing systems.

**Electronically-expanded classroom.** A full motion, two-way video and audio distance education system that links classrooms. A computer network is part of the system. For the purposes of this study, the electronically-expanded classroom comprised two units:
Send room. A room was from which the instructor originated the class material via video and audio equipment. Students were present in this room.

Receive room. A room across the hall from the send room also configured with video and audio equipment. Students in the receive room were able to interact with the instructor and students in the send room.

Teleconferencing. A term used as a reference to any type of interactive, electronic communication between individuals. For instance, audio teleconferencing referred to the interactive communication between individuals using primarily audio-based equipment.

Description of the Electronically-Expanded Classroom

The electronically-expanded classroom consisted of two rooms in the College of Education's Matthews Hall. The send room was located in Matthews 307 which is the distance education facility of the Center for Professional Development and Technology. The room was equipped with a video camera at the front of the room that provided shots of students and a video camera in the back of the room that provided shots of the instructor. A visualizer (in essence, a video overhead device) that could be used for paper-based graphic materials was located at the instructor's desk. The instructor's desk had two computers and small video monitors. The instructor could zoom and focus the cameras, change between cameras, and roll videotapes from a control panel adjacent to the desk. The instructor used a combination of lecture, computer demonstrations, and structured laboratory exercises to teach the content of the course.
Students viewed the video output of the room on one large monitor and viewed the output of the receive room on another monitor. Students were able to hear and talk to students in the other room.

The receive room was Matthews 310, across the hall from the send room. Students could see and hear the students in the send room. In addition, students in the receive room could also see a picture of themselves. One camera operated by a teaching assistant provided pictures of the students in this room. The video and audio was distributed between the two rooms via the campus cable television system. This provided a full-motion, analog television signal between the two rooms.

All formal instruction (e.g., lectures, demonstrations) was presented by the instructor via the two-way video and audio system. During formal instruction periods, the teaching assistant operated the video and audio equipment but did not provide any of the instruction. Hands-on computing activities were supervised by both the instructor and teaching assistant. The teaching assistant provided help with student computing problems and provided guidance during laboratory exercises.

Descriptions of the daily procedures used in the room during the study period are located in the sections on the comparison groups and treatment groups in chapter 3. Figure 1 is a diagram of the of the send room and its various components. Figure 2 is a diagram of the receive room. The receive room was also used as the teaching location for the comparison groups. The video and audio equipment was stored in a corner of the room when not in use. The equipment did not interfere with the teaching practice of the comparison groups. Figure 3 is a
conceptual diagram of the flow of the analog television signal between the two rooms.

The model for the electronically-expanded classroom is what Stone (1990) referred to as the "candid classroom" (p. 231). In essence the candid classroom allows for the televised activities of a traditional classroom requiring a minimum of broadcast television techniques. "As a process it is television for education, as opposed to education for television, with studio accoutrements (sic) and production requirements transparent and purposely secondary to normal in-class activities" (Stone, 1990, p. 232). The faculty member is an active classroom participant creating materials and activities appropriate for daily activities. This is opposed to the model where the television teacher is more actor or talent in a pre-produced telecourse.
Figure 1. Diagram of send room (Matthews Hall Room 307).
Figure 2. Diagram of receive room (Matthews Hall Room 310).
Figure 3. Conceptual diagram of signal flow.
CHAPTER 2

REVIEW OF RELATED LITERATURE

Introduction

Distance education systems take several forms, ranging from traditional print-based correspondence study to interactive, two-way video and audio electronic communication systems. All of the various systems have been proven effective considering such variables as student achievement, attitudes toward course material, gender difference, and age when compared to alternate methods of instruction (Moore & Thompson, 1990; Schlosser & Anderson, 1994). Results for variables such as dimensions of student control (Baynton, 1992), learning style (Coggins, 1988; Ehrman, 1990), and attrition rate (Coggins, 1988; Dille & Mezack, 1991) have been mixed, depending on the type of delivery system. The electronically-expanded classroom that is the focus of this study shares characteristics with other telecommunications systems. This review focuses on four areas of interest: (a) definitions of distance education, (b) research on student achievement in and attitudes toward courses via various systems, © the role of the remote-site facilitator in distance education, and (d) research on student attitudes and anxiety towards computers.

Definitions of Distance Education

Schlosser and Anderson (1994) pointed out that the problem with defining distance education is that "distance" has many meanings, and the term distance education has been applied to a large variety of programs. The definition also seems
to change based on each application of new technology. The largest number of technology-based changes have occurred in the last 20 years.

William Rainey Harper instituted a correspondence program at the University of Chicago before the turn of the century. That program is generally considered to be one of the first implementations of distance education at a university in the United States. Various courses offered by both schools and businesses were evident in the mid 1880’s in Europe (Schlosser and Anderson, 1994). There is no doubt that print-based correspondence education over its approximately 150 year history has proven effective (Willis, 1994; Verduin & Clark, 1991, Keegan, 1990).

The term distance education was coined in 1982 at a conference of the International Council for Correspondence Education (ICCE). As a response to the many emerging teaching and learning patterns based on technology, the ICCE changed its name to the International Council for Distance Education (Garrison, 1989). All of the new patterns of education that were considered distance education had in common the separation of the teacher and learner (as did correspondence study).

In 1979, UNESCO defined distance education as

Education conducted through the postal services, radio, television, telephone or newspaper, without face-to-face contact between teacher and learner. Teaching is done by specially prepared material transmitted to individuals or learning groups. Learners’ progress is monitored through written or taped exercises, sent to the teacher, who corrects them and returns them to learners with criticism and advice (cited in Keegan, 1990, p. 44).
Keegan felt that this definition was too restrictive and did not allow for various interactive systems. Keegan also considered Shale’s (1988) definition — “education at a distance” — as too simplistic. Keegan synthesized the following components from the many emerging concepts of distance education:

- the quasi-permanent separation of teacher and learner throughout the length of the learning process (this distinguishes it from conventional face-to-face education);

- the influence of an educational organization both in the planning and preparation of learning materials and in the provision of student support services (this distinguishes it from private study and teach-yourself programs);

- the use of technical media - print, audio, video or computer - to unite teacher and learner and carry the content of the course;

- the provision of two-way communication so that the student may benefit from or initiate dialogue (this distinguishes it from other uses of technology in education); and

- the quasi-permanent absence of the learning group throughout the length of the learning process so that people are usually taught as individuals and not in groups, with the possibility of occasional meetings for both didactic and socialization purposes. (p. 44)

The last component of Keegan's definition is no longer applicable in most two-way interactive situations. Group instruction in classrooms via distance education is a normal application of distance education.

In 1990, Moore proposed that the definition of distance education "consists of all arrangements for providing instruction through print or electronic
communications media to persons engaged in planned learning in a place or time different from that of the instructor or instructors" (p. xv).

Peters (cited in Schlosser & Anderson, 1994) emphasized the role of technology, defining distance education as a method of imparting knowledge, skills and attitudes which is rationalized by the application of division of labor and organizational principles as well as by the extensive use of technical media, especially for the purpose of reproducing high quality teaching material which makes it possible to instruct great numbers of students at the same time wherever they live. It is an industrialized form of teaching and learning. (p. 2)
Peters' definition de-emphasizes the role of group instruction and characterizes distance education as a tool for mass distribution of material regardless of setting.

Heinich, Molenda, and Russell (1993) have taken Keegan's (1990) definition and refined it to a form of education characterized by physical separation of learners from the teacher, an organized instructional program, technological media, and two-way communication.

While not offering a definition of distance education, Garrison and Shale (1987) suggested three essential criteria for classifying distance education:

1. Distance education implies that the majority of educational communication between (among) teacher and student(s) occurs noncontiguously.
2. Distance education must involve two-way communication between (among) teacher and student(s) for the purpose of facilitating and supporting the educational process.

3. Distance education uses technology to mediate the necessary two-way communication. (p. 11)

Current application of the term distance education tends to refer to real-time, interactive systems. Recently, approaches such as telecourses (e.g., delivered by television) and correspondence courses tend to be referred to by those names. That is, the delivery system is being used to define the type of distance education.

Research on Distance Education

Heinich, Molenda, and Russell (1993) offer a useful taxonomy of telecommunications systems for distance education. The systems include radio, audio teleconference (e.g., telephone system link between locations), audiographic teleconference (e.g., telephone system link and computer-generated still video images), computer conference (computers connected via modem or network), teletext/videotext (various text-base and commercial on-line services), one-way video and audio (e.g., broadcast television), one-way video with two-way audio (e.g., TI-IN network), and two-way video and audio (various compressed video systems). Each system has advantages and disadvantages based on objectives of use (Heinich, Molenda & Russell, 1993). For instance, it is not necessary to be able to read and write in order to learn from radio. But, radio is problematic if visuals are necessary for instruction. Two-way video and audio systems provide more opportunity for student interaction between two locations but can prove to be expensive.

Blackwood and Trent (1968) measured the effectiveness of teaching a money management short course to adult women via audio teleconferencing. The course
was offered in a morning and afternoon session. Scores of the groups were pooled. The group taking the course via audio teleconferencing (N = 37) was compared to subjects taking the course in a traditional face-to-face manner (N = 34). A pretest-posttest design was incorporated to measure the amount of change in subject matter competency and attitude toward the method of presentation. Both measures were also analyzed according to demographic characteristics. Blackwood and Trent found that, for the women studied, there was no significant difference in subject matter competency or attitudes toward the presentation based on age, level of education, and time of day taking the course.

Hoyt and Frye (1972) expanded on the study by Blackwood and Trent (1968). Hoyt and Frye mentioned that previous studies of the Telelecture system at Kansas State University exhibited flawed methodology and did not include variables related to student characteristics. Hoyt and Frye used students (N = 378) taking six different courses, both graduate and undergraduate, using face-to-face instruction and simultaneous audio teleconferencing. The authors found no significant difference on student achievement variables across the six courses. Based on progress toward student goals, the authors found one course showed an advantage for the audio teleconference group. In addition, the study found that students who were successful in the course, regardless of teaching method, were more motivated and responsible than unsuccessful students. Successful students in the audio teleconference groups were more self-reliant and independent than the on-campus groups.

Burge and Howard (1991) opined that a course using audio teleconferencing should not try to duplicate a traditional classroom setting. Using audio teleconferencing, they studied graduate elementary and secondary school principals
in courses that emphasized small group work among students at different sites, whole class work without the instructor listening in, and whole class work with the instructor as moderator. At the end of the course, students from 14 classes were surveyed. Results indicated that students were generally satisfied with the courses. In addition, respondents indicated the importance of the instructor in maintaining control over the dialogue and equipment operation. Most students also indicated that lack of visual material presented a challenge but felt that printed materials could bridge the gap.

Knapper (1990) studied students in the Caribbean taking an audio teleconference course from the University of Waterloo in Canada. He found that audio teleconferencing could provide personal and immediate contact between students and instructor, combat the loneliness of a long distance learner, stress oral communication, and be relatively inexpensive compared to other telecommunications systems. Similar to Burge and Howard (1991), Knapper also suggested that the audio teleconferences should be student-centered and not lecture-oriented.

Ellis and Mathis (1985) studied two sections (N = 117) of an introductory sociology course. In reviewing 11 previous studies related to teaching various courses via television, the authors found that most suffered from methodology problems. In addition, Ellis and Mathis (1985) found that "in most of the studies, the televised lectures were "studio lectures," usually involving somewhat different presentation styles and the use of more elaborate visual aids than typical classroom lectures" (p. 165). The purpose of their study was to correct for lack of randomization and student self-selection. Subjects in two course sections were randomly assigned to two groups resulting in two experimental and two control
groups. Course material was presented by the instructor in one room and televised live to the other. Although the difference was not significant, the students viewing the course by television performed higher on two of the four course exams. Ellis and Mathis reported no significant attendance problems but indicated that some students were displeased with missing some of the material due to missed video shots and occasional audio fidelity problems. The authors concluded that this study reinforced the notion that college courses could be taught effectively via television, whether live or videotaped.

Beare (1989) studied 175 undergraduate and graduate students enrolled in a Special Education course at Moorhead State University. The purpose of the study was to determine the effectiveness, measured by final course grade and course evaluation, of several presentation methods. Presentation methods included lecture, lecture with videotape copies available for student review, one-way video, two-way audio lecture, audio cassette-based lecture, videotape-based lecture, and videotape viewed by on-campus students. Beare found that there was no significant difference as to medium of presentation on course mastery or course evaluation. Beare also mused that lack of access to the instructor was offset by students reviewing taped segments of the course.

Based on the high drop-out rate of community college telecourses, Dille and Mezack (1991) sought to identify predictors of attrition among community college students taking courses via telecourse (television). Subjects (N=151) were assessed for demographic characteristics, locus of control, as measured by Rotter's Internal-External Locus of Control Scale, and learning styles, as measured by Kolb's Learning Style Inventory. Results of the study found that locus of control and various demographic characteristics were significant predictors of telecourse
attrition. Learning style, as measured by Kolb’s Learning Style Inventory, did not have a significant effect on attrition. To that end, the authors suggested that a high risk student would be "25 years old or younger, divorced, with fewer than thirty college credit hours completed, a GPA lower than 3.0-2.9, a higher than average Rotter score (above 7.5), and a higher than average (25 or above) Concrete Experience score, a lower than average (below) AC-CE score" (p. 32).

Western Kentucky University is a pioneer in the use of distance education to teach nursing, according to Fulmer, Hazzard, Jones, and Keene (1992). The authors reported that 23 classes had been taught in the recent past, 12 of which were for nursing education. Their two-way video and audio system used microwave transmission between campuses in Bowling Green and Owensboro. Students in the remote site could hear and see the instructor in the origination site, but the instructor and students in the origination site could not see return video pictures from the remote site. A nursing faculty member functioned as the remote-site coordinator.

The study group consisted of nursing students enrolled in a pharmacology course over a two-year period. Pooling subjects resulted in the an experimental group (off-campus) of 24 members and origination site (on-campus) of 26 members. Results of the study indicated that the experimental group (off-campus) performed better based on the number of A and B grades achieved. In addition, the experimental group achieved fewer C and D grades than did the control group (on-campus).

Fulmer, Hazzard, Jones, and Keene (1992) also found that students in both sites found the instructor to be effective, students in the remote site would often discuss issues among themselves (similar to findings of Haynes & Dillon, 1992), and
students were initially uncomfortable with the distance education technology.

Students enrolled in a high school honors anatomy and physiology course were the focus of a study by Martin and Rainey (1993). The purpose of the study was to determine whether there was a difference in student achievement and attitudes toward the course between students taught the course via a satellite-delivered course and students taught the course in a traditional classroom. The experimental group received the course via the TI-IN network in seven schools in the state of Alabama. The control group was also constituted from seven schools. Schools were matched on various characteristics such as student enrollment and local community population. The experimental and control groups were matched on demographic variables such as race, gender, and socioeconomic status. Students viewed the course via a television monitor and could talk back to the instructor via telephone. The control group instruction was based on the same curriculum materials but taught by a local instructor in each of the seven control group schools. All instructors used a common table of specifications for the course material.

Scores of the seven sections of both the experimental and control groups were combined for data analysis using the t-test procedure for dependent means. Pretest difference on course content was found not to be significant between the experimental and control groups (N=98). The experimental group performed significantly better on the course content posttest. Results of the posttest on attitudes toward the course revealed no significant difference between the two groups.

Martin and Rainey (1993) concluded that a satellite-delivered, one-way video, two-way audio system such as the TI-IN network did not affect student achievement and attitude for the students enrolled in the honors science course.
The authors noted that there needs to be more research on the establishment of criteria for student participation in distance education courses.

Haynes and Dillon (1992) studied students enrolled in a required library science course at the University of Oklahoma. The principal variable of interest was student interaction in a two-way compressed video and audio distance education system. Other variables studied were student outcomes related to course content and attitudes. Students attended at the origination site at the main campus in Norman and the remote site at the Tulsa campus. The subjects of the study (N = 12) were nontraditional. Haynes and Dillon noted that "both groups fit the profile of a nontraditional student; they are part-time students, hold full-time jobs, are married with families, and are older than traditional students" (p. 40).

Students were administered a subject matter pretest and posttest. Results of the analysis indicated no significant difference on specific content items except for two specific objectives. The students in the origination room scored higher on one objective, and students in the remote site scored higher on one objective. Haynes and Dillon noted that this supports the contention that face-to-face instruction is not more effective than mediated instruction. The study also found that remote site subjects interacted more with other members of the remote site and interacted less with the instructor. Remote site students felt that students in the origination room were the primary focus of attention of the instructor. Results of the attitude survey indicated that subjects had a negative response to the technology of the system more than anything course related. The authors noted that audio quality was the major focus of the complaints. Availability of resources such as computers required for portions of the course and library material was a particular concern of students in this study. An expanded administration of the attitude instrument to students
taking other courses over the same system revealed the same complaint about technical quality.

Simpson, Pugh, and Parchman (1991) discussed the design, implementation, and evaluation of a two-way, compressed video and audio system to train Navy personnel. The study had four objectives: (a) to determine the impact of the system on student performance, (b) to determine the impact of the system on student and instructor attitudes, (c) to document the support requirements and technical problems associated with startup and operation of the system, and (d) to assess the cost-effectiveness of the system.

The remote site was treated as the experimental group, and the origination site functioned as a control group. Four short courses of varying lengths were studied. Scores of subject matter mastery from two courses indicated no significant difference, but sample sizes were very small (13 and 15, respectively). Results of the attitude survey of all four groups were pooled yielding a sample size of 48. Attitudes were similar between students at the originating site and the remote sites. The authors noted that remote-site students did not feel that they had as much access to the instructor as those in the origination-site. The remote-site students indicated that they wanted to see video shots of the origination site students (a limitation of the system design). In addition, the remote-site students were more likely to comment on technical problems, particularly audio, than the origination-site students (Simpson, Pugh, & Parchman, 1991).

Moore and Thompson (1990) reviewed distance education literature and found that teaching and learning at a distance is effective "when effectiveness is measured by the achievement of learning, by attitudes of students and teachers, and by cost effectiveness" (p. 34). The authors noted that much of the research on
achievement focuses on special groups, such as gifted learners in the K-12 environment. In addition, there is a need for more "between groups" research with an attempt at randomization to control for systematic biases in the study groups.

In another recent review of distance education literature, Schlosser and Anderson (1994) noted that much of research centers on adult, off-campus college students and highly motivated, college-bound high school students. The authors conclude that distance education students have the potential to learn as well as students taught in traditional classrooms even though students tend to prefer the traditional classroom.

Schlosser and Anderson (1994) also found that distance education success is linked to instructor effectiveness. Instructors need to plan course presentations extensively, provide modes for student interaction, and design materials to complement the technology being used.

After reviewing the literature related to distance education, Willis (1993) concluded that preparation may be more important than innovation. That is, proper application of instructional design procedures, extensive lesson preparation, and attention to technical equipment details may contribute more to effectiveness than learner characteristics. Willis also stressed that all technical systems have built-in limitations that can be overcome by a trained instructor.

Role of Remote-Site Facilitators

Willis (1993) noted that the role of the facilitator is to function "as a bridge between students and instructor, keeping informed of student interests and progress, and providing guidance and answering questions as needed" (p. 31). To that end, the facilitator in remote sites needs to understand the goals of the
instructor and the needs of the students. Willis (1993) described three categories of on-site facilitators:

- **On-site facilitators with specific content expertise.**
  In this instance, the facilitators help explain difficult concepts in the course material. In laboratory situations, the facilitator functions as a lab assistant, providing advice, passing out materials and supervising student activities during the session.

- **Facilitators with limited content expertise.**
  Although not a content expert, the facilitator adds a personal dimension to the sessions. In addition, the facilitator can monitor student behavior, observe motivation and interest and provide extra attention to students that request it.

- **Facilitators with no content expertise.**
  Primary role of this category is as technician for the video and audio equipment. In addition, the facilitator would distribute and collect materials, proctor exams and generally handle organizational tasks.

Willis (1993) also noted that the facilitator should be considered an important contributor to the teaching process.

Much of the literature focuses on the role of facilitator in one-way video, two-way audio, satellite-delivered distance education. In the K-12 environment, the facilitator is often the regular classroom teacher. Oliver (1994) noted that this resulted in a “team teaching” approach where the content came from the distant instructor and the local teacher managed the instruction on site. Typical duties for the on-site facilitating teacher were:
- monitor student progress.
- manage logistics related to dissemination of course materials.
- lead discussion and encourage interaction with distant instructor and locally within the receive site classroom.
- compile and supervise the use of secondary instructional materials.
- assist the distant teacher with student evaluation; and
- manage the overall group process at the local site (Oliver, 1994).

Heinich, Molenda, and Russell (1993) reported that in formal K-12 distant education courses students achieved better when the remote instructor and local classroom teacher worked as a team. Similar to other studies, achievement increases were tied to the following behaviors by the local classroom teacher when the teacher:

- Watched and participated actively in all programs with the students.
- Encouraged interaction with the distant teacher.
- Answered simple questions.
- Solved immediate problems.
- Provided additional quizzes and worksheets.
- Took responsibility for operating and trouble shooting the equipment (Heinich, Molenda & Russell, 1993, p. 307).

A study at the University of North Texas investigated student perceptions of instructional method related to the role of the local site facilitator (Knezek, Miyashita, Jones, & Bills, 1993). Interviews were conducted with students participating in an introductory Japanese language course offered via the TI-IN network. The broadcast instructor for the course was American. The TI-IN network requires that an adult be present at the remote sites.
During the course, the research team provided five separate learning “scenarios” for the five students taking the course:

1. TI-IN with normal facilitation (an adult with no subject matter expertise). Primary activity of the facilitator was organizational and equipment technician.

2. TI-IN with local subject matter expertise facilitation. A native Japanese graduate student provided additional clarification of content and provide supplemental instruction.

3. TI-IN with a shared subject matter expert. This portion of the study simulated the use of the facilitator also from a remote site. The students received instruction from the regular distance teacher via satellite and the help of the facilitator from a simulated remote location (another room). This portion of the study was designed to test the efficacy of distribution of subject matter experts to multiple sites.

4. TI-IN with subject matter expert providing instruction in a “conversational” mode. This mode reversed the role of the instructor and facilitator. The facilitator taught the lesson in a conversational approach and the regular course material was treated as supplemental or review material.

5. Traditional classroom instruction. This was a theoretical approach described to students where all students in all remote sites would be brought together in one classroom and taught the course in a traditional fashion.

Interviews were conducted with participating students. Results indicated that the students preferred an American instructor; liked having a native Japanese facilitator; facilitator teaching skills were as important as subject matter expertise; the facilitator did not detract from the broadcast instructor; facilitator cultural
anecdotes added interest; extra outside classtime must be allocated to take full advantage of the facilitator's expertise, and facilitator expertise especially increases student conversational skills (Knezek, Miyashita, Jones, & Bills, 1993).

The role of the facilitator varies depending on the particular model of instruction and technological implementation. Training in the use of equipment and facilitation techniques is important to raise the level of the local site supervisor from "baby sitter" to "facilitator" (U.S. Congress, Office of Technology Assessment, 1989a). Spitzer, Bauwens, and Quast (1989) found in a study of telecourses that well-trained graduate students met with student approval as content experts and provided a cost-efficient approach to remote site facilitation.

Research on Computer Attitudes and Anxiety

Loyd and Gressard (1984b) raised the point that a positive attitude toward school subjects is important for the success of the learning process. As computer use in society has increased, more and more schools are teaching computer skills as part of the general curriculum. Citing previous research on mathematics anxiety, Loyd and Gressard suggested that "students' attitudes toward computers and toward learning about computers may be an important factor in the success or failure of the new computer programs" (p. 501). The authors developed the Computer Attitude Scale (CAS) and tested its reliability and factorial validity. The CAS consisted of three subscales measuring computer anxiety, computer liking, and confidence in computer use. Summing the three subscales yielded a Total Score. In a study of students (N = 155) in grades 8 through 12, the coefficient alpha reliabilities for the Computer Anxiety, Computer Liking, Computer Confidence and Total Score were reported as .86, .91, .91, and .95, respectively. Loyd and Gressard (1984b)
concluded that the subscales were sufficiently stable to be used as separate indicators or combined for a total indicator of computer attitudes.

In a companion study, Loyd and Gressard (1984a) noted some students reacted positively and some students reacted negatively when computers were introduced into classrooms. Using the CAS, Loyd and Gressard studied high school and college students (N = 354) to determine the effect of gender, age, and computer experience on computer attitudes. Factor analysis of variance was performed using the CAS subscales (Computer Anxiety, Computer Confidence, and Computer Liking) as dependent variables and age, gender, and computer experience as independent variables. Interaction effects were also analyzed. Results indicated that the simple main effect of computer experience was significant for the three dependent variables of computer anxiety, computer confidence, and computer liking in addition to age for computer liking. The interaction effect of age and experience was significant for computer confidence and computer liking. Gender was found not to be a significant variable.

In a study of educators over a two-year period, Honeyman and Warren (1987) also found that gender, age, and occupation were not related to measures of computer anxiety. The authors studied teachers and administrators taking an introductory computer skills course. Subjects were evenly divided as to gender and were between 22 and 46 years old. Other results of the study found that computer anxiety was reduced over time based on the amount of previous computer experience. The authors suggested that educators can reduce computer anxiety by allowing adequate time for computer activities.

Koohang (1989) studied 81 undergraduate teacher education students at Southern Illinois University in order to determine if computer attitude was related
to gender, keyboard familiarity, prior computer experience, programming knowledge, database management knowledge, and spreadsheet knowledge. Attitude was derived from an author-created scale with subscales for anxiety, confidence, liking, and usefulness.

Koohang reported no significant difference in attitude based on gender, but males perceived computers to be more useful. Students with more computer experience and keyboarding skills expressed a more positive attitude toward computers. Students with programming knowledge were less anxious regarding computers. Word processing and spreadsheet experience was an indicator of a positive attitude. The author suggested that word processing, spreadsheets, and database software should be part of every student's knowledge.

Leso and Peck (1992) studied students enrolled in a computer tools (e.g., word processing, spreadsheets, and database) course and a computer language programming course in order assess changes in student anxiety. They hypothesized that students in a programming course would have lower levels of computer anxiety than those students in a tools course. A second hypothesis stated that the reduction of anxiety would be greater for students in the tools course. Pretest scores of the groups \( N = 60 \) revealed no significant difference in anxiety level. There was a significance favoring the tool course on the measure of posttest anxiety. The authors suggested that if the goal of a computer course is to reduce anxiety, a tool course would be appropriate.

Okebukola, Sumampouw, and Jegede (1992) studied 426 high school students in Australia to judge the effect of experience on anxiety and interest. The study found that decreased anxiety was related to increased amounts of experience. Four of twelve items on computer interest were found to be significantly different.
based on experience. An interesting result, according to Okebukola, Sumampouw, and Jegede, was that students with extensive experience (10-12 years) felt that computers can be a boring friend. The authors suggest that more hands-on experience can result in lower anxiety and greater interest in computers.

Liu, Reed, and Phillips (1992) also studied computer anxiety and experience. In a study of teacher education students, the authors found that gender, year in school, major, and prior computer experience had significant effects on computer anxiety. A interaction between year and major was also found to be significant. In addition, the study found that approximately half of the teacher education students had no prior experience with computers and were apprehensive at the prospect of using computers. The study analyzed undergraduates (N=914) in a required educational psychology course over a four-year period.

Summary

Based on the literature reviewed here, it is apparent that students in distance education environments achieve the same on various measures (and in some cases higher) as students taught a similar courses in a traditional manner. The literature also supports Moore and Thompson's (1990) contention that student achievement and attitudes are an acceptable metric of effectiveness of technology-based teaching systems. The literature also indicates that students are more preoccupied with technical problems than with any particular method of instruction.

Research on computer attitudes indicates that a student's prior experience is probably the best indicator of student attitude. Several authors suggest that novice students should be exposed to skills such as word processing, spreadsheets, and databases as a means to build confidence. For the most part, there seems to be no
effect on attitude based on gender, age, and occupation, although Liu, Reed, and Phillips (1992) found a connection to anxiety in teacher education students.

There seems to be no research on students taking a computer course via distance education. In addition, there seems to be no research on attitude of students meeting a graduation requirement (institutional requirement) as opposed to taking a required course for a major field of study. That is, students in a required major course are self-selected for that major and, hence, self-selected for the course. Finally, the role of the remote-site facilitator cannot be overlooked. Research indicated that students perform better in remote sites when the facilitator is both qualified to operate the technical equipment and has some subject matter expertise. The role of the facilitator is dependent on the nature of the technical system and the design of the instructional process.
CHAPTER 3

METHODOLOGY

Purpose

This study was designed to determine whether subject matter knowledge and attitudes towards computers differed between students taught a competency-based ("hands-on"), introductory computer course in an electronically-expanded classroom and students taught the same course in a traditional classroom.

Variables of interest to the study were difference in knowledge of course content as measured by pretest and posttest, difference in final course grade as a numeric score, and difference in attitude toward computers as measured by pretest and posttest. Demographic information was collected that had potential for additional analysis. Students participating in the electronically-expanded classroom responded to a special survey reflecting their satisfaction with the presentation method.

Research Participants

The population of this study included all students enrolled in course sections of Computer Applications in Education (CECS 1100) offered by the College of Education at the University of North Texas during the summer sessions of 1995. The course is a graduation requirement for most undergraduate students enrolled at the University of North Texas. The course is also used by a small number of students as an elective or as a requirement for those seeking an Information Processing Technologist endorsement for the State of Texas teaching certificate. Similar courses, with different software emphasis, are offered by other academic
units at the University of North Texas. For the most part, content of the course, testing procedures, and assignments are standardized across all sections of CECS 1100. Therefore, all students receive the same basic content. There is some variance in procedure at the discretion of the individual instructors. General course procedures are administered by a lead instructor. These include the preparation of the course syllabus, design of course assignments, and test preparation. Based on experience with the course, all instructors use the prepared assignment material, and a few will modify the test material to suit individual preferences.

For the purposes of this study, both instructors used identical assignments, lecture presentation materials, hands-on computing practice materials, and tests. Course content was prescribed through the use of a common table of specifications. A sample course syllabus is included as Appendix A. Except for differences in instructor information (name, office phone number, office hours, etc.) and course schedule dates, all participants in the study received an identical course syllabus.

Two sections of CECS 1100 were offered Summer I and Summer II. Three sections were scheduled for Summer II, but the third section did not have adequate enrollment and was canceled. Some of the students in the canceled section opted to enroll in one of the other two sections that were offered during Summer II. Participants were self-selected as to summer session and course section. The course sections were taught by two instructors designated as Instructor A (investigator for the study) and Instructor B (lead instructor for the course).

The comparison groups were taught from 9:30am to 11:20am during both summer sessions. The electronically-expanded classroom portion of the study was conducted from 11:30am to 1:20pm during both summer sessions. These sections
were taught by Instructor A. All sections of the course met four days a week for five weeks.

A total of 109 students participated in the study. Totals do not include those students that either dropped or did not complete the course. A non-completer was defined as a student that did not take the final exam or did not complete two or more of the five required homework assignments. There were two non-completers in Section 3 (a treatment group) of Summer I. Both students cited health problems as the reason for not completing the course. Both students re-enrolled in Section 2 (a treatment group) of Summer II. One of the two students did not complete the course the second time again citing health problems. Due to late registration in Summer II, one student in Section 1 and two students in Section 2 missed the pretests. They were treated as non-participants. In Section 3 of Summer I, one student opted not to participate after the first week of the study and was transferred to the Section 2 comparison group.

One student in the Summer II comparison group was also treated as a non-participant. This student was attending under the auspices of the Americans with Disabilities Act and received a considerable amount of special consideration in order to complete the course. The nature of disabilities is protected by the confidentiality agreement between instructor and student as dictated by the Americans with Disabilities Act. Based on the participant’s disability and the amount of special treatment provided, it was decided that the student did not represent the typical participant in the study.

General Design

This study utilized a method that most resembled a nonequivalent control group design as described by Campbell and Stanley (1963). It was not possible to
randomly assign instructors or students to specific course sections. Students taught in the electronically-expanded classroom were compared to students taught in traditional classrooms. For the purposes of this study, the electronically-expanded classroom group functioned as the treatment group. There was the opportunity to randomly assign students in these sections to one of the two treatment rooms. Students taught the course in the traditional manner functioned as the comparison groups. Table 1 provides additional information as to final course scheduling and number of study participants. Each summer session had both a treatment and a comparison group.

Table 1

<table>
<thead>
<tr>
<th>Section #</th>
<th>Time</th>
<th>Session</th>
<th>Function</th>
<th>Study Designation</th>
<th>Instructor</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>002</td>
<td>9:30a-11:20a</td>
<td>Summer I</td>
<td>Comparison</td>
<td>Group 1</td>
<td>B</td>
<td>32</td>
</tr>
<tr>
<td>003</td>
<td>11:30a-1:20p</td>
<td>Summer I</td>
<td>Treatment</td>
<td>Group 2</td>
<td>A</td>
<td>23</td>
</tr>
<tr>
<td>001</td>
<td>9:30a-11:20a</td>
<td>Summer II</td>
<td>Comparison</td>
<td>Group 3</td>
<td>A</td>
<td>26</td>
</tr>
<tr>
<td>002</td>
<td>11:30a-1:20p</td>
<td>Summer II</td>
<td>Treatment</td>
<td>Group 4</td>
<td>A</td>
<td>28</td>
</tr>
</tbody>
</table>

The designation of the scheduled courses and study groups were changed from the original design. Table 2 presents the original design of the study. The original design specified that all the comparison groups from both summer sessions would be combined to form a composite group. The value of this combination was to increase sample size thereby increasing power of the various statistical tests.
Table 2

Study Groups Schedule and Designations as Originally Proposed

<table>
<thead>
<tr>
<th>Section #</th>
<th>Time</th>
<th>Session</th>
<th>Function</th>
<th>Study Designation</th>
<th>Instructor</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>002</td>
<td>9:30a-11:20a</td>
<td>Summer I</td>
<td>Comparison</td>
<td>Group 1</td>
<td>B</td>
<td>32</td>
</tr>
<tr>
<td>003</td>
<td>11:30a-1:20p</td>
<td>Summer I</td>
<td>Treatment</td>
<td>Group 2</td>
<td>A</td>
<td>48</td>
</tr>
<tr>
<td>002</td>
<td>9:30a-11:20a</td>
<td>Summer II</td>
<td>Comparison</td>
<td>Group 3</td>
<td>B</td>
<td>32</td>
</tr>
<tr>
<td>003</td>
<td>11:30a-1:20p</td>
<td>Summer II</td>
<td>Comparison</td>
<td>Group 4</td>
<td>A</td>
<td>32</td>
</tr>
<tr>
<td>004</td>
<td>1:30p-3:20p</td>
<td>Summer II</td>
<td>Comparison</td>
<td>Group 5</td>
<td>A</td>
<td>32</td>
</tr>
</tbody>
</table>

During the Summer I study period, the classroom used for the treatment group was unexpectedly available. This offered the opportunity to extend the study with another treatment group. This increased the number of treatment groups to two and reduced the number of comparison groups to two. One of the comparison groups became a treatment group and the other, Section 4 in Table 2, did not meet enrollment expectations and was canceled.

Comparison Groups

Two sections (N = 58) of CECS 1100 functioned as comparison (e.g., control) groups. Other than the administration of the study instruments, the course sections were structured in the same fashion as taught in long semesters. Instructor B taught the comparison group during Summer I, and Instructor A taught the comparison group during Summer II. Both course sections were taught in the same room in Matthews Hall, College of Education, at the University of North Texas. The room had four tiers with nine student seats per tier. Each student seat had a computer. There were seats for 36 students in the room, but enrollment was limited to 32
(normal department policy) to provide spare or backup computers in case of hardware difficulties. This facilitated the “hands-on” approach to learning computers favored by the Computer Education and Cognitive Systems program track of the Technology and Cognition Department. The comparison groups were taught in the traditional fashion. The description below describes those procedures. For the purpose of teaching consistency during the study, the instructors met regularly to discuss daily procedures.

In addition to lecture material, instructors demonstrated the operation of hardware and software. The instructor’s computer station was located at the front of the room. A color LCD panel was used to project the instructor’s computer output onto a screen located at the front of the class. Students had the option to work along with the instructor or to simply observe the software demonstrations. Various “hands-on” exercises were provided for student practice. Students that found it hard to keep up with the instructor were encouraged to observe the demonstration and take notes rather than fall farther behind. During “hands-on” practice sessions, the instructors observed the class by walking around and worked individually with students. Students were encouraged to use the text and the software online help to solve operational problems.

The primary software for the course was Microsoft WORKS® Version 2.0. This software is an integrated package with modules for word processing, spreadsheet, and database. Microsoft Windows® Version 3.1 was the operating environment software. In addition, students were issued E-mail accounts and were encouraged to correspond with the instructor via E-mail using Novell Groupwise® Version 4.1 for Windows®. Students were also encouraged to explore the Internet
using Hgopher® and Netscape® Version 1.1 software. All of the above mentioned software packages were demonstrated by the instructors prior to use by students.

The course requirements consisted of five computer-based assignments covering file management, word processing, spreadsheets, charts, and database. These homework assignments comprised 40 percent of the course grade. There were four tests and a final examination. The first four tests had both a cognitive component and a "hands-on" computer component. Both components of the exam were of equal value. The final exam was a 94-item comprehensive exam. All five tests were equally valued (20 percent each) and comprised 60 percent of the course grade. All homework assignments and tests were used in the previous long spring semester. No modifications were made to any course materials during the study period.

The "hands-on" computer portion of the first four tests tested the same skills demonstrated in the homework assignments. All tests except the final exam were limited to 70 minutes. During the "hands-on" computer portion of the exam, instructors only solved hardware-related problems. Students were told in advance that if the instructor answered a question with the phrase "I'm sorry, I cannot answer that question" the implication was that the question was part of the material being tested.

As part of the first class period all students in the comparison groups were explained the nature of the study. After a question and answer session, participants signed a Use of Human Subjects consent form (Appendix B), as required by the University of North Texas. The Computer Education and Cognitive Systems program track of the Technology and Cognition Department has a policy offering
an incentive to participants in research studies. For this study, that incentive was an extra grade of 100 averaged into the "Homework" portion of the course grade.

**Treatment Groups**

The treatment group consisted of students taught CECS 1100 during both Summer sessions in an electronically-expanded classroom. Students were self-selected to course section and time. The groups met the first day in the auditorium of Matthews Hall. The research study was explained, and participants signed the Use of Human Subjects consent form. Of key importance was the explanation that the participants would be randomly assigned to two different rooms for the duration of the course. A different consent form (Appendix C) reflecting this difference was administered to the treatment groups. All students enrolled in the sections designated as treatment groups opted initially to participate in the study. The description below describes the procedure for randomization of participants to the two treatment rooms. The procedure resulted in a pretest-posttest, control group, experimental design as described by Campbell and Stanley (1963). While results of coin flips were different for each session, the randomization procedure described was uniform.

While students completed the pretests as a group, the class roll was updated with names of late enrollees. The names were alphabetized into the class roll. The teaching assistant for the course was asked to identify one of three pages of a random number table located in the appendix of Borg and Gall's (1989) *Educational Research* (a research methods textbook). The teaching assistant was then asked to identify the starting position on the page by closing her eyes and dropping a finger on the page of random numbers. A coin flip determined whether selection would proceed down columns or across rows. A flip of "heads" indicated a movement
down columns. Another coin flip determined whether the first participant selected would be assigned to the one or the other of the two rooms that comprised the electronically-expanded classroom. Using the first digits of the numbers in the table, the first two-digit number matching a member of the class list indicated the first participant selected. For instance, the participant that was 22nd in the alphabetized class roll was assigned to a group when number 22 came up on the number table. The next participant was assigned to the other group and so forth. When both groups were constituted, a coin flip of “heads” determined which group was assigned to the send room. The group designated as “One” went to the send room if the coin flip was “heads.” If the flip was “tails” the group was assigned to the receive room.

Names of the participants in each group were announced after the completion of the pretests, and participants were moved to the two rooms that comprised the electronically-expanded classroom. The rest of the first class period was spent acclimating students to the audio and video equipment, discussing the syllabus, and other organizational tasks.

Day-to-day course material dissemination and procedures (described previously for the traditional sections) were the same for the electronically-expanded classroom, except that the lectures were presented to the send and receive rooms via television equipment. During “hands-on” software exercises, the instructor supervised participants in the send room, and the teaching assistant supervised participants in the receive room.

The teaching assistant was chosen for her expertise with the laboratories and classrooms of the Technology and Cognition Department. In addition, the teaching assistant had several years of experience with the course software.
The following description offers some insight into the teaching method and resulting participant behaviors of the treatment groups. The instructor made a point of stopping by the receive room before class to chat with students, deliver course materials to the teaching assistant, and to check the calibration of the video equipment. This is analogous to a instructor visiting an off-campus site in a traditional distance education system. This behavior is suggested to allow remote-site students the opportunity to see the instructor “in person” and to help build a sense of community among the remote-site participants (Willis, 1994; Willis, 1993; Moore & Thompson, 1990). Students in the receive room routinely sought out the instructor after class by walking across the hallway to the send room, stopped to talk in the hallway, or made office visits.

A typical day would begin with the instructor seated at the teaching station in the send room. Any day-to-day organizational business was conducted at this time. Lecture material and software demonstrations were delivered via audio and video to the receive room. Students in the send room would also see the material and software demonstrations via video monitor. A variety of video devices in the send room allowed the instructor to transmit pictures of himself, shots of students in the send room, both pre-prepared and hand written graphic material, computer output, and videotape. The instructor would manually switch between the various sources during the presentation. Several techniques were developed by the instructor to compensate for limitations in send room hardware. For instance, participants in both the send and receive room found that the computer output, translated to a video signal, was hard to see. Whenever possible, the instructor used a video camera to “zoom in” on the computer monitor. This proved to be an acceptable solution to the problem. Participants also noted that black text on white
paper was also difficult to see. Black text on colored paper proved to be a workable solution.

In addition to seeing the instructor's presentation on a video monitor, the students in the receive room could see the output of the camera in their room. This, in essence, amounted to seeing pictures of themselves. This was what the send room saw (the participants in the receive room) also. During the lectures and software demonstrations, the teaching assistant operated the video camera in the receive room. If a participant asked a question, the teaching assistant zoomed in for a close-up shot of the student asking the question. The sound in the receive room was picked up by one of two microphones in the room. The instructor and participants in the send room heard the question via the speaker in the video monitor showing the shot from the receive room.

After a lecture or software demonstration, participants were provided "hands-on" computer exercises. During the exercises, the instructor supervised the send room, and the teaching assistant supervised the activities in the receive room. A wide shot of each room was used and the audio system was on. This would allow the instructor to see the activities in the other room (and participants in the receive room could also see the same wide shot and hear the activities in the send room). It was not uncommon for the instructor to step back "on camera" to explain a particular point germane to the exercise. The instructor and teaching assistant walked around the room observing progress and worked with individual students to solve operational problems with the software. Although the teaching assistant was immediately available in the receive room, occasionally students would direct a question to the instructor in the send room. This is consistent with findings from a study on the relationship between students and remote-site facilitators participating
in a TI-IN network course. That is, students understood that the instructor was the “expert” regarding the subject matter of the course (Knezek, Miyashita, Jones, & Bills, 1993).

Occasionally, time allowed participants the opportunity to work on homework assignments during class time. This was the procedure for both the comparison and treatment groups. Participants were allowed a certain amount of autonomy on how they spent this time, although they were not allowed to leave class. Participants that had already completed the homework were encouraged to send E-mail, or “surf” the Internet.

Instrumentation

Subjects in the treatment and control groups were administered the same instruments. Subjects in the electronically-expanded classroom responded to an additional instrument to measure satisfaction with the presentation method.

Knowledge of course material (Hypothesis 1) was measured using a pretest and posttest (Appendix D). The instrument was also the final exam for the course. Questions on the instrument were drawn from the test item pools from the instructor's guides to the required texts. Some questions relate to unique content (e.g., operating system and application software, network procedures, Internet access, electronic mail) of the course not covered by the texts.

The original 100-item (4-choice, multiple choice) instrument was submitted to the Lead Instructor and other instructors experienced with the course to assess content validity. Based on discussions with other instructors familiar with the course, the instrument was judged acceptable and administered to one section of CECS 1100 during the Spring semester of 1995 pilot study. Participant responses were coded dichotomously as either correct or incorrect. As dichotomous
variables, Cronbach’s alpha is equivalent to a Kuder-Richardson 20 coefficient (SPSS for Windows®, Professional Statistics, Release 5, 1992). Reliability was established at .77.

The instrument was item analyzed. Six items were deleted which reduced the number of items to 94. Subsequent administration to both the treatment and comparison groups during Summer I resulted in a post-hoc reliability coefficient of .77. In order to maintain consistency of instrumentation across both summer sessions, no modifications were made to the instrument based on post-hoc analysis.

Final course grade as a numeric score (Hypothesis 2) was derived from the instructor’s grade book. The “homework” portion of the final grade included the score of 100 offered as an incentive for participating in the study.

The Computer Attitude Scale (CAS) developed by Loyd and Gressard (1984b) was used to assess attitude toward computers (Hypothesis 3). The CAS (Appendix E) is a 30-item, 4-point Likert-type instrument with three subscales: (a) Computer Anxiety Sub-Scale; (b) Computer Liking Sub-Scale; and (c) Computer Confidence Sub-Scale. Together, the scale yields a Total Computer Attitude Score. Items were scored from 1 to 4; a complete “positive” attitude score is 120.

The instrument was originally devised to measure attitude toward computers of students in grades 8 through 12 enrolled in a computer-based education program. The reliability coefficient alpha for the Total Computer Attitude was established as .95 (Loyd & Gressard, 1984b). The reliability of .95 was verified in a similar study of adult learners (Loyd & Loyd, 1985). Woodrow (1991) noted that "The Computer Attitude Scale was found to sample from both the affective and behavioral domains but none from the cognitive domain. Its use for computer novices, therefore, is particularly recommended" (p. 182).
Loyd and Loyd (1985) studied educator's attitudes toward computers. The goal of the study was to continue reliability and validity studies of the CAS using different populations. One hundred fourteen teachers taking a microcomputer staff development course were administered the CAS. Results of this study were very similar to the previous studies of the CAS.

The instrument was administered to one section of CECS 1100 during the Spring semester pilot study. Cronbach's alpha was computed at .96 for the combined instrument. This is consistent with the findings of Loyd and Gressard (1984a; 1984b) and Loyd and Loyd (1985).

The instrument for satisfaction with the presentation method (Hypothesis 4) was adapted from a list of criteria offered by Biner (1993). Biner developed a pool of 72 criteria to measure student attitude toward televised courses. Biner's criteria were validated by using a Content Validity Ratio (CVR) described by Lawshe (1975, cited in Biner, 1993). Similar to correlation, a CVR has a range from -1 to +1. Only criteria that had at least a CVR of zero or higher (50% of judges rated the criterion relevant) were included in the pool of items. Biner noted that the relevance of a particular criterion is dependent on the individual judge's perception of needs of a particular course or system. To that end, the items used for the instrument for this study were based on their relevance to the electronically-expanded classroom. This relevance was determined by the experience of the investigator and the opinions of two other individuals familiar with the design and operation of the facilities used for this study.

The instrument used to measure satisfaction with the presentation method for the send room was a 21-item, 5-point Likert-type scale (coded from 1 to 5) plus a 2-point item (coded 1 or 2); a total potential score is 107. The receive room
instrument had one additional 5-point Likert-type item (item #20) inquiring about the performance of the teaching assistant. This item was tabulated separately to allow for comparison of scores for the two rooms. Post-hoc reliability analysis indicated a coefficient alpha of .89. Both instruments are included as Appendix F.

Demographic information (Appendix G) was collected during the course. Demographic categories are based on Pace’s (1983) College Student Experience Questionnaire (CSEQ). The instrument was developed by Pace to measure the quality of student effort and goal attainment for traditional students enrolled in four-year universities. Pace (1984) reports that the instrument is reliable and valid.

Data Collection

The CAS and subject matter pretest were administered on the first day of class. The CAS was administered first followed by the subject matter pretest. Both instruments were administered after the nature of the study was explained and participants had signed the Use of Human Subjects consent form. Participants that missed the pretests due to late registration or nonattendance on the first day were treated as nonparticipants.

The CAS posttest and the satisfaction with the presentation method instrument (treatment groups only) were administered during the last week of class. There was a two-day window of opportunity between the last regular course exam and the final exam.

The subject matter posttest was also the final exam and was administered during the regular final exam period. The demographic information was collected during the course at the convenience of the instructor. Participants were reminded of the importance of reading instrument items carefully and asked to ensure that
they answered all items. For the purposes of data coding, participants were asked to place the last four digits of their student identification number on the instruments.

Data Analysis

All statistical data were analyzed using SPSS® for Windows®, Version 6.1.2., 1995. Descriptive data such as frequencies, means, standard deviations, variances, and sample sizes were generated to describe the study population and, where appropriate, to describe the pilot study population. All statistical data were tested for two-tailed significance at a .05 alpha level.

Hypotheses 1 and 3 used analysis of covariance (ANCOVA) to compare combined group adjusted mean scores on posttests and to control for the pretest scores. Hypothesis 1 analyzed posttest scores on a paper and pencil final exam using the same exam as a pretest. The dependent variable was the final exam using the pretest as a covariate. Hypothesis 3 analyzed posttest scores on an attitudes toward computers survey using the same survey as a pretest. The dependent variable was the attitudes toward computers posttest using the pretest as a covariate. The independent variable for Hypotheses 1 and 3 was group membership (electronically-expanded classroom or traditional classroom). Between groups was the source of variation of interest for the tests. Correlation between the covariate and dependent variables was established and found to be significant. Data were tested for homogeneity of regression slopes, which would indicate that the change in dependent variable due to the covariate was the same across both levels of the factor variables. Unless reported otherwise in the data analysis, all ANCOVA analyses met this assumption. Initial investigation of pretests and posttests for knowledge of the course material and attitudes towards computers was conducted using $t$ tests for independent samples. Levene's Test for Homogeneity of Variances
was used to determine which $t$ statistic (pooled or separate variances) was
appropriate. Unless otherwise reported in the data analysis, this test was met by all
$t$ tests and, therefore, used the pooled variance $t$-statistic.

Hypothesis 2 investigated final course grade as a numeric score. A $t$ test for
independent samples was used to compare the combined scores of treatment groups
and combined scores of comparison groups. Unless otherwise noted in the data
analysis, all $t$-tests met the assumption of homogeneity of variance described
previously. The dependent variable was final grade as a numeric score and the
independent variable was group membership (electronically-expanded classroom or
traditional classroom). Analysis of variance was used for additional data analysis.

Hypothesis 4 analyzed the difference in satisfaction with the presentation
method of the course between those that participated in the send room and those
that participated in the receive room of the electronically-expanded classroom. The
send and receive room scores from each summer session were combined to form a
composite score. A $t$ test for independent samples was used to compare the mean
satisfaction score of the two groups. The dependent variable was the score on the
satisfaction survey. The independent variable was group membership (send or
receive room) Unless otherwise noted in the data analysis, all $t$ tests met the
assumption of homogeneity of variance as described earlier. Analysis of variance
was used for additional data analysis regarding Hypothesis 4.

Pilot Study

The demographic information survey, subject matter and attitudes toward
computers instruments were pilot tested using one section ($N=28$) of CECS 1100
during the Spring 1995 semester. The course used for the pilot test was taught by
Instructor A (investigator for the study). Results of the instrument pilot testing are discussed in the section on instrumentation.

There was not an opportunity to pilot test the treatment before the study period. Therefore, the first administration of the satisfaction with the presentation method instrument (Appendix F) occurred during the study period. A post-hoc reliability analysis was performed and is discussed in the section on instrumentation.

The technology used in the electronically-expanded classroom had been demonstrated several times. During the pilot testing period, the system was demonstrated three additional times in order to give other CECS courses a demonstration of “distance education.” The system was also demonstrated during the World Education Technology Institute held at the University of North Texas during Summer II of 1994. All demonstrations of the technology were conducted by the investigator of this study. This experience was sufficient to determine that the system was stable and capable of providing the necessary tools in which to conduct this study.

As part of the pilot study, baseline information on students enrolled in CECS 1100 sections during the Fall 1994 and Spring 1995 was collected. Data was collected for several reasons. First, it would establish some parameters for the “typical” CECS 1100 for the long semesters just prior to the study. The variables of final course grade as a numeric score, gender, and academic standing were investigated. Second, this study used two instructors. Instructor performance in terms of student's final course grade as a numeric score demonstrated that the instructors had comparable outcomes. Therefore, it was assumed that the instructors' performance would also be uniform for the study. Third, the
instruments were pilot tested during long semesters. Again, the results of the long semesters could be used as baseline information for comparison with the summer study population. The results of the analysis of the two previous long semesters is provided below. Totals reflect the combination of the totals from both the fall and spring semesters. Table 3 indicates the academic standing and Table 4 indicates the gender of participants during the two long semesters that immediately preceded the Summer 1995 study period.

Table 3

Analysis of Academic Rank for Fall 1994 and Spring 1995 Semesters of CECS 1100

| Rank   | Fall 94 |  | Spring 95 |  |
|--------|---------|  |           |  |
|        | Frequency | Percent | Frequency | Percent |
| Freshman | 90 | 28.1 | 91 | 25.0 |
| Sophomore | 92 | 28.8 | 101 | 27.7 |
| Junior | 75 | 23.4 | 90 | 24.7 |
| Senior | 54 | 16.9 | 64 | 17.6 |
| Other | 9 | 2.8 | 18 | 4.9 |
| Total | 320 | 100.0 | 364 | 100.0 |

Table 4

Analysis of Gender for Fall 1994 and Spring 1995 Semesters of CECS 1100

| Gender | Fall 94 |  | Spring 95 |  |
|--------|---------|  |           |  |
|        | Frequency | Percent | Frequency | Percent |
| Male | 104 | 32.5 | 136 | 37.4 |
| Female | 216 | 67.5 | 228 | 62.6 |
| Total | 320 | 100.0 | 364 | 100.0 |
Noncompleters were not included in the analysis. The difference in the frequency in each academic standing and gender category was analyzed using a chi-square goodness-of-fit test. Results of the analysis indicated that there was no significant difference between the categories of academic standing \( \chi^2 (4, N = 684) = 2.8176, p > .05 \) and gender \( \chi^2 (1, N = 684) = 1.7679, p > .05 \) between the fall and spring semester. Based on this analysis, the totals from the fall and spring semester were combined. The combined frequencies and percentages for academic standing and gender are reported, respectively, in Table 5 and Table 6.

Table 5

Combined Frequencies of Academic Standing of CECS 1100 Sections

<table>
<thead>
<tr>
<th>Rank</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cum Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freshman</td>
<td>181</td>
<td>26.5</td>
<td>26.5</td>
<td>26.7</td>
</tr>
<tr>
<td>Sophomore</td>
<td>193</td>
<td>28.2</td>
<td>28.2</td>
<td>54.7</td>
</tr>
<tr>
<td>Junior</td>
<td>165</td>
<td>24.1</td>
<td>24.1</td>
<td>78.8</td>
</tr>
<tr>
<td>Senior</td>
<td>118</td>
<td>17.3</td>
<td>17.3</td>
<td>96.1</td>
</tr>
<tr>
<td>Other</td>
<td>27</td>
<td>3.9</td>
<td>3.9</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>684</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Table 6

Combined Frequencies of Gender of CECS 1100 Sections

<table>
<thead>
<tr>
<th>Gender</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cum Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>240</td>
<td>35.1</td>
<td>35.1</td>
<td>35.1</td>
</tr>
<tr>
<td>Female</td>
<td>444</td>
<td>64.9</td>
<td>64.9</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>684</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>
The expected frequencies based on this combination were used to test whether there was a significant difference as to academic standing and gender between the long semesters and the summer study period.

Group means for final course grade as a numeric score were calculated for the two long semesters immediately prior to the summer study period. This included 12 sections during the Fall 1994 and 12 sections during Spring 1995. Group means are reported in Table 7.

Table 7
Final Grade Group Means and Other Descriptive Statistics for Fall 1994 and Spring 1995 Sections of CECS 1100

<table>
<thead>
<tr>
<th>Group</th>
<th>M</th>
<th>SD</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall, 1994</td>
<td>91.5609</td>
<td>8.9984</td>
<td>320</td>
</tr>
<tr>
<td>Spring, 1995</td>
<td>92.0750</td>
<td>7.0603</td>
<td>364</td>
</tr>
<tr>
<td>Combined</td>
<td>91.8345</td>
<td>8.0235</td>
<td>(N=684)</td>
</tr>
</tbody>
</table>

A t-test revealed no significant difference between final grades for students in the Fall 1994 sections and Spring 1995 sections \( t = -0.82, t_{cv}(602.61) = 1.960, p > .05 \).

Table 8
Final Grade Group Means, Descriptive Statistics, and T Test for Pilot Study Population on Gender

<table>
<thead>
<tr>
<th>Group</th>
<th>M</th>
<th>SD</th>
<th>SE of Mean</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>90.6876</td>
<td>8.078</td>
<td>.521</td>
<td>240</td>
</tr>
<tr>
<td>Female</td>
<td>92.4545</td>
<td>7.934</td>
<td>.377</td>
<td>444</td>
</tr>
<tr>
<td>t-value</td>
<td>df</td>
<td>2-tail sig.</td>
<td>SE of Diff.</td>
<td></td>
</tr>
<tr>
<td>-2.76*</td>
<td>682</td>
<td>.006</td>
<td>.640</td>
<td></td>
</tr>
</tbody>
</table>

*\( t_{cv} = 1.960, p < .05 \).
The homogeneity of variance assumption was not met so the un-pooled variance t-statistic was used for this test. There was a significant difference in final grades (Table 8) based on gender. Females performed better than males.

Table 9 indicates the final grades of the pilot study population by academic standing. Analysis of variance, with a Tukey-B post-hoc comparison, revealed that Freshman performed significantly lower \( E = 6.4583, F_{cv}(4, 679) = 3.32, p. < .05 \) than the other categories of academic standing.

Table 9

Final Grade Group Means and Other Descriptive Statistics for Academic Rank of Pilot Study Population

<table>
<thead>
<tr>
<th>Group</th>
<th>M</th>
<th>SD</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freshman</td>
<td>89.3272</td>
<td>9.6393</td>
<td>181</td>
</tr>
<tr>
<td>Sophomore</td>
<td>92.7869</td>
<td>6.8657</td>
<td>193</td>
</tr>
<tr>
<td>Junior</td>
<td>92.6247</td>
<td>7.1810</td>
<td>165</td>
</tr>
<tr>
<td>Senior</td>
<td>92.4863</td>
<td>7.7260</td>
<td>118</td>
</tr>
<tr>
<td>Other</td>
<td>94.1573</td>
<td>6.6253</td>
<td>27</td>
</tr>
</tbody>
</table>

During the pilot period, Instructor A taught three sections of the course and Instructor B taught four sections. Table 10 provides comparative data on students' final grade as a numeric score for both instructors during the fall and spring semesters.

Results of analysis of variance on the seven sections taught by Instructor A and Instructor B indicated no significant difference between the means of the final grades as a numeric score. Results of the analysis is reported in Table 11. This data suggest that instructor performance, as measured by final course grade, was equivalent across at least two semesters.
This brief analysis of previous sections of CECS 1100 indicated that the final grades of students were similar for Instructors A and B. In addition, the composition, based on academic standing and gender, of the seven sections of Instructor A and B did not significantly differ from the expected composition of the majority of sections taught during the same semester. There was a significant difference in final grade based and gender and academic standing of the pilot study population.

Table 10

Comparison of Student Final Grades by Instructors A and B

<table>
<thead>
<tr>
<th>Instructor</th>
<th>Semester</th>
<th>M</th>
<th>SD</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Fall, 1994</td>
<td>95.5377</td>
<td>6.7908</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>Fall, 1994</td>
<td>94.3150</td>
<td>5.5416</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>Spring, 1995</td>
<td>93.0396</td>
<td>4.4246</td>
<td>28</td>
</tr>
<tr>
<td>B</td>
<td>Fall, 1994</td>
<td>94.0300</td>
<td>7.0153</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>Fall, 1994</td>
<td>94.6250</td>
<td>6.6346</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>Spring, 1995</td>
<td>90.8334</td>
<td>10.4467</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>Spring, 1995</td>
<td>94.5184</td>
<td>5.6734</td>
<td>32</td>
</tr>
</tbody>
</table>

Table 11

ANOVA for Final Grade of Seven Sections Taught by Instructors A & B

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F Ratio</th>
<th>F Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>6</td>
<td>444.7727</td>
<td>74.1288</td>
<td>1.4999*</td>
<td>.1797</td>
</tr>
<tr>
<td>Within</td>
<td>205</td>
<td>10131.2852</td>
<td>49.4209</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>211</td>
<td>10576.0579</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Ec(6, 205) = 2.05, p > .05.
CHAPTER 4

ANALYSIS OF DATA

Introduction

The goal of this study was to test the following hypotheses:

1. There is no significant difference in cognitive (“paper and pencil”) knowledge of course content, as measured by pretest and posttest, between students enrolled in a competency-based (“hands-on) computer applications course taught in an electronically-expanded classroom and students taught in a traditional classroom.

2. There is no significant difference in final grade, as a numeric score, between students taught in an electronically-expanded classroom and students taught in a traditional classroom.

3. There is no significant difference in attitudes, as measured by pretest and posttest, toward computers between students taught in an electronically-expanded classroom and students taught in a traditional classroom.

4. There is no significant difference in satisfaction with the presentation method between the rooms (send and receive) that comprised the electronically-expanded classroom.

Study population demographics are described. The findings are reported by hypothesis number as listed above. Additional findings are reported for the population demographics and each hypothesis.
Description of Study Population

Table 12 indicates the breakdown of the study population according to academic standing. Table 13 indicates frequency of gender for the study population during the summer sessions of 1995.

Table 12

Frequency of Academic Standing of Study Population

<table>
<thead>
<tr>
<th>Rank</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cum Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freshman</td>
<td>20</td>
<td>18.3</td>
<td>18.3</td>
<td>18.3</td>
</tr>
<tr>
<td>Sophomore</td>
<td>18</td>
<td>16.5</td>
<td>16.5</td>
<td>34.9</td>
</tr>
<tr>
<td>Junior</td>
<td>23</td>
<td>21.1</td>
<td>21.9</td>
<td>55.6</td>
</tr>
<tr>
<td>Senior</td>
<td>38</td>
<td>34.9</td>
<td>34.9</td>
<td>90.8</td>
</tr>
<tr>
<td>Other</td>
<td>10</td>
<td>9.2</td>
<td>9.2</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>109</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Table 13

Frequency of Gender of Study Population

<table>
<thead>
<tr>
<th>Gender</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cum Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>47</td>
<td>43.1</td>
<td>43.1</td>
<td>43.1</td>
</tr>
<tr>
<td>Female</td>
<td>62</td>
<td>56.9</td>
<td>56.9</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>109</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

The population (N = 109) ranged in age from 18 to 51. Median age was 23, with 19-year-olds (n = 21) comprising 19.1 percent of the study population. Sixty-nine percent (n = 76) reported that the course was a graduation requirement, and approximately 14 percent (n = 15) were taking the course as an elective. Approximately 60 percent of the study population was taking one other course in
addition to participating in the study course. Table 14 indicates the breakdown of participants' course load during the study period.

Table 14

Summer Course Load and Living Arrangements for the Study Period

<table>
<thead>
<tr>
<th>Course Load</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cum Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 hours</td>
<td>9</td>
<td>8.3</td>
<td>8.3</td>
<td>8.3</td>
</tr>
<tr>
<td>6 hours</td>
<td>64</td>
<td>58.7</td>
<td>58.7</td>
<td>67.0</td>
</tr>
<tr>
<td>3 hours</td>
<td>36</td>
<td>33.0</td>
<td>33.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>109</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Table 15 reports the living arrangements and amount of hours worked by the study participants. Almost half the participants (48.2 percent) indicated that they commuted to campus to attend the course. Approximately 70 percent of the participants reported that they were working during the study period.

Table 15

Living Arrangements and Number of Hours Worked During Study Period

<table>
<thead>
<tr>
<th>Living Arrangement</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cum Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dorm/College Housing</td>
<td>14</td>
<td>12.8</td>
<td>12.8</td>
<td>12.8</td>
</tr>
<tr>
<td>Private</td>
<td>41</td>
<td>37.6</td>
<td>37.6</td>
<td>50.5</td>
</tr>
<tr>
<td>Commute</td>
<td>53</td>
<td>48.6</td>
<td>48.6</td>
<td>99.1</td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
<td>.9</td>
<td>.9</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>109</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

(Table continues)
The most frequent major field of study (Table 16) of the participants was education followed by art or music and the social sciences.

Table 16

Frequency of Major Field of Study

<table>
<thead>
<tr>
<th>Major</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cum Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Art/Music</td>
<td>21</td>
<td>19.1</td>
<td>19.3</td>
<td>19.3</td>
</tr>
<tr>
<td>Bio Sciences</td>
<td>6</td>
<td>5.5</td>
<td>5.5</td>
<td>24.8</td>
</tr>
<tr>
<td>Business</td>
<td>8</td>
<td>7.3</td>
<td>7.3</td>
<td>32.1</td>
</tr>
<tr>
<td>Bus. Computers</td>
<td>2</td>
<td>1.8</td>
<td>1.8</td>
<td>33.9</td>
</tr>
<tr>
<td>Computer Sci.</td>
<td>2</td>
<td>1.8</td>
<td>1.8</td>
<td>35.8</td>
</tr>
<tr>
<td>Education</td>
<td>32</td>
<td>29.4</td>
<td>29.4</td>
<td>65.1</td>
</tr>
<tr>
<td>Humanities</td>
<td>7</td>
<td>6.4</td>
<td>6.4</td>
<td>71.6</td>
</tr>
<tr>
<td>Math</td>
<td>2</td>
<td>1.8</td>
<td>1.8</td>
<td>73.4</td>
</tr>
<tr>
<td>Phy. Sciences</td>
<td>2</td>
<td>1.8</td>
<td>1.8</td>
<td>75.2</td>
</tr>
<tr>
<td>Social Sciences</td>
<td>18</td>
<td>16.5</td>
<td>16.5</td>
<td>91.7</td>
</tr>
<tr>
<td>Undecided</td>
<td>9</td>
<td>8.3</td>
<td>8.3</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>109</strong></td>
<td><strong>100.0</strong></td>
<td><strong>100.0</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>
Participants were asked to self-report their grade point average (GPA) as part of the demographic survey. GPA's ranged from 0.00 to 4.00 on a four-point scale. Mean GPA for the population as reported was 2.826, median GPA was 2.845, and the mode was 3.00. There were 10 first-semester freshman that did not have a grade history established. Approximately 70% of the participants had taken a computer course in either high school or college.

Additional Findings Related to the Study Population

A chi-square goodness-of-fit analysis was conducted on the frequency of academic standing in the study population. The percentage of frequency of academic standing of the pilot study population was used as the expected frequency for the analysis. A similar analysis was conducted on frequency of gender. Results of the analysis are reported in Table 17.

Table 17

Chi-Square Analysis of Study Population Academic Standing and Gender Using Pilot Study Population as Expected Frequency

<table>
<thead>
<tr>
<th>Group</th>
<th>Observed</th>
<th>Expected</th>
<th>Residual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic Rank</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freshmen</td>
<td>20</td>
<td>30.63</td>
<td>-10.63</td>
</tr>
<tr>
<td>Sophomore</td>
<td>18</td>
<td>32.39</td>
<td>-13.39</td>
</tr>
<tr>
<td>Junior</td>
<td>23</td>
<td>25.51</td>
<td>-2.51</td>
</tr>
<tr>
<td>Senior</td>
<td>38</td>
<td>18.42</td>
<td>19.58</td>
</tr>
<tr>
<td>Other</td>
<td>10</td>
<td>3.05</td>
<td>6.95</td>
</tr>
<tr>
<td>Total</td>
<td>109</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chi-Square</td>
<td>46.2750</td>
<td>4</td>
<td>.0001</td>
</tr>
</tbody>
</table>

(Table continues)
The frequency of academic standing and gender differed significantly when compared to the pilot study population. Any residual score greater than plus or minus 2 indicates that the category significantly contributes to the difference (Hinkle, Wiersma, & Jurs, 1988).

Data Analysis for Hypothesis 1

Hypothesis 1 states that there is no significant difference in acquired cognitive ("paper and pencil") knowledge of course content, as measured by pretest and posttest, between students enrolled in a competency-based ("hands-on") computer applications course taught in an electronically-expanded classroom and students taught in a traditional classroom. Participants were administered a paper and pencil pretest (Appendix D) on the first day of class. The same instrument was administered on the final day of class as the final exam for the course. Group means and other descriptive data for the pretest as well as a t-test analysis are presented in Table 18. There was minimal variance in pretest scores for the study groups as indicated in Table 18. The treatment groups pretest mean scores ranged from 32 to 73, and the comparison groups’ pretest scores ranged from 31 to 77. A t-test on posttest scores revealed more variability between groups, but the difference on the posttest scores was not significant. The posttest scores for the treatment groups ranged from 70 to 95 whereas the comparison group posttest scores ranged from 54
to 92. The results of the analysis on the posttest scores are reported in Table 19.

The data did not meet the assumption of homogeneity of variance so the t statistic for separate variance was used for the analysis.

Table 18

**Group Means, Descriptive Statistics, and T Test for Pretest Scores of Subject Matter Knowledge**

<table>
<thead>
<tr>
<th>Group</th>
<th>M</th>
<th>SD</th>
<th>SE of Mean</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>52.9216</td>
<td>9.180</td>
<td>1.285</td>
<td>51</td>
</tr>
<tr>
<td>Comparison</td>
<td>52.6552</td>
<td>10.469</td>
<td>1.375</td>
<td>58</td>
</tr>
</tbody>
</table>

**t-value** | df | 2-tail sig. | SE of Diff. |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>.14*</td>
<td>107</td>
<td>.889</td>
<td>1.898</td>
</tr>
</tbody>
</table>

*icv = 1.995, p > .05.

Table 19

**Group Means, Descriptive Statistics, and T Test for Posttest Scores of Subject Matter Knowledge**

<table>
<thead>
<tr>
<th>Group</th>
<th>M</th>
<th>SD</th>
<th>SE of Mean</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>81.2745</td>
<td>6.030</td>
<td>.844</td>
<td>51</td>
</tr>
<tr>
<td>Comparison</td>
<td>79.0690</td>
<td>8.385</td>
<td>1.101</td>
<td>58</td>
</tr>
</tbody>
</table>

**t-value** | df | 2-tail sig. | SE of Diff. |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.59*</td>
<td>103.11</td>
<td>.115</td>
<td>1.388</td>
</tr>
</tbody>
</table>

*icv = 1.990, p > .05.

Analysis of covariance was used to analyze the posttest scores. The covariate was the pretest. Analysis of covariance adjusted the means by statistically controlling for the effect of entry level subject matter knowledge as measured by the pretest. The independent variable was group membership (electronically-expanded classroom or comparison group), and the dependent variable was the adjusted posttest mean scores. Results of the analysis of covariance (Table 20)
indicated no significant difference in adjusted means of posttest scores between those taught the course in the electronically-expanded classroom and those taught the course in the tradition fashion.

Table 20

Results of ANCOVA for Posttest Scores on Subject Matter Test

<table>
<thead>
<tr>
<th>Group</th>
<th>Obs. Mean</th>
<th>Adj. Mean</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>81.275</td>
<td>81.222</td>
<td>51</td>
</tr>
<tr>
<td>Comparison</td>
<td>79.069</td>
<td>79.121</td>
<td>58</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F Ratio</th>
<th>F Prob</th>
</tr>
</thead>
<tbody>
<tr>
<td>Covariate</td>
<td>1612.480</td>
<td>1</td>
<td>1612.480</td>
<td>40.449</td>
<td>.000</td>
</tr>
<tr>
<td>Between</td>
<td>119.809</td>
<td>1</td>
<td>119.809</td>
<td>3.005*</td>
<td>.086</td>
</tr>
<tr>
<td>Within</td>
<td>4225.602</td>
<td>106</td>
<td>39.864</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>5957.890</td>
<td>108</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Ec(1, 106) = 3.95, p > .05.

Based on the results on the analysis of covariance, Hypothesis 1 is retained. That is, according to the data analysis, there is no significant difference in subject knowledge of the course material as measured by the posttest, when controlling for incoming course material knowledge as measured by the pretest, between participants taught the course in an electronically-expanded classroom and those taught the course in a traditional classroom. This analysis was based on the combined scores of the two treatment groups and the combined scores of the two comparison groups.

Additional Findings for Subject Matter Posttest Scores of Study Groups

As a matter of interest, the treatment and comparison groups were decomposed into two groups each and treated as four separate groups. Preliminary data analysis using ANOVA on the pretest found no significant difference for
subject matter knowledge among the four groups \([E = .8497, Ecv(3, 105) = 2.71, p > .05]\). An ANOVA on the posttest subject matter scores for the four groups indicated a significant difference \([E = 15.4701, Ecv(3, 106) = 2.70), p. < .05\]. Mean scores and other descriptive statistics are reported in Table 21. A post-hoc Tukey-B comparison test revealed that the Summer I comparison group was significantly different from the other groups. In addition, the Summer II comparison group performed significantly higher than the Summer I comparison group.

Table 21

<table>
<thead>
<tr>
<th>Group</th>
<th>M</th>
<th>SD</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sum I Treatment</td>
<td>79.1739</td>
<td>5.5812</td>
<td>23</td>
</tr>
<tr>
<td>Sum I Comparison</td>
<td>74.5313</td>
<td>8.1319</td>
<td>32</td>
</tr>
<tr>
<td>Sum II Treatment</td>
<td>83.0000</td>
<td>5.9255</td>
<td>28</td>
</tr>
<tr>
<td>Sum II Comparison</td>
<td>84.7407</td>
<td>4.3553</td>
<td>26</td>
</tr>
</tbody>
</table>

An ANCOVA using the 4 groups as a factor on subject matter knowledge as measured by the posttest, using the pretest as a covariant, revealed that the data did not meet the homogeneity of regression slopes assumption. Therefore, ANCOVA was not an appropriate test to determine the effect of the pretest on the posttest means of the four-group data.

An ANCOVA on the entire study population, using living arrangement as a factor, indicated that participants living on campus performed significantly worse \([E = 6.12, Ecv(3, 105) = 2.715, p. < .05]\) on the subject matter posttest with the pretest as a covariate. No other categorical demographic variables proved to be significant factors in the same test.
Data Analysis for Hypothesis 2

Hypothesis 2 states that there will be no difference in the final course grade, as a numeric score, between students taught in an electronically-expanded classroom and students taught in a traditional classroom. The scores for the send and receive rooms of the electronically-expanded classroom were combined to establish one mean score for the treatment groups. Scores for the comparison groups were combined to establish one mean score for those groups. A t-test on the combined means of final course grade as a numeric score (Table 22) revealed no significant difference. Final grades for the treatment groups ranged from 77.61 to 99.77. Final grades for the comparison groups ranged from 79.75 to 98.80.

Table 22

<table>
<thead>
<tr>
<th>Group</th>
<th>M</th>
<th>SD</th>
<th>SE of Mean</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>94.4902</td>
<td>4.149</td>
<td>.581</td>
<td>51</td>
</tr>
<tr>
<td>Comparison</td>
<td>93.7116</td>
<td>3.826</td>
<td>.502</td>
<td>58</td>
</tr>
<tr>
<td>t-value</td>
<td>df</td>
<td>2-tail sig.</td>
<td>SE of Diff.</td>
<td></td>
</tr>
<tr>
<td>1.02*</td>
<td>107</td>
<td>.310</td>
<td>.764</td>
<td></td>
</tr>
</tbody>
</table>

*tcv = 1.995, p > .05.

Therefore, Hypothesis 2, which states that there will be no difference between the treatment group and comparison group as to final grade as a numeric score, is retained.

Additional Findings for Final Grades of Study Groups

Again, as a matter of interest, group means for the de-composed summer treatment groups and the comparison groups were compared. Analysis of variance and a post-hoc Tukey-B comparison test on the final grade group means found that
the Summer I comparison group significantly varied from the Summer I treatment
group and the Summer II comparison group.

Table 23

Means of Final Grades and Other Descriptive Statistics of De-Composed Study
Groups

<table>
<thead>
<tr>
<th>Group</th>
<th>M</th>
<th>SD</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sum I Treatment</td>
<td>95.0552</td>
<td>3.170</td>
<td>23</td>
</tr>
<tr>
<td>Sum I Comparison</td>
<td>92.3750</td>
<td>4.132</td>
<td>32</td>
</tr>
<tr>
<td>Sum II Treatment</td>
<td>94.0261</td>
<td>4.816</td>
<td>28</td>
</tr>
<tr>
<td>Sum II Comparison</td>
<td>95.3565</td>
<td>2.665</td>
<td>26</td>
</tr>
</tbody>
</table>

The means and other descriptive data are found in Table 23. Results of the analysis
of variance are reported in Table 24.

Table 24

ANOVA for Final Grade as a Numeric Score for De-Composed Study Groups

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F Ratio</th>
<th>F Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>3</td>
<td>157.3468</td>
<td>52.4489</td>
<td>3.5439*</td>
<td>.0171</td>
</tr>
<tr>
<td>Within</td>
<td>105</td>
<td>1553.9582</td>
<td>14.7996</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>109</td>
<td>1711.3050</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Ec(k, 106) = 2.7148, p < .05.

This effect is not found for the two group model used for the study or for
the entire population in general. Neither academic standing nor the levels of the
other categorical variables demonstrated a significant effect on final grade of the
entire study population.

Data Analysis for Hypothesis 3

Hypothesis 3 states that there is no significant difference in attitude toward
computers, as measured by pretest and posttest, between students taught in an
electronically-expanded classroom and students taught in a traditional classroom. Participants were administered the attitudes toward computers instrument (Appendix E) before the subject matter pretest on the first day of the course. The posttest administration occurred between the last regular course exam and the final exam. A score of 120 indicated a perfect positive attitude, and a score of 30 indicated a perfect negative attitude. Treatment group scores on the pretest for attitude toward computers ranged from 59 to 120. Comparison groups scores ranged from 55 to 118. Tables 25 and 26, respectively, report the analysis.

Table 25

**Group Means, Descriptive Statistics, and T-Test for Pretest Scores of Attitudes Toward Computers**

<table>
<thead>
<tr>
<th>Group</th>
<th>M</th>
<th>SD</th>
<th>SE of Mean</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>92.3725</td>
<td>17.121</td>
<td>2.397</td>
<td>51</td>
</tr>
<tr>
<td>Comparison</td>
<td>91.6897</td>
<td>17.168</td>
<td>2.254</td>
<td>58</td>
</tr>
<tr>
<td>t-value</td>
<td>.21*</td>
<td>df</td>
<td>2-tail sig.</td>
<td>SE of Diff.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>107</td>
<td>.836</td>
<td>3.291</td>
</tr>
</tbody>
</table>

*tcv = 1.990, p > .05.

Table 26

**Group Means, Descriptive Statistics and T-Test for Posttest Scores of Attitudes Toward Computers**

<table>
<thead>
<tr>
<th>Group</th>
<th>M</th>
<th>SD</th>
<th>SE of Mean</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>102.680</td>
<td>12.427</td>
<td>1.757</td>
<td>50</td>
</tr>
<tr>
<td>Comparison</td>
<td>99.5172</td>
<td>13.384</td>
<td>1.757</td>
<td>58</td>
</tr>
<tr>
<td>t-value</td>
<td>1.27*</td>
<td>df</td>
<td>2-tail sig.</td>
<td>SE of Diff.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>106</td>
<td>.208</td>
<td>2.499</td>
</tr>
</tbody>
</table>

*tcv = 1.991, p > .05.
Treatment group scores on the posttest for attitudes toward computers ranged from 76 to 120. Comparison group scores ranged from 64 to 118. Posttest means for the treatment and comparison groups attitudes toward computers were compared using analysis of covariance. The pretest scores were the covariate. Group membership (electronically-expanded classroom or traditional classroom) was the independent variable. Students in the treatment group had slightly higher attitudes toward computers at the end of the course.

Table 27

Results of ANCOVA for Posttest Scores for Attitudes Toward Computers

<table>
<thead>
<tr>
<th>Group</th>
<th>Obs. Mean</th>
<th>Adj. Mean</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>102.680</td>
<td>102.620</td>
<td>(1 missing) 50</td>
</tr>
<tr>
<td>Comparison</td>
<td>99.517</td>
<td>99.577</td>
<td>58</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F Ratio</th>
<th>E Prob</th>
</tr>
</thead>
<tbody>
<tr>
<td>Covariate</td>
<td>9954.036</td>
<td>1</td>
<td>9954.036</td>
<td>133.258</td>
<td>.000</td>
</tr>
<tr>
<td>Between</td>
<td>248.711</td>
<td>1</td>
<td>248.711</td>
<td>3.330*</td>
<td>.071</td>
</tr>
<tr>
<td>Within</td>
<td>7843.216</td>
<td>105</td>
<td>74.697</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>18045.963</td>
<td>107</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Ec(1, 105) = 3.96, p > .05.

Based on the analysis of covariance reported in Table 27, Hypothesis 3 is retained. That is, there was no significant difference in attitude toward computers, controlling for entry attitude, between the participants in the electronically-expanded classroom and participants in the traditional classroom.

Additional Findings for Posttest Attitude Scores of Study Groups

As in the analysis for Hypotheses 1 and 2, the two study groups were decomposed into two treatment and two comparison groups to facilitate additional data analysis of interest to the study investigator. Results of an analysis of
covariance based on four groups revealed there was a significant difference in posttest attitude using the four group factor \( E = 2.64, \text{Ec}(3, 104) = 2.72, p. < .05 \). Table 28 indicates the means on the attitudes toward computers posttest using the pretest as a covariate. T-tests on the adjusted means, with an adjusted alpha level of .0083 (to compensate for experiment-wise error increase), between the means revealed that the mean for the Summer I comparison group was significantly lower \( t = 2.6474, \text{tcv}(107) = 1.995, p. < .0083 \) than that of the Summer I treatment group.

**Table 28**

**Results of T-Test on Adjusted Means for Attitudes Toward Computers, ANCOVA**

<table>
<thead>
<tr>
<th>Group</th>
<th>Obs. Mean</th>
<th>Adj. Mean</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sum I Treatment</td>
<td>103.087</td>
<td>103.818</td>
<td>23</td>
</tr>
<tr>
<td>Sum I Comparison</td>
<td>95.781</td>
<td>97.624</td>
<td>32</td>
</tr>
<tr>
<td>Sum II Treatment</td>
<td>102.333</td>
<td>101.798</td>
<td>27</td>
</tr>
<tr>
<td>Sum II Comparison</td>
<td>103.148</td>
<td>101.109</td>
<td>26</td>
</tr>
</tbody>
</table>

Data Analysis for Hypothesis 4

Hypothesis 4 states that there will be no difference in satisfaction with the presentation method between the sections that comprised the electronically-expanded classroom. The satisfaction with the presentation method instrument (Appendix F) was administered to participants after the last regular exam and before the final exam for the course. A perfect positive satisfaction score was 107, and a perfect negative satisfaction was a score of 22. In addition, the two receive rooms answered one additional 5-point Likert-type item relating to the performance of the teaching assistant. The combined send rooms were compared to the combined receive rooms using a t test. The receive rooms had a slightly higher satisfaction
with the presentation method but the difference was not significant. Results of the analysis are reported in Table 29. Based on the t-test analysis of satisfaction with the presentation method, Hypothesis 4 is retained. That is, there was no difference in satisfaction with the presentation method between the combined send and combined receive rooms during both summer sessions.

Table 29

<table>
<thead>
<tr>
<th>Group</th>
<th>M</th>
<th>SD</th>
<th>SE of Mean</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Send</td>
<td>94.8077</td>
<td>6.639</td>
<td>1.302</td>
<td>26</td>
</tr>
<tr>
<td>Receive</td>
<td>95.4000</td>
<td>10.235</td>
<td>2.047</td>
<td>25</td>
</tr>
<tr>
<td>t-value</td>
<td>-0.25*</td>
<td>df</td>
<td>2-tail sig.</td>
<td>SE of Diff.</td>
</tr>
<tr>
<td></td>
<td>49</td>
<td>0.807</td>
<td>2.406</td>
<td></td>
</tr>
</tbody>
</table>

*tcv = 2.011, p > .05.

Additional data analysis on some of the items was conducted. The comparison between the two receive rooms on satisfaction with the teaching assistant was not significant. The results of this analysis are reported in Table 30.

Table 30

<table>
<thead>
<tr>
<th>Group</th>
<th>M</th>
<th>SD</th>
<th>SE of Mean</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer I Receive Room</td>
<td>4.4545</td>
<td>.688</td>
<td>.207</td>
<td>11</td>
</tr>
<tr>
<td>Summer II Receive Room</td>
<td>4.7857</td>
<td>.426</td>
<td>.114</td>
<td>14</td>
</tr>
<tr>
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<td>df</td>
<td>2-tail sig.</td>
<td>SE of Diff.</td>
</tr>
<tr>
<td></td>
<td>15.83</td>
<td>0.181</td>
<td>0.236</td>
<td></td>
</tr>
</tbody>
</table>

*tcvv = 2.12, p > .05.
Scores did not meet the criteria for Levene's Test for Homogeneity of Variance \([E = 5.900, Ec_{v (1, 16)} = 4.49, p < .05]\) so a nonpooled variance t test was used for the significance test.

Additional Findings for Satisfaction with Presentation Method

As in the analysis for the other hypotheses, the groups were de-composed into separate send and receive rooms for each summer session. Means and other descriptive data are reported in Table 31.

Table 31

Group Means and Other Descriptive Statistics by Individual Rooms for Satisfaction with Presentation Method

<table>
<thead>
<tr>
<th>Group</th>
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<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sum I Send</td>
<td>97.7500</td>
<td>3.7929</td>
<td>12</td>
</tr>
<tr>
<td>Sum I Receive</td>
<td>93.4545</td>
<td>11.5184</td>
<td>11</td>
</tr>
<tr>
<td>Sum II Send</td>
<td>92.2857</td>
<td>7.599</td>
<td>14</td>
</tr>
<tr>
<td>Sum II Receive</td>
<td>96.9286</td>
<td>9.2526</td>
<td>14</td>
</tr>
</tbody>
</table>

Analysis of variance of the four group satisfaction scores means reported in Table 31 revealed no significant difference \([E = 1.2713, Ec_{v} = 2.80, p > .05]\).

The mean score for “The quality of audio from the speakers” (Item 15) was the lowest followed by “The ease of communicating through the audio system” (Item 16). Means were 3.78 and 3.80, respectively. This is consistent with earlier findings in the review of literature. Item 5, “The timeliness with which tests and assignments were graded and returned,” had the highest mean score \((X = 4.82)\) of any item (excluding Item 22, which was a dichotomous scale requiring either a “yes” or “no” answer). A mean of 4.78 was the second highest and corresponded to “The degree to which the instructor demonstrated competence in
operating the video and audio equipment (Item 19). The mean score for the item 13, "Overall, this instructor was:", was 4.75. Although Item 21, "Compared to conventional courses, this course was:", was scored third lowest (X = 4.04), the response to the Item 22 "Would you enroll in another course taught in this manner" (scored 1 for "no" and 2 for "yes") was positive (X = 1.90, S.D. = .30).
CHAPTER 5

SUMMARY OF FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

Introduction

The purpose of this study to was determine if students taught a competency-based ("hands-on") computer course in an electronically-expanded classroom would perform as well as students taught the course in a traditional classroom. Variables of interest were cognitive subject matter expertise as measured by a paper and pencil final exam, final course grade as a numeric score, attitudes toward computers, and assessment of the presentation method for those that participated in the electronically-expanded classroom. The study population consisted of students enrolled in Computer Applications in Education (CECS 1100) offered by the College of Education at the University of North Texas. The study spanned all sections of the course during the Summer 1995.

The electronically-expanded classroom consisted of two rooms connected via video and audio equipment. This was the treatment group. Students taking the course in a traditional setting functioned as the comparison group. As originally proposed, there was to be one treatment group during the Summer I session. The room necessary for the electronically-expanded classroom was unexpectedly available just before the Summer II session so another treatment group was constituted. This resulted in one treatment and one comparison group per summer session. A total of 109 participants completed the study.

In sections used for the treatment groups, participants were randomly assigned to one of two rooms. The course instructor was located in the send room,
and a teaching assistant supervised participants in the receive room. Participants in both the treatment groups and the comparison groups were self-selected as to summer session and course section. One instructor taught the two treatment groups and one of the comparison groups. Another instructor taught one of the comparison groups. Teaching method was standardized as much as possible.

Participants were administered pretests and posttests for subject matter knowledge and attitudes toward computers. The posttest scores were analyzed using the pretests as covariates. Final course grade as a numeric score data were derived from instructor grade books. The treatment groups were administered a satisfaction with the presentation method instrument that measured various aspects of the teaching procedures and technology concerns.

The original study design proposed to combine all the comparison groups in order to increase the power of the tests. The addition of a second treatment group resulted in a decrease in comparison groups. Scores of the two treatment groups were combined, and the scores from the two comparison groups were combined. This resulted in a two-group model that was used for hypothesis testing for this study. In order to demonstrate the feasibility of the electronically-expanded classroom, it was desirable to maintain the null hypotheses for this study.

Summary of Major Findings

The major findings of this study are as follows:

1. The treatment group mean score was slightly higher on both the paper and pencil pretest and posttest of course knowledge, but the difference was not significant. An ANCOVA on the posttest scores, using the pretest scores as a covariate, indicated that the treatment group adjusted mean score was higher than that of the comparison group, but the difference was not significant. The
hypothesis of no significant difference on adjusted posttest means between those taught in the electronically-expanded classroom and those taught in the traditional fashion was retained.

2. Final grade as a numeric score was slightly higher for the treatment group, but the difference was not significant. The null hypothesis that students in the electronically-expanded classroom would not significantly differ on final grade as a numeric score from those taught in the tradition classroom was retained.

3. Treatment group mean scores on both the pretest and posttest for attitudes toward computers was higher than that of the comparison group but not significantly different. An ANCOVA on the posttest scores, using the pretest scores as a covariate, indicated that the treatment group adjusted mean score was higher than that of the comparison group, but the difference was not significant for attitudes toward computers. The null hypothesis of no difference on attitude toward computers for students in the electronically-expanded classroom and the traditional classroom situation was retained.

4. The receive room mean score for satisfaction with presentation method was slightly higher but not significantly different from the send room means score. There was no significant difference in the receive room's ratings of the teaching assistant. The Summer II receive room rated the teaching assistant slightly higher than did the Summer I receive room. The null hypothesis of no significant difference for satisfaction with the presentation method was retained.

Discussion of Findings

As a matter of interest to the investigator, the combined study groups were de-composed for additional analysis to build a case for generalizing the summer population to the larger, long semester population of CECS 1100. A chi-square
analysis was conducted for academic standing and gender using the pilot study (long semester) group percentage of frequency as the expected frequency. Frequency of academic standing and gender of the study population varied significantly from that of the pilot study population. The study population had fewer freshmen, more seniors and more categorized as "Others."

In the pilot study population, females significantly outperformed males $[\chi^2 = 7.6278, \chi^2(1, 682) = 3.84, p < .05]$ and freshmen scored significantly lower $[\chi^2 = 6.4593, \chi^2(4, 679) = 2.37, p < .0001]$ than the other academic standings for the final course grade. The combined groups used for hypothesis testing in this study revealed no significant difference for gender or academic standing. When the two groups were de-composed into four groups (two treatment and two comparison), an ANOVA with a Tukey-B post-hoc comparison indicated that the Summer I comparison group performed significantly worse on the subject matter posttest (Hypothesis 1), and the Summer II comparison group performed significantly better than the Summer I comparison group. Again using the pilot study data as a metric, the two treatment groups and the Summer II comparison group had fewer freshmen than expected, and the Summer I comparison group had considerably more (45%) than expected. It is speculated that the Summer I comparison group performance was skewed by the number of freshmen. It is also speculated that this distinction was lost when the Summer I comparison group was combined with the Summer II comparison group. The lower scores of freshmen may have been neutralized when combined with a group having more higher performing seniors and "Others" than expected. The Summer I comparison group effect was also observed for Hypotheses 2 and 3.
It is also interesting to note that the ANCOVA on posttest scores for subject matter knowledge, using living arrangements as a factor, indicated that those living in on-campus housing performed significantly worse than those in the other living arrangement categories. Forty percent of the freshmen in the study population reported living in university housing. An ANCOVA on the posttest for attitudes toward computers, using academic standing as the factor, revealed that the adjusted means for freshmen was lower than that of the other categories and that the means for “Others” was higher than those of the other categories. It is also speculated that if all study groups had matched the pilot study population, the effects described above would have been indicated in the two-group model used for hypothesis testing.

Another possible explanation is that the Summer I comparison group was the only study group taught by a different instructor. The pilot study data indicated that past performance of instructors for this study was not significantly different when comparing final course grades. Nevertheless, instructor performance cannot be overlooked as a potential confounding variable when considering the difference between the uncombined groups.

Conclusions

Based on the methodology and findings of this study, the following is concluded:

1. The electronically-expanded classroom as a method of instruction was as effective as the traditional method for the study population when considering subject matter knowledge (Hypotheses 1 & 2).

2. When compared to the traditional method, the electronically-expanded classroom did not significantly affect student attitudes toward computers for the computer course used in this study.
3. Technical problems associated with electronic equipment influence students' satisfaction with course presentation methods. Students are especially sensitive to audio-related difficulties.

4. As another variation on distance education as defined in the review of literature, students taking a course in an electronically-expanded classroom have learning outcomes and attitudes comparable to those of students taking courses via other distant education systems.

5. Traditional, on-campus students performed equally as well in this distance education situation as the nontypical students described in the review of literature.

6. A competency-based ("hands-on") course can be taught via distance education methods.

7. Factors such as age, gender, previous computer experience, academic major, and other demographic characteristics are not factors in learning outcomes and attitude measures for this study. There is evidence that academic standing may be a factor.

Discussion of Conclusions

The conclusions of this study closely paralleled the findings of previous distance education studies. For instance, Blackwood and Trent (1968) found no significant difference in subject matter competency and presentation method attitude for students taking a money management course via audio conferencing. Fulmer, Hazzard, Jones, and Keene (1992) investigated nursing students taking a course via one-way video with two-way audio. Results indicated that remote site students performed slightly better than on-campus site students. Martin and Rainey
(1993) found similar results with high school students taking course via the TI-IN network compared to students taking the same courses in the traditional fashion. There was no significant difference in attitudes toward the course, but students taking the course via TI-IN had scores significantly higher on subject matter posttests. Haynes and Dillion (1992) studied nontraditional students taking a required course via two-way video and audio. While subject matter expertise and course attitude was not significantly different, students did indicate some displeasure with the technology. Simpson, Pugh, and Parchman (1991) found similar student outcome variables not to be significantly different but also reported that students found problems with the technology. Based on reviews of literature, both Moore and Thompson (1990) and Schlosser and Anderson (1994) concluded that distance education, regardless of delivery method, is effective for instructional purposes. This study offers additional evidence to support that generalization.

The electronically-expanded classroom offers a different approach to distance education as defined in the review of literature. There is not one all-encompassing model for distance education (U. S. Congress, Office of Technology Assessment, 1989a). Students in both rooms of the electronically-expanded classroom had equal access to university facilities, equal access to the instructor, and equivalent computing hardware. This is not the case in the typical distance education situation where the remote learner may not have convenient access to on-campus facilities.

This study was an attempt at between groups research using randomization as called for by Moore and Thompson (1990). The review of literature indicated that most distance education studies compared the remote site outcomes to the on-campus site outcomes. This study treated the send and receive room as one unit. There was no significant difference between the send and receive rooms on the
variables of interest and demographic characteristics (demographic characteristics are assumed to be controlled by randomization) when comparing send and receive rooms. But, the randomization was carried out on intact groups that were compared to nonrandomized intact groups. The significance tests on the variables of interest must be interpreted with caution due to the tenuous nature of the comparisons.

The review of literature for this study supported Schlosser and Anderson's (1994) opinion that much of the research in distant education focuses on adult learners, off-campus college students, or highly motivated high school students. This study provided an opportunity to investigate a population of traditional undergraduate college students taking, for most, a required, university-mandated course.

Based on the methodology of this study, it could be cautiously generalized that the entire CECS 1100 population would perform at the same level as the study population.

This study was also concerned with the notion that the course taught was competency-based as opposed to a lecture style course. Results from this study indicate that students in competency-based ("hands-on") CECS 1100 performed as well in the electronically-expanded classroom as those taught in the traditional classroom. This suggests that the nature of the course content and teaching method should not be a concern unless there is some limitation to the technological equipment. Planning and execution by the instructor will enhance the capabilities or overcome the limitations of the equipment (Schlosser & Anderson, 1994). It seems logical that a noncomputer, competency-based course could be successfully
taught with proper equipment and a trained instructor. Similar conclusions are offered by Willis (1993).

There was no significant difference in attitudes toward computers based on hypothesis testing in this study. There was an effect related to academic standing as an additional finding. Demographic variables for the entire study population had no apparent effect on computer attitudes except as noted earlier regarding academic standing. Honeyman and Warren (1987) found that gender, age, and occupation were not related to computer anxiety. Koohang (1989) found no difference in attitudes using gender as a factor, but computer experience was related to positive attitude. Okebukola, Sumampouw, and Jegede (1992) also concluded that computer experience was a significant variable regarding anxiety. This study found no significant effect for attitudes toward computers when using previous computer experience as a factor. This may simply be an indication that students are more technologically savvy than students from the near past.

Results from the satisfaction with the presentation method indicated that participants in the electronically-expanded classroom were sensitive to technical problems especially audio-related difficulties. Several studies in the review of literature indicated similar results. While participants noted some dissatisfaction with audio quality, it had no apparent effect on learning outcomes and attitudes for this study. Based on the experience of the investigator, the technical problems were minor. It is speculated that major technical difficulties as an on-going problem would affect student learning outcomes and attitudes.

One of the assumptions of this study was that it was desirable to maintain all null hypotheses in order to demonstrate the feasibility of the electronically-expanded classroom as an effective method of instruction. Based on the
methodology of this study, all null hypotheses were retained. But, any-large scale
generalizations must be tempered by the fact that the relatively small study
population and its incumbent sample sizes limited the power of the statistical
procedures. In addition, it is unlikely that every variable can be analyzed or
controlled; therefore, perfect certainty of statistical tests can be ensured (Kirk, 1982).
This was the case when analyzing the de-composed groups regarding the subject
matter posttest and the attitudes toward computers posttest. It is possible that the
comparison group in question showed significant difference based on the fact that it
was the group with a different instructor. Academic rank seems to be a more
plausible explanation than instructor difference.

Finally, the difference between statistical significance and “real world”
significance must be considered. The scores related to grade, both paper and pencil
subject matter knowledge, and final grade as a numeric score were quite high for
both the treatment and comparison groups. In essence, the study measured levels of
the letter grade “A.” While the differences here seemed important for the study,
they would probably be of no consequence to the student— the primary
stakeholder.

Recommendations and Implications

Moore and Thompson (1990) concluded that distance can be effective when
effectiveness is measured by student achievement, attitudes of students and teachers,
and by cost effectiveness. The review of literature indicated that student learning
outcomes and attitude variables have been studied. The majority of findings tend to
be positive. There is little if any research on cost effectiveness. Distance education
systems tend to be hybrids of various telecommunication systems based on unique
needs (Heinich, Molenda, & Russell, 1993). This makes it inherently difficult to
determine a cost structure that can be both useable and generalizable. All equipment for this study was previously installed or readily available as an existing campus resource. Except for minimal out-of-pocket costs for miscellaneous cables, this study did not require any capital expenditure. It is suggested that administrators in higher education institutions consider alternative uses of distance education equipment that currently exists or as part of initial purchase decisions. In addition, all design plans for new campus buildings should have provisions for the installation and cabling of technology-based systems. Jacobson (1994) suggests that the appeal of distance education systems to academe is the potential to reach larger populations of students without the added expense of new construction. The electronically-expanded classroom has the same basic appeal within the existing campus infrastructure. On-going budget cuts will require all administrators to look for alternative, cost-efficient approaches to current educational practice. Dirr (1990) noted that in the mid-1990s 100,000 new faculty members will be needed to off-set retirements while, at the same time, retrenchment policies may prevent adequate replacement faculty from being hired. If technology-based solutions are selected, administrators must provide for the technical training of existing faculty and staff. These costs must be weighed against the costs of traditional solutions such as hiring new faculty or new construction.

The review of literature indicated that the remote-site facilitator played an important part in the effectiveness of distance education processes. Many states have legislative mandates on the certification of distance education site facilitators for K-12 environments (U. S. Congress, Office of Technology Assessment, 1989a). It is suggested that administrators in higher education cannot make the assumption that technology-based systems of instruction can replace personnel costs. It is safe
to assume that increasingly sophisticated technology systems will require more support personnel. Maintenance and operating costs cannot be overlooked.

In a study of telecourses at Boise State University, Spitzer, Bauwens, and Quast (1989) investigated the feasibility of offering large scale undergraduate core courses via television. While student achievement and attitude were positive, Spitzer, et al. (1989) reported that the most important lesson learned was that technical excellence was critical and that future improvements to their system would come in the area of equipment upgrades and personnel training. Results from this study and the review of literature indicated that students' main concern was with quality of the audio and video signals. The implication here is that any technology-based equipment acquisition decisions cannot be made by using a least cost criteria. It is recommended that those involved in purchase decisions of technology-based components pay heed to the emerging research available (e.g., Hienich, Molenda, & Russell, 1993) on student expectations regarding the output of technical equipment.

While not a major finding from the methodology of this study, there were indications that freshmen enrolled in CECS 1100 did not perform equal to other academic standings. This was the case with both the pilot study population and in one of the study comparison groups. More research is indicated on the effect of academic standing on performance in technology-intensive learning situations such as the electronically-expanded classroom and other distance education systems. As noted in the review of literature, most distance education programs have served either nontraditional, adults or high achieving high school students. If institutions of higher education continue to evolve into what Rossman (1992) envisions as the "worldwide electronic university," more research needs to be conducted in order to
investigate how underclassmen will be affected by the new academic environment. The implication is that future student learning outcomes research on environmental effects of college on students should include various forms of technology as a potential factor. In addition, future research on student outcomes using the developmental approach on the effect of attending college should consider the interaction of technology and student developmental level.
Instructor: Mark Mortensen
Matthews Hall Rm. 321
Phone: (817) 565-4130

Office Hours: Monday - Thur 10:00-11:00am
2:00-3:00pm
Or by appointment

Section 3 is part of the larger CECS 1100 program. There are a number of sections being offered this semester. For most of you, this course is required for graduation. Therefore, much of the course material is standardized across all sections.

Objectives:
Computer Applications in Education is an introduction to computer usage in educational situations. Applications on computer usage for classroom activities are studied. Experience will be gained with software tools such as word processing, spreadsheet, and data base packages.
The primary goals are:
1. To provide participants with knowledge about how computers can be applied in public education and society today.
2. To provide an overview of computer terminology, history, hardware, software and system design
3. To provide experience and skill in using an integrated software to solve typical educational information processing problems.

Texts Required:

Grading System:
There will be five exams and six assignments. No grades will be dropped in this course.
Your grades will be weighted as follows:

Exams .............. 60%
Assignments ......... 40%

The grading scale is as follows:
A ............. 90% and above
B .................. 80-89%
C ................... 70-79%
D ................... 60-69%
F .................. below 60%
Exams:
There will be five exams. A majority of the exams are paper and pencil as well as hands-on. The final is strictly a paper and pencil exam. All of the exams are closed book.

Deadline for Make Up Exams: one week after the regularly scheduled test.

Attendance Policy for CECS 1100.003:
Regular and punctual class attendance is expected. Much of this class is demonstration; therefore, you are at a great disadvantage if a class period is missed. In accordance with the requirements of the UNT Undergraduate Catalog for 1994-95, you are hereby informed that upon the accumulation of 4 absences (15% of the course), you will be dropped from the course with a grade of WF. Please consult page 34 of the UNT Undergraduate Catalog for 1994-95 for more information on authorized absences.

Software:
Only MS WORKS Windows Series, Version 2.0 will be supported in the class or lab. I can make some allowances for MS WORKS Windows Series, Version 3.0 if you can print at home on an Inkjet or better printer. Under no circumstances will any other software or platforms be supported.

Computer/Laboratory Assignments:
The computer assignments will demonstrate your ability to use the computer and to use MicroSoft Works. Assignments will be accepted late with a penalty of 1 point per day and the first day begins with the call for papers at the beginning of class on the assignment due date.

Lab Information:
Lab procedures will be discussed in class. The General Access Lab hours are posted on the door of Matthews Hall Rm. 309. The information is also on the brochure that will be issued to you in class. Currently, the General Access Lab in Matthews Hall is the only one running Novell 4.1. (The rest of the university is currently upgrading.) Please be advised that you will not be able to access MS WORKS from other locations on campus. Essentially this means that you need to work in Matthews Hall 309.

Class Supplies:
You will be given a diskette to use in this class. You are expected to bring it to every class period and to treat it with care. If you lose or damage the diskette, you must provide an equivalent replacement. Only class material is to be stored on this disk!

Please have paper and a pen or pencil for note taking. You will also be provided with a network account and storage space on the network. This will be further explained in class.

Cheating:
Cheating and disciplinary action for cheating is defined by the UNT Policy Manual Code of Student Conduct and Discipline. Cheating is an act of academic dishonesty and is defined as:
"Plagiarism and cheating refer to the use of unauthorized books, notes, or otherwise securing help in a test; copying tests, assignments, reports, or term papers; representing the work of another as one's own; collaborating, without authority, with another student during an examination or in preparing academic work; or otherwise practice scholastic dishonesty."

"Academic dishonesty matters may first be considered by the faculty member who may assign penalties such as failing, reduction or changing of a grade in a test, course, assignment, or other academic work, denial of a degree and/or performing additional academic work not required of other students in the course. If the student does not accept the decision of the faculty member, he/she may have his/her case heard by the academic department chairperson or head for review of his/her case. If the student does not accept the decision of the academic department chairperson, he/she may then follow the normal appeal procedures listed in Disciplinary Procedures."

**EEO/ADA Statement:**

It is the policy of the University of North Texas not to discriminate on the basis of race, color, religion, sex, age, national origin, disability or disabled veteran or veteran of the Vietnam Era status in its educational programs, activities, admissions or employment policies. Questions or complaints should be directed to the Equal Opportunity Office, (871) 565-2456. TDD access is available through Relay Texas: 1-800-735-2989 (TDD Callers). The University of North Texas does not discriminate on the basis of an individual's disability and complies with Section 504 and Public Law 101-336 (Americans with Disabilities Act) in its admission, accessibility, treatment and employment of individuals in its programs and activities. The University of North Texas provides academic adjustments and auxiliary aids to individuals with disabilities, as defined under the law, who are otherwise qualified to meet the institution's academic and employment requirements. Please see the instructor outside of class to make any arrangements involving special accommodations.
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<td>WW 6</td>
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<td>Test 3 (70 min's)</td>
<td>Assigns 3 &amp;</td>
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<td>Database</td>
<td>WW 8</td>
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<tr>
<td>7/3/95</td>
<td>Test 4 (70 min's)/Integration</td>
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<td>7/4/95</td>
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<td>7/5/95</td>
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EC - Essentials of Computing
WW - Works for Windows
APPENDIX B

USE OF HUMAN SUBJECTS CONSENT FORM
FOR COMAPRISON GROUPS
REQUEST FOR YOUR PARTICIPATION IN A RESEARCH STUDY
Traditional CECS 1100 Sections (Summer, 1995)

Dear CECS 1100 Student:

This is a request for your participation in a research study of CECS 1100 students. The study is being conducted for doctoral dissertation research by Mark Mortensen. The study will compare your subject matter knowledge, final grade and attitudes toward computers with students taught CECS 1100 in an electronically-expanded classroom. The anticipated result of the study is that students taught CECS 1100 in an electronically-expanded classroom will not differ with students taught in a traditional classroom.

It is policy of the Computer Education and Cognitive Systems (CECS) program to award an incentive to students volunteering for research studies. If you choose to participate you will receive an additional homework grade of 100 to be averaged into the homework portion of your final grade.

Participation in this study will require you to:

- Take a test that will indicate your entry-level knowledge of course material.

- Take a test of your attitudes toward computing at the beginning and the end of the course.

- Fill out a questionnaire about your academic standing, age, gender, previous computer experience, work schedule, etc.

Participation in the study in no way affects your grade in this course. You are not required to participate in this study. You may withdraw your consent at any time without penalty, prejudice or loss of benefits.

All forms will be kept confidential and you will not be identified as an individual in any of the data analysis. For record keeping purposes, you will be identified only by the last four digits of your student I.D. number.

Please fill out the attached informed consent form indicating your participation in the research study described above. Please detach this cover letter for your records.

Sincerely,

Mark Mortensen
Principle Investigator
Doctoral Student in Higher Education
Lecturer, Department of Technology & Cognition
USE OF HUMAN SUBJECTS
INFORMED CONSENT

I have heard a clear explanation of the research study in which I am being asked to participate. I understand that this study is being used as dissertation research for Mark Mortensen, doctoral student in Higher Education.

I agree to:

- Take the tests of my prior course material knowledge and attitudes toward computers.

- Fill out the demographic information questionnaire.

In addition, I give my consent for my scores on the subject matter tests, attitudes, and demographic information to be compared with other sections of CECS 1100 participating in this study. I understand that these scores will be kept confidential and I will not be identified as an individual. I understand that I may withdraw my consent at any time without penalty, prejudice or loss of benefits.

With my understanding of this, having received information about the study and satisfactory answers to the questions I may have asked, I voluntarily consent to participate in this study. If I have any questions regarding this research, I may contact Mark Mortensen at (817) 565-4130.

I consent to participate in this study:  
Name  
I.D. Number

I do not wish to participate in this study:  
Name  
I.D. Number

This project has been reviewed and approved by the University of North Texas Committee for Protection of Human Subjects.
APPENDIX C

USE OF HUMAN SUBJECTS CONSENT FORM
FOR TREATMENT GROUPS
REQUEST FOR YOUR PARTICIPATION IN A RESEARCH STUDY
Electronically-Expanded Classroom

Dear CECS 1100 Student:

This is a request for your participation in a research study of CECS 1100 students. The study is being conducted for doctoral dissertation research by Mark Mortensen. CECS 1100, section 003 is being taught as an electronically-expanded classroom. In essence, the course will be taught to two rooms at the same time using two-way audio and video. The study will compare your subject matter knowledge, final grade and attitudes toward computers with students taught CECS 1100 in a traditional classroom. The anticipated result of the study is that students taught CECS 1100 in an electronically-expanded classroom will not differ with students taught in a traditional classroom.

It is policy of the Computer Education and Cognitive Systems (CECS) program to award an incentive to students volunteering for research studies. If you choose to participate you will receive an additional homework grade of 100 to be averaged into the homework portion of your final grade.

Participation in this study will require you to:

- Be assigned to one of two rooms for the entire length of the course.

- Take a test that will indicate your entry-level knowledge of course material.

- Take a test of your attitudes toward computing at the beginning and the end of the course.

- Fill out a questionnaire about your academic standing, age, gender, previous computer experience, work schedule, etc.

- Fill out a questionnaire about your attitudes toward the presentation method.

Participation in the study in no way affects your grade in this course. You are not required to participate in this study. You may withdraw your consent at any time without penalty, prejudice or loss of benefits.

All forms will be kept confidential and you will not be identified as an individual in any of the data analysis. For record keeping purposes, you will be identified only by the last four digits of your student I.D. number.
If you choose not to participate, every attempt will be made to place you in another section of CECS 1100 during the summer session. If you chose not to participate, you can not receive the extra credit incentive.

Please fill out the attached informed consent form indicating your participation in the research study described above. Please detach this cover letter for your records. Thank you.

Sincerely,

Mark Mortensen
Principle Investigator
Doctoral Student in Higher Education
Lecturer, Department of Technology & Cognition
I have heard a clear explanation of the research study in which I am being asked to participate. I understand that this research is being used as a dissertation for Mark Mortensen, doctoral student in Higher Education.

I agree to:

- Be assigned to one of two rooms for the duration of the study.
- Take the tests of my prior course material knowledge and attitudes toward computers.
- Fill out the demographic information and attitudes toward the presentation questionnaires.

In addition, I give my consent for my scores on the subject matter tests, attitudes, and demographic information to be compared with other sections of CECS 1100 participating in this study. I understand that these scores will be kept confidential and I will not be identified as an individual. I understand that I may withdraw my consent at any time without penalty, prejudice or loss of benefits.

With my understanding of this, having received information about the study and satisfactory answers to the questions I may have asked, I voluntarily consent to participate in this study. If I have any questions regarding this research, I may contact Mark Mortensen at (817) 565-4130.

I consent to participate in this study: ____________________________

Name

__________________________

I.D. Number

I do not wish to participate in this study: ____________________________

Name

__________________________

I.D. Number

This project has been reviewed and approved by the University of North Texas Committee for Protection of Human Subjects.
APPENDIX D
PRETEST - POSTTEST FOR SUBJECT
MATTER KNOWLEDGE
Bubble the correct answer on the scantron. DO NOT MARK ON THE TEST!!

1. Which of the following is **NOT** part of the definition of computer literacy?
   a. programming  
   b. knowledge  
   c. awareness  
   d. interaction

2. The ________ of computers makes them ideal for processing large amounts of data.
   a. reliability  
   b. speed  
   c. decision-making capabilities  
   d. ease of use

3. Computer errors are most often caused by:
   a. bad chips  
   b. CPU circuitry  
   c. power fluctuations  
   d. humans

4. The largest single user of computers is:
   a. the government  
   b. AT&T  
   c. schools  
   d. the banking industry

5. Robots have replaced humans in some jobs that are too ________ to be done by humans.
   a. critical  
   b. tedious  
   c. dangerous  
   d. all of the above

6. The computer and its associated equipment are called:
   a. the CPU  
   b. peripheral equipment  
   c. hardware  
   d. a network

7. Software is:
   a. computer instructions  
   b. the CPU  
   c. diskettes  
   d. memory

8. The most common input device on a personal computer is the:
   a. wand reader  
   b. bar code reader  
   c. keyboard  
   d. mouse

9. The most common output device on a personal computer is the:
   a. monitor  
   b. hard drive  
   c. printer  
   d. network

10. ________ storage holds data and programs permanently.
    a. Primary  
    b. Secondary  
    c. Main  
    d. Peripheral
11. The most widely used software is for:
   a. spreadsheets           c. word processing
   b. database management    d. communications

12. __________ software automatically recalculates the results when a number is changed.
   a. Word processing       c. Database management
   b. Spreadsheet           d. Communications

13. __________ software helps keep track of and examine large amounts of data.
   a. Spreadsheet           c. Word processing
   b. Database management   d. Artificial intelligence

14. Information stored in __________ will be lost once the power is shut off.
   a. RAM                   c. ROM
   b. CD-ROM                d. C:

15. Laser printers form characters by using a technology based on:
   a. heat                  c. light
   b. friction              d. sound

16. The basic unit for storing data in computer memory is called a:
   a. bit                   c. bite
   b. byte                  d. kilobyte

17. The capacity of a 1.44MB diskette is approximately how many text characters?
   a. 1,400                 c. 144,000
   b. 14,400                d. 1,400,000

18. "Booting" the computer means:
   a. changing the drives   c. starting the CPU
   b. cabling the hardware  d. printing

19. A "warm boot" on a DOS based machine is accomplished by what keystrokes?
   a. Control-Alt-Delete    c. Control-Shift-Delete
   b. Shift-Alt-Space       d. Shift-Space-Escape

20. MS-DOS is:
   a. operating system software c. utility software
   b. application software     d. hardware devices
21. Microsoft WINDOWS is an example of:
   a. operating system software  c. GUI (Graphic User Interface)
   b. applications software       d. DOS

22. In the WINDOWS file manager, a directory structure is represented by:
   a. file folder icon  c. document icon
   b. diskette icon     d. none of the above

23. In WINDOWS or DOS, a filename is limited to how many characters?
   a. 2  c. 6
   b. 4  d. 8

24. Which of the following is NOT a correct DOS filename?
   a. TermPap1  c. TERMpap 1
   b. TERMPAP1   d. termpap1.Bob

25. The command in DOS that will list the files on a disk is:
   a. FILE  c. XCOPY
   b. DIR     d. COPY

26. To prepare a new diskette for use by a system, use the:
   a. DISKCOPY command  c. CHKDSK command
   b. TYPE command      d. FORMAT command

27. Which command will return all files with the 3rd letter of Q and the extension EXE?
   a. dir ??Q?????.EXE  c. DIR.exe
   b. DIR ??Q?????.*     d. dir *.Exe

28. After entering your login name on the network, you must enter your:
   a. H:  c. floppy disk
   b. password       d. DOS

29. To inform the computer that you are finished entering data on one line, you
   would normally press the:
   a. INSERT key       c. CONTROL key
   b. ENTER key        d. ESCAPE key

30. A device that allows data to be written to a diskette or to be read from a diskette
    is called a disk
    a. drive             c. pack
    b. mouse             d. writer
31. Icons and menus encourage pointing and clicking with a:
   a. keyboard  
   b. function key  
   c. mouse  
   d. scanner

32. The person considered to be the first computer programmer was:
   a. Grace Hopper  
   b. Ada Byron  
   c. Charles Babbage  
   d. Lord Mellon

33. Herman Hollerith's ___________ machine won the right to compute the 1890 United States census.
   a. tabulating  
   b. analytic  
   c. difference  
   d. zone specific

34. The first digital computer that worked electronically was the:
   a. Mark I  
   b. ENIAC  
   c. UNIVAC  
   d. Atanasoff-Berry

35. The commercial computer age began with the delivery of the _________ computer.
   a. Mark I  
   b. ENIAC  
   c. UNIVAC  
   d. Atanasoff-Berry

36. The 1st computer generation used:
   a. transistors  
   b. microprocessors  
   c. vacuum tubes  
   d. integrated circuits

37. The 4th computer generation used:
   a. transistors  
   b. microprocessors  
   c. vacuum tubes  
   d. integrated circuits

38. The goal of the 5th generation of computers encompasses the following research field:
   a. expert systems  
   b. natural languages  
   c. artificial intelligence  
   d. all of the above

39. Steve Jobs and Steve Wozniak formed:
   a. Microsoft  
   b. Computerland  
   c. Apple  
   d. Lotus-1-2-3

40. Bill Millard founded:
   a. Microsoft  
   b. Computerland  
   c. Apple  
   d. Lotus-1-2-3
41. __________ is a scientifically oriented language.
   a. FORTRAN c. BASIC
   b. COBOL d. Pascal

42. On-screen pictures are called:
   a. cursors c. icons
   b. prompts d. pointers

43. The __________ shows where the next character you type will appear on the screen.
   a. cursor c. pointer
   b. menu d. function key

44. __________ automatically starts a word at the left margin of the next line if there is not enough room for it on the previous line.
   a. Scrolling c. Reformatting
   b. Formatting d. Word wrap

45. An on-screen list of command choices is called a(n):
   a. index c. catalog
   b. menu d. icon

46. Microsoft WORKS for WINDOWS is an example of:
   a. operating system software c. applications software
   b. utility software d. shareware

47. How many documents can be open in Microsoft WORKS at any given time?
   a. 2 c. 6
   b. 4 d. 8

48. What is the main disadvantage of an integrated software package?
   a. network installable c. can switch between modules
   b. less powerful than standalone d. uses common set of commands packages

49. Word processing can be seen as:
   a. Creating a document c. Editing a document
   b. Formatting a document d. All of the above

50. __________ refers to the appearance of a document.
   a. Style c. Format
   b. Font d. Composition
51. Printed characters in darker type than surrounding characters are called:
   a. boldface  c. halftones
   b. italics  d. hard fonts

52. ________ deletes a block of text from its original location and places it in another location.
   a. Copy  c. Cut and paste
   b. Search  d. Copy and paste

53. Finding and changing each instance of a repeated item is referred to as:
   a. format and style  c. conditional replace
   b. edit and delete  d. find and replace

54. A ________ is a complete set of characters in a particular size, typeface, weight, and style.
   a. font  c. type category
   b. point size  d. linotype

55. In the headers and footers dialogue box, what command will place the page number in either the header or footer?
   a. &L  c. &P
   b. P&  d. Page &

56. With Show All Characters turned on, a tab looks like a(n):
   a. upside down triangle  c. right arrow
   b. empty space  d. underline

57. The keyboard shortcut for the Save command is:
   a. Control + F  c. Control + V
   b. Control + S  d. Control + R

58. Create a blank line between lines of text by:
   a. pressing ENTER  c. pressing Control + V
   b. select INSERT LINE on menu  d. pressing INS +X

59. The active font is the one currently appearing in the:
   a. first character  c. font list box
   b. last character  d. Design menu

60. A spreadsheet is comprised of:
   a. records and fields of data  c. rows and columns of data
   b. fields and entries of data  d. none of the above
61. The intersection of a row and column is called a:
   a. cell  c. cell pointer
   b. field  d. value

62. Spreadsheet entries that have numeric data and can be used in calculations are called:
   a. records  c. values
   b. labels  d. rates

63. Mathematical statements used to make spreadsheet calculations are called:
   a. formulas  c. rates
   b. values  d. labels

64. In order to indicate that you are entering a formula, precede it with a:
   a. >  c. =
   b. *  d. +

65. The formula A2 +$V2 represents what type of cell reference?
   a. mixed  c. relative
   b. constant  d. absolute

66. In the function SUM(C3:C25), the information in the parenthesis is a:
   a. entry  c. range
   b. value  d. table

67. The default chart for a WORKS spreadsheet is:
   a. line chart  c. pie chart
   b. multiple hi-lo chart  d. bar chart

68. A pie chart represents data in terms of:
   a. currency  c. functions
   b. data points  d. percents

69. A __________ is an organized collection of related data.
   a. field  c. database management system
   b. database  d. relation

70. A collection of related records make up a:
   a. data item  c. file
   b. category  d. field
71. The database view that shows only one record at a time is:
   a. list        c. query
   b. form        d. report

72. The function that allows the selection of certain records is:
   a. list        c. query
   b. form        d. report

73. Which of the following is NOT a capability of a query?
   a. use range operators  c. use wildcards
   b. return 2 out of 4 fields d. use multiple criteria

74. In list view, WORKS displays ###### in a field if:
   a. field width is inadequate  c. document is not named
   b. a report is referenced      d. format for weight

75. Sorting from A to Z is ________________.
   a. lateral  c. descending
   b. ascending  d. matrix regression

76. If you only want to print certain fields use the:
   a. query function  c. report function
   b. search function  d. none of the above

77. Information in a field is called a:
   a. record  c. label
   b. entry  d. view

78. ________________ view closely resembles a spreadsheet.
   a. Form  c. List
   b. Design  d. Fixed view

79. To view records not matching your query:
   a. rephrase the query  c. click the Swap tool
   b. select Switch Hidden Records  d. select Swap records

80. The conditional operator for less than or equal to is:
   a. < >        c. <=
   b. >=        d. > <
81. Which of the following data integration scenarios is possible?
   a. database into spreadsheet           c. database into word processing
   b. chart or graphics into word processing   d. all of the above

82. The area of memory where cut or copied information is temporarily stored is called the:
   a. Scrapbook                        c. Clipboard
   b. WorksPad                         d. SafetyNet

83. In WINDOWS, the active window always displays:
   a. a scroll bar                      c. at least one tool
   b. a colored Title bar               d. drag link

84. You can resize a window by clicking and dragging a:
   a. zoom box                         c. corner of the window
   b. Title bar                        d. scroll bar

85. A person who gains access to a computer system illegally, usually from a personal computer via a data communications network is called a:
   a. pirate                           c. techie
   b. zapper                           d. hacker

86. Which of the following is NOT one of the three basic categories of computer crime?
   a. theft of computer time           c. theft of hardware
   b. theft of programs                d. alteration of data

87. Which of the following is the weakest link in any computer security system
   a. people                           c. hardware
   b. programs                         d. communication systems

88. A set of illicit instructions that passes itself on to other programs with which it comes in contact is called a:
   a. trapdoor                         c. Trojan horse
   b. virus                            d. worm

89. A(n) _________ is a device that converts a digital signal to an analog signal:
   a. digitizer                       c. modem
   b. demodulator                    d. modulator
90. ____________ is the process of sending messages directly from one computer to another.
   a. Modulation       c. Demodulation
   b. Electronic Mail   d. Microwave

91. "Gopher" is:
   a. Virus           c. Virus protection program
   b. Internet interface d. E-mail system

92. A(n) ____________ system works by figuring out what a question means, then matching it against the facts and rules that it "knows."
   a. expert           c. strategic
   b. natural language d. information

93. Unconventional computers whose chips are actually designed to mimic the human brain are called:
   a. neural plans       c. nets
   b. sensory nets       d. neural networks

94. Software that is given away free, although the maker hopes that satisfied users will voluntarily pay for it, is called:
   a. site license       c. freeware
   b. shareware          d. licensed software
APPENDIX E
PRETEST - POSTTEST FOR ATTITUDES TOWARDS COMPUTERS
Last four digits of I.D. #: __________________

Please answer the following questions by putting a cross mark (X) in either "strongly agree," slightly agree," slightly disagree," or "strongly disagree" column.

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1. Computers do not scare me at all.
2. Working with a computer would make me very nervous.
3. I do not feel threatened when others talk about computers.
4. I feel aggressive and hostile towards computers.
5. It wouldn't bother me at all to take computer courses.
6. Computers make me feel uncomfortable.
7. I would feel at ease in a computer class.
8. I get a sinking feeling when I think of trying to use a computer.
9. I would feel comfortable working with a computer.
10. Computers make me feel uneasy and confused.
11. I'm no good with computers.
13. I don't think I would do advanced computer work.
14. I am sure I could work with computers.
15. I'm not the type to do well with computers.
16. I am sure I could learn a computer language.
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17 I think using a computer would be very hard for me.
18 I could get good grades in a computer course.
19 I do not think I could handle a computer course.
20 I have a lot of self-confidence when it working with computers.
21 I would like working with computers.
22 The challenge of solving problems with computers does not appeal to me.
23 I think working with computers would be enjoyable and stimulating.
24 Figuring out computer problems does not appeal to me.
25 When there is a problem with a computer run that I can't immediately solve, I would stick with it until I have the answer.
26 I don't understand how some people can spend so much time working with computers and seem to enjoy it.
27 Once I start to work with the computer, I would find it hard to stop.
28 I will do as little work with computers as possible.
29 If a problem is left unsolved in a computer case, I would continue to think about it afterward.
30 I do not enjoy talking with others about computers.
APPENDIX F
SATISFACTION WITH PRESENTATION METHOD INSTRUMENT - 2 FORMS
Last four digits of ID# __________  

For students attending in Matthews 307

Please indicate your satisfaction with the course by circling the number corresponding to one of the categories listed below.

very poor = 1  poor = 2  average = 3  good = 4  very good = 5

Example:  1  2  3  4  5

1. The clarity in which class assignments were communicated.

2. The typical amount of time the prepared graphics were left on the screen to be copied into your notes.

3. The degree to which the prepared (overheads and computer-generated) graphics helped you gain a better understanding of the course material.

4. The quality of the prepared graphics used for the class.

5. The timeliness with which tests and assignments were graded and returned.

6. The degree to which the types of instructional techniques (demonstrations, lectures, class exercises) helped you gain a better understanding of the course material.

7. The extent the room was free from adjacent noise, students talking to each other, people coming in and out, etc.

8. The extent to which the instructor made students feel they were part of the class and "belonged."

9. The instructor's organization and preparation for class.

10. The instructor's general level of enthusiasm.

11. The extent to which the instructor encouraged class participation.

12 How well instructor responded to questions over the video and audio system

13. Overall, this instructor was:

14 The quality of the video pictures.

15. The quality of audio from the speakers.

16. The ease of communicating through the audio system.

17. The degree of confidence you had that the class would not be interrupted by technical problems.

18. The degree to which the instructor handled problems during "hands-on" computer exercises.

19. The degree to which the instructor demonstrated competence in operating the video and audio equipment.

20. Overall, the course was:

Please turn to next page.
For the following questions, place a mark in the appropriate space.

21. Compared to conventional courses, this course was:
   ______ Much Worse ______ Worse ______ About the Same ______ Better ______ Much Better

22. Would you enroll in another course taught in this manner?
   ______ No ______ Yes
Please indicate your satisfaction with the course by circling the number corresponding to one of the categories listed below.

very poor = 1  poor = 2  average = 3  good = 4  very good = 5

Example: 1 2 3 4 5

1. The clarity in which class assignments were communicated. 1 2 3 4 5
2. The typical amount of time the prepared graphics were left on the screen to be copied into your notes. 1 2 3 4 5
3. The degree to which the prepared (overheads and computer-generated) graphics helped you gain a better understanding of the course material. 1 2 3 4 5
4. The quality of the prepared graphics used for the class. 1 2 3 4 5
5. The timeliness with which tests and assignments were graded and returned. 1 2 3 4 5
6. The degree to which the types of instructional techniques (demonstrations, lectures, class exercises) helped you gain a better understanding of the course material. 1 2 3 4 5
7. The extent the room was free from adjacent noise, students talking to each other, people coming in and out, etc. 1 2 3 4 5
8. The extent to which the instructor made students feel they were part of the class and "belonged." 1 2 3 4 5
9. The instructor's organization and preparation for class. 1 2 3 4 5
10. The instructor's general level of enthusiasm. 1 2 3 4 5
11. The extent to which the instructor encouraged class participation. 1 2 3 4 5
12. How well instructor responded to questions over the video and audio system. 1 2 3 4 5
13. Overall, this instructor was: 1 2 3 4 5
14. The quality of the video pictures. 1 2 3 4 5
15. The quality of audio from the speakers. 1 2 3 4 5
16. The ease of communicating through the audio system. 1 2 3 4 5
17. The degree of confidence you had that the class would not be interrupted by technical problems. 1 2 3 4 5
18. The degree to which the teaching assistant handled problems during "hands-on" computer exercises. 1 2 3 4 5
19. The degree to which the instructor demonstrated competence in operating the video and audio equipment. 1 2 3 4 5
20. The degree to which the teaching assistant demonstrated competence in operating the video and audio equipment. 1 2 3 4 5
21. Overall, the course was: 1 2 3 4 5
For the following questions, place a mark in the appropriate space.

21. Compared to conventional courses, this course was:
   ______ Much Worse ______ Worse ______ About the Same ______ Better ______ Much Better

22. Would you enroll in another course taught in this manner? ______ No ______ Yes
APPENDIX G

DEMOGRAPHIC INFORMATION QUESTIONNAIRE
Last four digits of ID#________

1. What is your academic standing?
   _____ Freshman
   _____ Sophomore
   _____ Junior
   _____ Senior
   _____ Other

2. Age_______

3. Gender
   _____ Male
   _____ Female

4. Which category best describes your course load this summer session?
   _____ 9 hours
   _____ 6 hours
   _____ 3 hours

5. Which category best describes your course load during a long semester?
   _____ 15 or more hours
   _____ 10 - 12 hours
   _____ 7 - 9 hours
   _____ 4 - 6 hours
   _____ 1 - 3 hours

6. Did you enter college here or did you transfer here from another college?
   _____ Entered here
   _____ Transferred from another 4 year school
   _____ Transferred for a 2 year school.

7. During this semester, are you living at:
   _____ dorm or other college housing
   _____ fraternity or sorority
   _____ private apartment, room or house near campus
   _____ house, apartment, parent's residence, etc.,
      away from campus (commute)
8. During this school session, about how many hours will you be working?
   _____ None, I'm not working this school session
   _____ about 10 hours or less
   _____ about 15 hours
   _____ about 20 hours
   _____ about 30 hours
   _____ about 40 hours
   _____ more than 40 hours

9. If you will be working, will it be on campus?
   _____ Yes
   _____ No

10. Which of the following comes closest to describing your major field of study?
    _____ Art or Music
    _____ Biological Sciences (biology, biochemistry, zoology, etc.)
    _____ Business
    _____ Business Computers
    _____ Computer Science
    _____ Education (including physical education, recreation, etc.)
    _____ Engineering
    _____ Humanities (literature, languages, history, philosophy, etc.)
    _____ Mathematics
    _____ Physical Sciences (physics, chemistry, earth science, astronomy, etc.)
    _____ Social Sciences (economics, psychology, sociology, political science, etc.)
    _____ Undecided

11. Was your most recent computer course:
    _____ Another college level computer course
    _____ A high school level computer course
    _____ This is my first computer course

12. Reason for enrolling in the course:
    _____ Required for graduation
    _____ Prerequisite for another course
    _____ Need for certification or endorsement such as IPT
    _____ Elective
    _____ Leveling course - will not receive graduation credit
    _____ Personal enrichment - will not receive graduation credit

13. What is your current GPA?
    _____ First semester Freshman - No GPA.
REFERENCES


