INFORMATION TO USERS

This manuscript has been reproduced from the microfilm master. UMI films the text directly from the original or copy submitted. Thus, some thesis and dissertation copies are in typewriter face, while others may be from any type of computer printer.

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleedthrough, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send UMI a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

Oversize materials (e.g., maps, drawings, charts) are reproduced by sectioning the original, beginning at the upper left-hand corner and continuing from left to right in equal sections with small overlaps. Each original is also photographed in one exposure and is included in reduced form at the back of the book.

Photographs included in the original manuscript have been reproduced xerographically in this copy. Higher quality 6" x 9" black and white photographic prints are available for any photographs or illustrations appearing in this copy for an additional charge. Contact UMI directly to order.

Order Number 9300660

A study of anxiety reducing teaching methods and computer anxiety among community college students

Taylor, Bernard Wayne, Ph.D.

University of North Texas, 1992

U·M·I

300 N. Zeeb Rd.
Ann Arbor, MI 48106

Taylor, Bernard Wayne, <u>A Study of Anxiety Reducing</u>
<u>Teaching Methods and Computer Anxiety among Community</u>
<u>College Students</u>. Doctor of Philosophy (Vocational
Technical Education), August, 1992, 114 pp., 24 tables,
bibliography, 61 titles.

The purpose of this study was to evaluate the
relationship between anxiety reducing teaching methods and
computer anxiety levels and learning gain of students in a
college level introductory computer course. Areas
examined were the computer anxiety levels of students
categorized by selected demographic variables, the
learning gain of students categorized by selected
demographic variables, and anxiety levels and learning
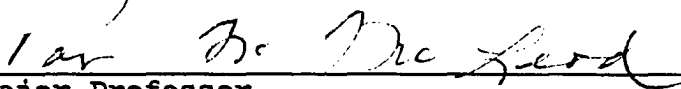gain of students after completion of the course.

Data for the investigation were collected via the
Standardized Test of Computer Literacy (STCL) and the
Computer Opinion Survey (CAIN), developed by Michael
Simonson et al. at Iowa State University. The
nonequivalent pretest/posttest control group design was
used. The statistical procedure was the t test for
independent groups, with the level of significance set at
the .05 level. The data analysis was accomplished using
the StatPac Gold statistical analysis package for the
microcomputer.

Based upon the analysis of the data, both hypotheses of the study were rejected. Research hypothesis number one was that students in a class using computer anxiety reducing teaching methods would show a greater reduction in computer anxiety levels than students in a traditional class. Hypothesis number two was that students in a class using computer anxiety reducing methods would show a greater learning gain than students in a traditional class. This research revealed that there was no statistically significant difference in the computer anxiety levels or the learning gain of students between the control group and the experimental group.
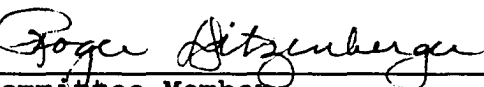
A STUDY OF ANXIETY REDUCING TEACHING METHODS

AND COMPUTER ANXIETY AMONG COMMUNITY

COLLEGE STUDENTS
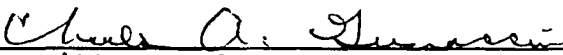
Bernard Wayne Taylor, A.A., B.A., M.A.
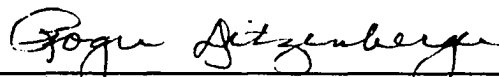
APPROVED:

_____
Major Professor

_____
Minor Professor

_____
Committee Member

_____
Committee Member

_____
Chair of the Department of Occupational
  and Vocational Education

_____
Dean of the College of Education

_____
Dean of the Robert Toulouse School
  of Graduate Studies

A STUDY OF ANXIETY REDUCING TEACHING METHODS

AND COMPUTER ANXIETY AMONG COMMUNITY

COLLEGE STUDENTS

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

Bernard Wayne Taylor, A.A., B.A., M.A.

Denton, Texas

August, 1992

TABLE OF CONTENTS

LIST OF TABLES

v

vi

.

vii

CHAPTER 1

INTRODUCTION

In recent years the term "computer literacy" has become more and more prevalent, and the teaching of computer literacy is now an important issue in the educational field. The educational system's focus on computer literacy, and the idea that every student should become computer literate, has affected virtually every level of education. In addition, computer literacy has become extremely important in the business world. Practically every business or educational publication has had some article or reference in recent issues concerning computer literacy.

The U.S. economy has rapidly progressed from a production oriented economy, to a service oriented one in which information technology has become a primary component. With transition to an information society has come a greater need for computer literacy and a greater burden on the educational system to make society computer literate. The first question that comes to mind is what does "computer literate" mean? Since International Business Machines introduction of the microcomputer in 1981, society has been affected by the spread of personal computers (Barnes 1986, 311).

1

It is important to realize the speed at which computer use is spreading, and the impact that it has on society. With this phenomenally fast transition to an information society, all citizens need to possess skills in computer use, but what skills are necessary to become computer literate? A review of the literature indicates no commonly accepted definition of computer literacy. Literacy is usually thought of as meaning the fundamental ability to communicate through the use of written language. When transferring this meaning to computers, then literacy would mean having a basic understanding of computers and how to use them. It appears that computer technology has developed and spread so rapidly that the understanding of the term "computer literacy" has had to evolve along with this development (Malpiedi 1989, 24). As society has been transformed into one that is heavily dependent upon information technology, computer technology has begun to affect nearly all aspects of contemporary organizational life (Howard, Murphy, and Thomas 1987, 13). It became necessary for educators to develop courses and a curriculum to meet the needs of a computer information society. The demand for computer training courses grew rapidly in both the academic and business segments. As management's need for more and better information increased, so did the need for computer training courses, providing computer training is a big business today. On any given day, all across the country there are probably thousands of computer courses

being conducted. In an attempt to make our society computer literate the phenomenon of computer anxiety, which is an important factor in the introduction of information technology, has been almost totally overlooked.

One of the fundamental principles of management is to take into consideration the fact that people exhibit a natural fear and resistance to change. It is important to note that the push for a computer literate society has not been accompanied by any systematic exploration of the impact of computer literacy on the participants (Mahmood and Medewitz 1989, 20). According to Mahmood and Medewitz, computer phobia is a complex matter that cannot be resolved merely by making people computer literate.

Statement of the Problem

The problem of this study was to determine if there is a significant relationship between the use of anxiety reducing teaching methods and the computer anxiety levels of students in a college level introductory computer course. The proposed study also attempted to determine if the use of anxiety reducing teaching methods resulted in a higher learning gain for students in a college level introductory computer course.

Objective of the Study

In order to evaluate the relationship between anxiety reducing teaching methods and the computer anxiety level and learning gain of students in a college level

introductory computer course, the objectives of this study
were to:

    1. compare the learning gain of students categorized
by selected demographic variables;

    2. compare the computer anxiety levels of students
categorized by selected demographic variables;

    3. compare the learning gain of students after
completion of the course;

    4. compare the change in computer anxiety levels of
students after completion of the course.

Significance of the Study

This study is significant in that little research has
been conducted in the area of computer anxiety. There are,
and will continue to be, a rapidly growing number of
computer users, and potential computer users, any number of
which may suffer from computer anxiety. A growing number
of decision-makers have a need to use computers, and many
of them will be making decisions concerning the teaching of
computer skills. They all need more information, that is
both relevant and reliable, about the nature of computer
anxiety, and the factors contributing to it. In addition,
there is a need for more knowledge about ways to help
individuals overcome computer anxiety through computer
courses.

This study has contributed to the small body of
knowledge about computer anxiety, by building and expanding
upon prior research that has been done in the areas of

computer literacy and computer anxiety. As was noted in the review of the literature, one theme was prevalent throughout, and that was the need for more research. It was observed that much of the research that has been done to date was lacking in strong research design, data collection methods, in instruments used, or a combination of all three. Most of the prior researchers called for further research, and some indicated the need to replicate the study because of some of the limitations imposed upon them from sources beyond their control. The purpose of this study was to contribute further knowledge about computer anxiety by attempting to clarify the following questions:

1. Do anxiety levels of individuals decrease over the term of a college course in computers?

2. Is age significantly related to computer anxiety levels among individuals?

3. Is gender significantly related to computer anxiety levels among individuals?

4. Is prior computer experience significantly related to computer anxiety among individuals?

Clarification of these questions will be useful to educators and decision-makers in business and industry whose responsibility it will be to provide quality instruction in computer use.

Hypotheses

To accomplish the purposes of this study the following hypotheses were tested:

1. There is no significant difference between the computer anxiety level of students in a traditional introductory college level computer course, and students in an introductory college level computer course where anxiety reducing teaching methods are used.

2. There is no significant difference between the learning gain of students in a traditional introductory college level computer course, and students in an introductory college level computer course where anxiety reducing teaching methods are used.

Limitations

The scope of this study was limited to persons who were attending the Henderson County Campus of Trinity Valley Community College during the 1991-1992 school year. Conclusions from this study will be generalizable to other community colleges which have similar geographic locations, programs, and student populations.

Further, it was not possible to randomly assign students because they were allowed to register for the class of their choice. The student's sampled were representative of students in introductory computer science classes at Trinity Valley Community College.

Definition of Terms

The following terms are defined as they relate to this study:

Algorithm is a sequence of instructions that tell how to solve a particular problem (Webster's Dictionary of the English Language 1990, CD 3).

Computer Anxiety is the fear or apprehension felt by individuals when they use computers, or when they consider the possibility of computer utilization (Simonson et al.; 1987, 238).

Computer Anxiety Index (CAIN) is a computer opinion survey developed by Michael Simonson et al. at Iowa State University designed to measure computer related anxieties (Simonson, et al. 1984, 5).

Computer literacy is an understanding of computer characteristics, capabilities, and applications, as well as an ability to implement this knowledge in the skillful, productive use of computer applications suitable to individual roles in society (Simonson et al.; 1987, 233).

Computerphobia is a fear or dread of the computer (Kennedy 1988, 297).

Hardware consists of all the physical elements of the computer, such as integrated circuits, wires, and keyboard (Webster's Dictionary of the English Language 1970, CD 48).

Information Technology is the methods by which we create, manipulate, and communicate information in all its

forms (Webster's Dictionary of the English Language 1990, CD 51).

Low-Literate Adults are those adults functioning below the ninth grade in reading, writing, and math (Lewis 1988, 6).

Software refers to all the program, computer languages, and operations used to make a computer perform a useful function (Webster's Dictionary of the English Language, 1990, CD 91).

Standardized Test of Computer Literacy (STCL) is a general assessment test developed by Michael Simonson et al. at Iowa State University designed to measure computer literacy (Simonson, et al. 1984, 4).

User Friendly means easier to learn to use, with less difficult concepts, as with some of the applications programs like VISICALC (Howard, Murphy, and Thomas 1987, 17).

User Hostile means somewhat unfriendly and difficult to learn to use, as with some of the computer programming languages (Howard, Murphy, and Thomas 1987, 17).

CHAPTER 2

REVIEW OF RELATED LITERATURE

This review includes material that addresses both
computer anxiety, and computer literacy which is very
closely associated with the subject, and which will
contribute to a better understanding of the investigation.

This review consists of three sections. The first
section provides an understanding of the rapidly increasing
importance of computers and computer literacy in our
contemporary information society. The second section
discusses the current status of computer anxiety, and some
possible techniques and strategies for dealing with it,
along with some implications for the design of introductory
computer courses. The final section looks at some present
methods of determining computer anxiety and assessing the
attitudes, values, and opinions toward information
technology.

Importance of Computers and Computer Literacy

The concept of computer literacy has changed
considerably since the term was introduced in the 1970's.
In the early years of the introduction of computer
technology, computers were closely linked to mathematics.
Some of the first computer courses offered in the high
schools and colleges were offered in the math department,

9

and taught by math teachers. In the late 1970's and early
1980's a computer literate person was a programmer using
computer languages like FORTRAN, COBOL, RPG, or BASIC, and
was usually someone with a math or engineering background
(Malpiedi 1989, 24). For several years computers were
mostly in the math and science curriculum area. With the
rapid spread of computers it was not long before other
areas of the curriculum began using them. As the use of
computers rapidly expands throughout the curriculum, it
becomes increasingly important to provide computer literacy
training for all students (Munger and Loyd 1989, 167).

Fifteen years ago students were taught programming
languages, but today they are taught applications such as
Lotus 1-2-3, Word Perfect, and dBase IV (Turner 1987, 12).
The concept of computer literacy has changed over the
years, and the content of the computer courses reflect that
change. In 1983 it was necessary to have some programming
skills in order to be computer literate, because most of
the time you had to provide your own program if you wanted
the computer to "do anything". Today there are so many
programs available to computer users that you can go to
almost any computer software store and purchase a program
to do just about anything you need to do. There are
obviously many problems associated with defining the skills
necessary to be computer literate, but there seems to be
common agreement that a computer literate person must have
the skills to use electronic spreadsheets, word processors,

and data-based management software (Barnes 1986, 312).
Computers are revolutionizing the way things are done, and
it is important to keep computer literacy courses in line
with what is needed to function in contemporary society.

Some people have suggested that computer literacy is a
disease invented by companies wanting to sell lots of
personal computers; it might also be suggested that the
term was invented by software companies in order to sell
more application software packages (Arden 1986, 27).
Eugene Arden also suggested that there are at least three
gradations beyond literacy that describe a hierarchy of
computer abilities; they are computer competent, computer
fluent, and computer genius.

Computer Anxiety

Arden introduced an important idea in his discussion
of the topic. He suggested that an individual not only be
competent with the computer, but should be comfortable as
well. This implies that a computer competent individual
does not suffer from computer anxiety. As the concept of
computer literacy continues to evolve, it is important to
become aware of the idea of computer anxiety and
incorporate plans for overcoming it.

Along with computer anxiety, another term was used in
this review of the literature; the term computerphobia -
having a fear or dread of the computer (Kennedy 1988, 297).
These feelings are pretty common among individuals when
they first attempt to use computers, according to Kennedy

(1988). This was one of only a few instances where this term was used in the literature. Almost all the other authors used the term computer anxiety to describe the phenomenon that is the subject of this investigation. Computer anxiety is a very common phenomenon in the business world as well as the educational setting. It occurs among students, teachers, white-collar workers, and managers, and a serious concerted effort is needed to help individuals overcome it. This phenomenon should be taken into consideration when planning and designing introductory computer courses, and strategies need to be developed for dealing with it both in the workplace and in the educational system.

As society has become more and more dependent upon information technology, the rapid growth in the use of computers has created a greater demand for computer training. As this demand grows, so does the importance of understanding and dealing with computer anxiety. Designing and implementing an introductory course in computers has been a difficult problem for educators, partly because of the diverse population it is designed to serve (Howard, Murphy and Thomas, 14). The authors of this article suggest that any effort to solve the problem of designing an introductory computer course will fail unless the phenomenon of computer anxiety is taken into consideration. In response to the computer anxiety problem, Howard, Murphy, and Thomas conducted a pre-post

experiment involving an introductory computer course. The
study was undertaken to determine if computer anxiety at
the end of an introductory computer course was
significantly lower than at the beginning of the course; to
investigate the possibility that the reduction in student
computer anxiety between the beginning and end of an
introductory computer course would be significantly greater
for groups in which "user-friendly" software was taught
before "user-hostile" software; and to explore the nature
of computer anxiety by testing for the significance of
correlation between student computer anxiety and the
following variables: (1) locus of control, (2) cognitive
style, (3) math anxiety, (4) computer knowledge, (5)
computer experience, (6) grade point average, (7) age and
class rank (See Table 1).

The results of this study suggest that an introductory
computer course should be designed with careful
consideration of the target audience in mind, and that
students should be segregated on the basis of computer
anxiety levels. The authors suggested that further
research should be conducted, because their study was
limited by a small sample size. In addition, the study
indicated a need for a differentiated approach, but more
research is needed to determine the most effective way to
reduce computer anxiety.

Not only are students' attitudes toward computers
important, but teachers' attitudes as well. Donna Mertens

Table 1

Factors Included in the Exploration of Correlates
of Students' Computer Anxiety

Locus of control	External locus of control types may be more computer anxious than internal types because they see the computer as an outside agent that exercises external control over them.	Howard (1986) Raub (1981)
Cognitive style	Analytic cognitive style types will be more comfortable with the logical discipline and high level of detail demanded by computing than will heuristic types.	Lucas (1981) Mason & Mitroff (1973)
Math anxiety	Math anxiety and computer anxiety may be closely related phenomena and can be expected to accompany each other.	Howard (1986) Raub (1981)
Trait anxiety	People who are anxious generally will exhibit state anxiety about computers; math anxiety and trait anxiety have been found to be correlated.	Howard (1986) Betz (1978)
Computer knowledge	Students with more conceptual computer knowledge will be less anxious about computer "unknowns".	Howard (1986)
Computer experience	Students with more hands-on computer experience will be less anxious about operating them.	Howard (1986)
Grade Point average	Raub theorized that better students will be more comfortable with the demands of a computer course.	Raub (1981)
Age	Older people will be more anxious about computers because they were less a part of the computer revolution.	Howard (1986) Weinberg & English (1981)
Class rank	Class rank (Freshman, etc.) is a surrogate for age.	Raub (1981)

and Zhali Wang conducted a study of computer attitudes among 43 pre-service teachers of hearing-impaired students, in an attempt to help clarify the character and significance of factors such as age, sex and computer experience in determining computer anxiety (Mertens and Wang 1988, 40). The results of this study indicated that age and sex were not significant variables, but computer experience was. However, while computer experience was found to be a major factor in computer liking and computer confidence, it was not a major factor in computer anxiety. The authors called for additional research to explore the important factors related to computer attitudes, and indicated that few studies have been conducted that examine attitudes toward computers and variables that influence such attitudes.

Throughout the literature, the same factors are mentioned again and again as possible correlates to computer anxiety (Honeyman and White 1987, 129). All across the country teachers and administrators are faced with the problem of providing computer instruction and computer related instructional programs for the students in the educational system. Before the teachers can provide the computer instruction, they must first become computer literate themselves, and often the teachers exhibit higher levels of computer anxiety than students (Honeyman and White 1987, 129). While other attempts have been made to investigate anxiety and the use of computers, the study

done by Honeyman and White was designed to measure the extent to which factors such as age, gender, previous experience, and time in contact with a computer, influenced the levels of anxiety experienced by teachers and school administrators learning to use the computer. The data for the study was collected over a two-year period from participants in a semester-long introductory computer course designed to teach applications software programs.

The results of this study indicated that significant changes in anxiety levels occurred over time. Participants with previous experience with computers had lower initial anxiety scores, than participants with no previous experience with computers. However it was shown that persons both with and without previous experience had significant reductions in their anxiety levels. In keeping with the conclusions of previous researchers, the findings of this study indicated no significant correlations between age and anxiety levels, or between gender and anxiety levels (Honeyman and White 1987, 136). One of the important implications of this study is that plans must be made for the training of teachers, and decision-makers cannot disregard the phenomenon of computer anxiety among teachers and administrators. As schools across the country continue to integrate computer technology into the curriculum, society must be aware of the factors that influence computer anxiety levels, and attempt to manage them so that they do not hold back technological

advancement. While this study indicated that an individual's anxiety level can be reduced over time, it also indicated that beginners require enough time working with a computer to allow their relatively high anxiety states to lower. Therefore it is important to design introductory computer courses that allow adequate time to learn to use the computer.

It is estimated that 2 million people will be employed in occupations directly related to computers by 1995, but even more importantly, millions of others will have to learn to use computers routinely in their everyday lives (Lewis 1988, 5). Despite the idea that adults experience computer anxiety the literature suggests that few studies have actually been conducted on this phenomenon. The study done by Linda Lewis attempted to determine if low-literate adults experienced computer anxiety. The study was very limited, and designed to gain a more accurate understanding of a unique population. The sample was limited to low-literate adults, and the instrument used was designed specifically for this study population. Lewis suggested that differences among populations have not been sufficiently explored, and that additional attitudinal correlates need to be researched with a variety of adult populations. The results of this study indicated that this population of low-literate adults did not appear to exhibit negative attitudes toward computers. This study also

appears to support the idea that gender is not a significant factor in computer anxiety.

N. Jo Campbell conducted a study to investigate the computer anxiety of rural middle school and secondary students (Campbell 1989, 213). The results of this study also supported the idea that sex is not a significant factor in computer anxiety. The Campbell study was broader than the one done by Lewis, having over 1,000 participants, and included students from rural school districts in two states. This study was interesting because the differences related to home availability of a computer, and school use of a computer were statistically controlled. The study showed that more males had a computer available at home than did females, but both males and females had computers available to them equally at school. Therefore, in earlier studies sex may have appeared to be a significant factor, while in fact it could have been the lack of sex equity in computer access at home. The researchers concluded that when effects due to computer access are statistically controlled, there are no sex differences in computer anxiety (Campbell 1989, 218). The increasing usage of computer technology requires that all students have equal access to computers and computer training courses, because business and industry trends demonstrate the need for students to become computer literate.

Another study done on computer attitudes also indicated no gender-related differences with respect to

attitudes toward computers and calculators (Munger and Loyd
1989, 175). This study attempted to determine if the
relationships between mathematics performance and computer
attitudes, and mathematics performance and calculator
attitudes are similar for males and females. The
researchers found that both males and females with positive
attitudes toward computers and calculators tended to
perform better than students with more negative attitudes.
Munger and Loyd indicated that empirical evidence
concerning gender differences in computer attitudes and
experience is limited, and suggested that because computer
technology is frequently associated with mathematics and
science, it is likely that factors which have discouraged
the participation of females in technical studies are also
causing females to participate less in computer studies
(Munger and Loyd 1989, 168).

Those who teach computer usage need to be aware of the
causes of computer anxiety, and attempt to help students
overcome it, and these methods of reducing anxiety, can
take many forms (Banks and Havice 1989, 22). Banks and
Havice demonstrated two strategies for dealing with
computer anxiety in an effort to evaluate the usefulness of
teaching methods with broadcast technology students. The
results of their investigation indicated the need for a
more structured environment when teaching computer skills.
These authors concluded that computer anxiety could be
reduced with the proper instructional method, namely

concentrating on teaching the computer skills before teaching the applications of those skills in specific areas (Banks and Havice 1989, 25).

In this review of the literature one theme was pervasive throughout in the search for information about computer anxiety, the need for more research. Cambre and Cook's review of the literature revealed the same need for more research, and with only one exception the authors observed that studies did not build upon one another (Cambre and Cook 1987, 15). These authors conducted a study to determine what could be learned about computer anxiety by taking advantage of a large, community based, summer computer orientation program. The course was open to students of all ages, allowing the researchers to use a more heterogeneous population than most other researchers had used. Therefore the researchers were able to assess computer anxiety in a largely heterogeneous, voluntary population, in a week-long beginning course, and determine if completion of the course lowered the anxiety level. In addition, they were able to determine if gender or age were factors in computer anxiety levels.

Because of the close similarity between this study by Marjorie Cambre and Desmond Cook, to this study, a couple of aspects of their study are of particular interest. First, the study concluded that:

1.   females described themselves as computer anxious more often than males;

2. adults appeared to be more fearful about the use of computers than did children and teenagers;

3. exposure to a one-week course in microcomputers had the effect of reducing instances of self-reported anxiety about the use of computers.

Second, the nature of the community program and administrative restrictions prevented the researchers from using a controlled experimental design. Therefore the study was descriptive, with instrumentation that was selected and adapted from instruments used by other researchers (Raub 1981; Rohner and Simonson 1981; Maur, 1983) and represented abbreviated versions of their scales. It was interesting to see that the researchers used five pre-course items and two items embedded in a post-course evaluation form, and assumed that the items used were valid measures of computer anxiety. The authors also suggested that their study should be replicated with other groups not necessarily committed to learning about computers, and that it may be possible that their results were a function of the self-selected sample and thus lack generalizability.

Methods of Determining Computer Anxiety

While Cambre and Cook were using abbreviated versions of instruments from other researchers, and adapting them to their own specific needs, others like Simonson, Maurer, Mortag-Torardi and Whitaker were developing standardized tests of computer literacy and computer anxiety. This

group attempted to develop a more encompassing definition for computer literacy that would incorporate existing definitions. In their studies, they found that computer literacy included skills in three areas, but in addition to that, "it was determined that a positive, anxiety free attitude toward computing was a prerequisite of computer literacy" (Simonson, et al.; 1987, 231). With this in mind, the group identified a four-part definition of computer literacy as follows:

> computer literacy was defined as "an understanding of computer characteristics, capabilities, and applications, as well as an ability to implement this knowledge in the skillful, productive use of computer applications suitable to individual roles in society."

The knowledge and skills of a computer literate person were divided into four categories: computer attitudes, computer applications, computer systems and computer programming. These four categories were defined as follows:

COMPUTER ATTITUDES referred to "an individual's feeling about the personal and societal use of computers in appropriate ways. Positive attitudes included an anxiety free willingness or desire to use the computer, confidence in one's ability to use the computer, and a sense of computer responsibility."

COMPUTER APPLICATIONS referred to "the ability to responsibly evaluate, select, and implement a variety of computer applications to do meaningful and efficient work based on an understanding of general types of applications,

capabilities and limitations of applications, and societal
impact of specific applications."
COMPUTER SYSTEMS referred to "the appropriate knowledgeable
use of equipment (hardware) and programs (software)
necessary for computer applications."
COMPUTER PROGRAMMING referred to "the ability to direct the
operation of the computer through the skillful use of
programming languages. This would require an understanding
of problem solving strategies, algorithms, flowcharts,
languages, and programming." This definition was used as
the basis for the development of the specific competencies
of the computer literate person, and for the construction
of test items to evaluate literacy (Simonson et al.; 1987,
234).

　　　Along with their work on a computer literacy test,
this group of researchers also developed a test of computer
anxiety. Others at Iowa State University had been working
on the development of a test to measure computer anxiety
for several years, and a computer anxiety test for teachers
developed by Rohner (Rohner 1981) was used as a model by
this group of researchers. Maurer and Simonson (Maurer and
Simonson, 1984) had reported that a person with computer
anxiety would exhibit the following behaviors: (1)
avoidance of computers, and the area where they were
located; (2) excessive caution when using computers;
(3) negative remarks toward computers and computing; and

(4) attempts to shorten periods when computers were being used. Thus, "computer anxiety was defined as the fear or apprehension felt by individuals when they used computers, or when they considered the possibility of computer utilization." This definition was the basis for the development of the Computer Anxiety Index (CAIN) (Simonson et al.; 1987, 238). The results of this research provided a much needed Standardized Test of Computer Literacy, as well as a Standardized Test of Computer Anxiety. The work of M. Simonson and his colleagues was very significant for this investigation, because the instrument developed by them for measuring computer anxiety, was used in this study.

Other researchers have also provided tests of computer literacy and computer anxiety, such as the Minnesota Computer Literacy and Awareness Assessment (MCLA) test (Anderson, Hansen, Johnson and Klassen, 1979) which was used as the computer literacy instrument in a study done by Mahmood and Mediwitz (Mahmood and Mediwitz 1989, 22). Their study was designed to investigate the effects of computer literacy on a person's attitudes, values, and opinions toward computers and information technology. It has generally been assumed that individuals who complete a computer literacy course will have a more positive attitude toward computers, and some studies have supported this idea (Munger and Loyd , 1989), while this particular research challenges that assumption. In this study, the researchers administered the test three times during the 16 week

semester to 100 business majors, and generated a rough classification of computer literacy stages that an individual progresses through in a computer literacy course. Those stages are:

> The Illiteracy Phase in which participants had no formal training in information technology and were not familiar with its benefits and applications;

> The Growth Phase in which subjects began to gain an understanding of how a computer works in a logical sense, and individuals started thinking about how some of their tasks can lend themselves to automation;

> The Maturity Phase in which the participants definitely knew what a computer could and could not do (Mahmood and Medewitz, 1989, 21).

The results indicated that an individual's attitudes, values, and opinions changed as they progressed through the stages of computer literacy, but those changes were very complex. In addition, "there is already controversy among curricula experts in the computer literacy area as to what to teach in a literacy course, and ... this research is perhaps adding more fuel to this controversy by suggesting that neither the awareness of what computers can do nor the knowledge of a programming language is sufficient enough to change subjects' attitudes toward computers" (Mahmood and Medewitz, 1989, 26).

The implications of the above study are important for all decision-makers in the field of education as well as in the business world. As computer technology continues to expand throughout the educational system, the number of students, teachers, counselors, and administrators interacting with computers increases at a mind-boggling

rate. It is safe to assume that at least some of these individuals suffer from computer anxiety, and may avoid interacting with computers if at all possible. Those in the business of educating others are especially interested in knowing which individuals suffer from computer anxiety, and how to help them overcome the handicap. Counselors can help if they have the means to do so, and an instrument has been developed for the purpose of identifying computer anxiety among students in Grades 4-8 (Campbell and Dobson 1987, 149). These researchers developed an 18 item computer anxiety screening test to be used with students in Grades 4-8. Their test is very limited, but it could be used by counselors to do initial screening of students. It is similar to many of the computer anxiety instruments developed and being used today which are very limited in their usefulness.

CHAPTER 3

METHOD OF PROCEDURE

Design of The Study

The study focused on determining learning gain and
computer anxiety levels for students in a computer class
using computer anxiety teaching methods as compared to
students in a class using traditional teaching methods.
Since the groups were not randomly formed, the research
design of the study was the nonequivalent control-group
design. The two groups consisted of students who enrolled
in the two classes for the spring semester 1992 at the
Henderson County Campus of Trinity Valley Community
College. The course was Computer Science 1312,
Fundamentals of Microcomputers, and the general
competencies of the course are:

1. The student will gain a knowledge of the basic
internal and external hardware of the microcomputer.

2. The student will gain a general knowledge of the
operation of the IBM and IBM compatible personal computers.

3. The student will gain a general knowledge of the
different peripheral devices available for a microcomputer.

4. The student will learn the technical terms and
definitions associated with the microcomputer.

27

5. The student will learn the basics of word processing, and be able to use a popular word processing package that is available commercially.

6. The student will learn the basics of electronic spreadsheets, and be able to use a popular electronic spreadsheet package that is available commercially.

7. The student will learn the basics of database management, and be able to use a popular database management package that is available commercially.

The control group was taught, using the traditional teaching methods. This method included the use of "user hostile" software consisting of WordPerfect, Lotus 1-2-3, and dBase IV. The experimental group was taught using anxiety reducing teaching methods. This method included the use of "user friendly" software consisting of the integrated software package PFS First Choice. The First Choice software package was used to teach the word processing, spreadsheet, and database skills. The following assumptions were made:

1. It was assumed that all participants would answer openly and accurately the questions on the test instrument.

2. It was assumed that participants involved in the study were representative of other students enrolled in other community colleges with similar programs, geographic locations, and student populations.

3. It was assumed that research data and conclusions were unaffected by uncontrolled data.

Population and Sample Selection

The population of this study was all students enrolled at the Henderson County Campus of Trinity Valley Community College during the spring semester 1992, which was about 1700 students. The sample selection was determined by who registered in each of the classes. During the first week of school, the students tend to change their schedules and do some changing from one class to another. After the first week, the experimental group consisted of 26 students, and strictly by coincidence the control group also had 26 students.

Consequently, the sample consisted of 26 students in each group to start the study. The students in both groups were aware that they were involved in the study.

Data Gathering

Once the groups were established, the students completed a pretest consisting of a computer anxiety test, and a standardized test of computer literacy. The instrument used in the study was a standardized test of computer literacy and computer anxiety index developed by Matthew Maurer and Michael R. Simonson at Iowa State University. The Standardized Test of Computer Literacy (STCL) consists of 80 questions broken down into three subtests. It is possible to use the entire STCL or any of the three subtests separately, or in any combination. The overall average reliability estimate for the STCL is .87 Simonson et al.; 1987, 241). The computer anxiety Index

(CAIN) consists of twenty-six questions that use a 6 point Likert-type scale. The test "was found to have an internal consistency reliability estimate of .94, and a test-retest reliability estimate of .90" (Simonson et al.; 1987, 245).

For the purposes of this study the Computer Anxiety Index (CAIN) was used to measure the computer anxiety level of the students. For measuring computer literacy, subtest one and subtest two from the Standardized Test of Computer Literacy (STL) were used. These two subtests measure computer systems and computer applications knowledge, while subtest three measures computer programming knowledge. Since computer programming is not one of the competencies for the computer science class involved in this study, subtest three was not used. At the end of the semester, both groups were administered a posttest consisting of the same CAIN test and STL test. Both groups were taught by the same instructor. Both the pretests and posttests were administered by the same instructor, and were hand scored using a key provided by the developer of the test instrument.

Data Treatment

After the collection of data, descriptive statistics for each group were computed. The mean change in computer anxiety level in the two groups was evaluated for each of the following classifications: (1) gender, (2) age group, (3) prior computer experience to determine if any significant differences exist. The pretest and posttest scores of the two groups for the same classifications as above were studied to determine if any significant differences in learning gain exist. Since the research design was a nonequivalent pretest/posttest design, the t test for independent groups was selected for data analysis. A statistical analysis software package, StatPac Gold, was used for the data analysis. The pretest/posttest scores of computer anxiety and computer literacy from both groups were analyzed to determine learning gain or loss, and the increase or decrease of computer anxiety levels.

The following hypotheses of this study were tested using the t test for independent groups with the significance level designated as .05. The null hypothesis was rejected if the probability of chance was .05 or less.

1. There is no significant difference between the computer anxiety level of students in a traditional introductory college level computer course, and students in an introductory college level computer course where anxiety reducing teaching methods are used.

2. There is no significant difference between the learning gain of students in a traditional introductory college level computer course, and students in an introductory college level computer course where anxiety reducing teaching methods are used.

CHAPTER 4

FINDINGS

<u>Analysis of Data</u>

The purpose of this study was to determine the comparative effectiveness of anxiety reducing teaching methods and traditional teaching methods in a college-level introductory computer science course. The study also attempted to determine any significant difference in learning gain between the two teaching methods. Fifty-two students at the Henderson County Campus of Trinity Valley Community College were in the two groups used in the study. The control group consisted of twenty-six students who enrolled in a Tuesday and Thursday introductory computer science class. The experimental group included twenty-six students who enrolled in a Monday, Wednesday, Friday introductory computer science class. The control group was taught using "user hostile" software consisting of Word Perfect, Lotus 1-2-3 and dBase IV. The experimental group was taught using "user friendly" software consisting of the integrated package PFS First Choice.

Fifteen comparisons were included in the study. Two of those were comparisons on the change in computer anxiety levels, and the learning gain. The other thirteen were comparisons of change in computer anxiety levels and

33

learning gain categorized by age level, gender, and prior
computer experience.

The raw data collected during the study were entered
into a spreadsheet (Appendices D & E). Data collected
included scores for each student on the pretest and
posttest on computer anxiety, and the pretest and posttest
on computer literacy. The data were analyzed using the
StatPac Gold Statistical Analysis Software. Fifteen $\underline{t}$
tests for independent groups were conducted. In each of
the tests, the group assignment was the independent
variable, and the dependent variable was either anxiety
change or learning gain. The StatPac Gold analysis
produced descriptive statistics which included the
Kolmogorov-Smirnov (K-S) statistic to determine the degree
of normality in the data. As the value of the K-S value
moves further away from zero, it indicates that the data
does not approximate a normal distribution. The
distribution is non-normal at the .05 level if the K-S
value is greater than .895. The StatPac Gold analysis
produced $\underline{t}$ test statistics which included the difference
between means of the control and experimental groups, the
standard error of the difference, a $\underline{t}$ statistic, degrees of
freedom, and probabilities of $\underline{t}$ for both one-tailed and
two-tailed tests. These figures are included in the tables
summarizing analysis results.

The $\underline{t}$ test for independent groups was selected to
analyze the data in this study primarily because of the

advantage it provides by allowing for testing the difference between samples with small numbers of cases. In addition, the t test procedure is robust even when underlying assumptions of normality of the distributions and homogeneity of variance are violated. The t distribution depends on the sample size, approaching normality as the sample size exceeds thirty. The significance level was set at .05 for this study.

Comparison of Computer Anxiety Teaching Methods Versus Traditional Teaching Methods

The first hypothesis for which this study was conducted was that there would be a significant difference between the change in the computer anxiety level of students in a traditional introductory computer science course, and students in an introductory college level computer course where anxiety reducing teaching methods were used. For the purpose of reporting data, this hypothesis will be referred to as hypothesis one. Results of the analysis for hypothesis one are summarized in Tables 2 through 11. In order to complete a thorough analysis of hypothesis one, the following objectives were accomplished:

1. compared the change in computer anxiety level of students after completion of the course categorized by age group;

2. compared the change in computer anxiety level of students after completion of the course categorized by gender;

3. compared the change in computer anxiety level of students after completion of the course categorized by prior computer experience;

4. compared the change in computer anxiety level of students between the control and experimental group.

In order to clarify the statistical analysis data for this hypothesis, it is necessary to examine the descriptive statistics contained in Tables 2 through 5. The information contained in these four tables is in the same form for each one. Table 2 contains descriptive statistics from the pretest scores on the computer anxiety test for the control group. The confidence interval calculated for the .05 significance level revealed that the lower limit of the control group score was 85.6772 and the upper limit was 91.5955 indicating that the true mean could be as low as 85.6772 or as high as 91.5955. The confidence interval was also calculated for the .01 significance level. The unbiased variance and standard deviation figures are calculated using the number of cases minus 1 in the denominator. In addition, the tables include skewness, kurtosis, and the Kolmogorov-Smirnov statistic for normality. The number of valid cases is shown as 22,

TABLE 2

DESCRIPTIVE STATISTICS FOR PRETEST SCORES

PRETEST SCORES ON THE ANXIETY TEST FOR
THE CONTROL GROUP

Pretest

Minimum	=	73
Maximum	=	100
Range	=	27
Sum	=	1950
Mean	=	88.6364
Median	=	88
Modes (Bimodal)	=	88 & 97
Variance	=	47.8678
Standard deviation	=	6.9187
Standard error of the mean	=	1.5098

95 Percent confidence interval around the mean =
85.6772 - 91.5955

99 Percent confidence interval around the mean =
84.7487 - 92.5240

Variance (unbiased)	=	50.1472
Standard deviation (unbiased)	=	7.0815
Skewness	=	-0.3135
Kurtosis	=	2.4249

Kolmogorov-Smirnov statistic for normality = 0.6774

Valid cases	=	22
Missing cases	=	0
Response percent	=	100.0 %

TABLE 3

DESCRIPTIVE STATISTICS FOR POSTTEST SCORES

POSTTEST SCORES ON THE ANXIETY TEST FOR
THE CONTROL GROUP

<u>Posttest</u>

Minimum   =   77

Maximum   =   108

Range   =   31

Sum   =   1986

Mean   =   90.2727

Median   =   89

Modes   =   86

Variance   =   48.3802

Standard deviation   =   6.9556

Standard error of the mean   =   1.5178

95 Percent confidence interval around the mean =
87.2978 - 93.2477

99 Percent confidence interval around the mean =
86.3643 - 94.1811

Variance (unbiased)   =   50.6840

Standard deviation (unbiased) =   7.1193

Skewness   =   0.4358

Kurtosis   =   3.1805

Kolmogorov-Smirnov statistic for normality = 0.5739

Valid cases   =   22
Missing cases   =   0
Response percent   =   100.0 %

because four students dropped out of the original group of 26 that started the semester. Comparing the information in Table 2 with that of Table 3 shows that the mean score on the anxiety test for the control group changed from pretest to posttest. They went up, indicating an increase in computer anxiety level as measured by the (CAIN) test. It did not increase by much (1.6363) but it did increase. Upon examination of Tables 4 and 5 it can be seen that pretest/posttest scores on the anxiety test for the experimental group indicates the computer anxiety level of that group also went up. The score for the experimental group increased by only about half as much (.08261) as the control group.

In addition, the pretest and posttest scores for both the experimental and the control groups were higher than the average scores reported by Michael Simonson on the normative data (Somonson et al. 1984, 48). The mean scores for the control group and the experimental group were both in the 88 to 90 range, while the average college student score reported by Simonson was 62.33. The $\underline{t}$ test for independent groups was used to determine if the experimental group's change in computer anxiety was significantly different from the control group's. In order to thoroughly analyze the data for testing hypothesis one, eight separate $\underline{t}$ tests were used.

TABLE 4

DESCRIPTIVE STATISTICS FOR PRETEST SCORES

PRETEST SCORES ON THE ANXIETY TEST FOR
THE EXPERIMENTAL GROUP

Pretest

Minimum	=	73
Maximum	=	107
Range	=	34
Sum	=	2071
Mean	=	90.0435
Median	=	90
Modes (Bimodal)	=	83 & 93
Variance	=	61.3459
Standard deviation	=	7.8324
Standard error of the mean	=	1.6699

95 Percent confidence interval around the mean =
86.7705 - 93.3164

99 Percent confidence interval around the mean =
85.7436 - 94.3434

Variance (unbiased)	=	64.1344
Standard deviation (unbiased)	=	8.0084
Skewness	=	0.0850
Kurtosis	=	2.7405

Kolmogorov-Smirnov statistic for normality = 0.4568

Valid cases	=	23
Missing cases	=	0
Response percent	=	100.0 %

TABLE 5

DESCRIPTIVE STATISTICS FOR POSTTEST SCORES

POSTTEST SCORES ON THE ANXIETY TEST FOR
THE EXPERIMENTAL GROUP

<u>Posttest</u>

Minimum	=	72
Maximum	=	105
Range	=	33
Sum	=	2090
Mean	=	90.8696
Median	=	91
Modes	=	92
Variance	=	58.6352
Standard deviation	=	7.6547
Standard error of the mean	=	1.6326

95 Percent confidence interval around the mean =
87.6698 - 94.0694

99 Percent confidence interval around the mean =
86.6657 - 95.0734

Variance (unbiased)	=	61.3004
Standard deviation (unbiased)	=	7.8295
Skewness	=	-0.3077
Kurtosis	=	3.2836

Kolmogorov-Smirnov statistic for normality = 0.6430

Valid cases	=	23
Missing cases	=	0
Response percent	=	100.0 %

The data were broken down into subsets based on (1) age group, (2) gender, (3) prior computer experience, and t tests were conducted on each of the subsets of data to determine if any significant differences existed in the change in computer anxiety scores using the above three variables to group them. This provided the information to determine if any significant differences in the change in anxiety scores existed between the two groups based on age group, gender, or prior computer experience. The results of the t test analysis based on those three variables are summarized in Tables 6 through 12.

The t test analysis of change in computer anxiety scores based on age group are shown in Tables 6 and 7. The figures in Table 6 are for the age group 17-22. There were 13 students within this age range in the experimental group, and 10 in the traditional group. The difference in the means was -0.6769 and the t statistic was 0.2018. The probability of t (two-tailed test) was 0.8420 indicating no difference between the two groups which was statistically significant at the .05 level.

Table 7 contains summary data from the t test analysis of change in computer anxiety scores for students in the age group 23 and over. There were 10 students within this age range in the experimental group, and 12 in the traditional group. The difference in the means was -0.5000 and the t statistic was 0.1913. The probability

TABLE 6

CHANGE IN COMPUTER ANXIETY SCORES BY AGE GROUP

T-TEST ANALYSIS OF CHANGE IN COMPUTER ANXIETY
FOR AGES 17-22

Variable under analysis - FROM PRE TO POST
Variable used to group cases - Study Group Student Is In

Group 1   1
1 = Experimental Group

Mean	=	-0.0769
Variance	=	82.5769
Standard deviation	=	9.0872
Standard error of the mean	=	2.5203

Group 2   2
2 = Traditional Group

Mean	=	0.6000
Variance	=	38.2667
Standard deviation	=	6.1860
Standard error of the mean	=	1.9562

T-Test Statistics

Difference (Mean X - Mean Y)	=	-0.6769
Standard error of the difference	=	3.3541
T-statistic	=	0.2018
Degrees of freedom	=	21
Probability of t (One tailed test)	=	0.4210
Probability of t (Two tailed test)	=	0.8420

TABLE 7

CHANGE IN COMPUTER ANXIETY SCORES BY AGE GROUP

T-TEST ANALYSIS OF CHANGE IN COMPUTER ANXIETY
FOR AGES 23 AND OVER

Variable under analysis - FROM PRE TO POST
Variable used to group cases - Study Group Student Is In

Group 1   1
1 = Experimental Group

Mean	=	2.0000
Variance	=	11.3333
Standard deviation	=	3.3665
Standard error of the mean	=	1.0646

Group 2   2
2 = Traditional Group

Mean	=	2.5000
Variance	=	58.4545
Standard deviation	=	7.6456
Standard error of the mean	=	2.2071

T-Test Statistics

Difference (Mean X - Mean Y)	=	-0.5000
Standard error of the difference	=	2.6133
T-statistic	=	0.1913
Degrees of freedom	=	20
Probability of t (One tailed test)	=	0.4251
Probability of t (Two tailed test)	=	0.8502

of t (two-tailed test) was 0.8502 indicating no difference between the two groups which was statistically significant at the .05 level. The summary data from the t test analysis of change in computer anxiety scores for students with no prior computer experience are shown in Table 8. For the purpose of this analysis the prior computer experience classification levels were collapsed. The prior computer experience variable used a classification based on 45 hour increments. The 45 hour increments were used because they could be loosely equated to a 3 semester hour college course in computer science. The data used in this study came from the student's own estimate of the number of hours experience on a computer, and this did not necessarily mean the student had completed a formal computer science class. For the purposes of this t test analysis group 0 (no prior experience) was used to obtain the figures in Table 8, while the experience classification levels were collapsed to obtain the figures in Table 9 (students with prior computer experience). The figures in Table 8 are for those students with no prior computer experience. There were 11 students who had no prior computer experience, in the experimental group, and 9 in the traditional group. The difference in the means was -0.8182 and the t statistic was 0.2971. The probability of t (two-tailed test) was 0.7698 indicating no difference between the two groups which was significant at the .05

TABLE 8

CHANGE IN COMPUTER ANXIETY SCORES
BY PRIOR COMPUTER EXPERIENCE

T-TEST ANALYSIS OF GROUP 1 AND 2
OF STUDENTS WITH NO EXPERIENCE

Variable under analysis - FROM PRE TO POST
Variable used to group cases - Study Group Student Is In

Group 1   1
1 = Experimental Group

Mean	=	3.1818
Variance	=	52.5636
Standard deviation	=	7.2501
Standard error of the mean	=	2.1860

Group 2   2
2 = Traditional Group

Mean	=	4.0000
Variance	=	18.7500
Standard deviation	=	4.3301
Standard error of the mean	=	1.4434

T-Test Statistics

Difference (Mean X - Mean Y)	=	-0.8182
Standard error of the difference	=	2.7537
T-statistic	=	0.2971
Degrees of freedom	=	18
Probability of t (One tailed test)	=	0.3849
Probability of t (Two tailed test)	=	0.7698

TABLE 9

CHANGE IN COMPUTER ANXIETY SCORES BY
PRIOR COMPUTER EXPERIENCE

T-TEST ANALYSIS OF GROUP 1 AND 2
OF STUDENTS WITH EXPERIENCE

Variable under analysis - FROM PRE TO POST
Variable used to group cases - Study Group Student Is In

Group 1   1
1 = Experimental Group

Mean	=	-1.3333
Variance	=	43.1515
Standard deviation	=	6.5690
Standard error of the mean	=	1.8963

Group 2   2
2 = Traditional Group

Mean	=	0.0000
Variance	=	64.3333
Standard deviation	=	8.0208
Standard error of the mean	=	2.2246

T-Test Statistics

Difference (Mean X - Mean Y)	=	-1.3333
Standard error of the difference	=	2.9473
T-statistic	=	0.4524
Degrees of freedom	=	23
Probability of t (One tailed test)	=	0.3276
Probability of t (Two tailed test)	=	0.6552

level. The figures in Table 9 (students with prior
computer experience) show the difference in the means was
-1.3333 and the t statistics was 0.4524. The probability
of t (two-tailed test) was 0.6552 indicating no difference
between the two groups which was significant at the .05
level. It is interesting to note that comparison of data
in Tables 8 and 9 show that the change in computer anxiety
scores for students with no experience increased in both
the experimental group and the traditional group (Table
8). At the same time the change in computer anxiety scores
for students with prior computer experience decreased for
students in the experimental group and remained about the
same for the traditional group (Table 9).

An additional t test was conducted to investigate
further the possible connection between change in computer
anxiety scores and the amount of prior computer
experience. This test was conducted comparing the change
in computer anxiety scores with hours of prior computer
experience regardless of whether the student was in the
control or the experimental group. The results of this t
test are shown in Table 10. This test compared the change
in computer anxiety scores for students with no prior
computer experience to those with computer experience up to
225 hours. This caused all the students in both study
groups to be included in the analysis. The data from the

TABLE 10

CHANGE IN COMPUTER ANXIETY SCORES BY
PRIOR COMPUTER EXPERIENCE

T-TEST ANALYSIS OF NO EXPERIENCE COMPARED
TO SOME EXPERIENCE TO 225 HOURS

Variable under analysis - FROM PRE TO POST
Variable used to group cases - by 45 hour increments

Group 1   0
0 = Zero Hours

Mean	=	3.5500
Variance	=	35.7342
Standard deviation	=	5.9778
Standard error of the mean	=	1.3367

Group 2   1
1 = Some Hours

Mean	=	-0.6400
Variance	=	52.4067
Standard deviation	=	7.2392
Standard error of the mean	=	1.4478

T-Test Statistics

Difference (Mean X - Mean Y)	=	4.1900
Standard error of the difference	=	2.0134
T-statistic	=	2.0811
Degrees of freedom	=	43
Probability of t (One tailed test)	=	0.0217
Probability of t (Two tailed test)	=	0.0434

t test (Table 10) show that the difference between the
means was 4.1900 and the t statistic was 2.0811. The
probability of t (two-tailed test) was 0.0434 indicating a
difference between the groups which was significant at the
.05 level. The mean anxiety level of those students with
no prior computer experience went up while the mean anxiety
level of those with some prior computer experience went
down.

The next t test analysis done between the control and
experimental group was the test for the change in computer
anxiety scores of male and female students. These results
can be seen in Tables 11 and 12. The data in Table 11 are
for male students. There were 10 males in the experimental
group, and 10 in the traditional group. The means was
-1.7000 and the t statistic was 0.6671. The probability of
t (two-tailed test) was 0.5132 indicating no difference
between the two groups which was statistically significant
at the .05 level. Table 12 represents the data for female
students. Thirteen 13 female students were in the
experimental group and 12 were in the traditional group.
The difference in the means was -0.1410 and the t statistic
was 0.0434. The probability of t (two-tailed test) was
0.9656 indicating no difference between the two groups
which was statistically significant at the .05 level.

While there was a statistically significant difference

TABLE 11

CHANGE IN COMPUTER ANXIETY
SCORES BY GENDER

T-TEST ANALYSIS OF GROUP 1 AND 2
OF MALE STUDENTS

Variable under analysis - FROM PRE TO POST
Variable used to group cases - Study Group Student Is In

Group 1   1
1 = Experimental Group

Mean	=	-0.3000
Variance	=	43.1222
Standard deviation	=	6.5668
Standard error of the mean	=	2.0766

Group 2   2
2 = Traditional Group

Mean	=	1.4000
Variance	=	21.8222
Standard deviation	=	4.6714
Standard error of the mean	=	1.4772

T-Test Statistics

Difference (Mean X - Mean Y)	=	-1.7000
Standard error of the difference	=	2.5484
T-statistic	=	0.6671
Degrees of freedom	=	18
Probability of t (One tailed test)	=	0.2566
Probability of t (Two tailed test)	=	0.5132

TABLE 12

CHANGE IN COMPUTER ANXIETY SCORES
BY GENDER

T-TEST ANALYSIS OF GROUP 1 AND 2
OF FEMALE STUDENTS

Variable under analysis - FROM PRE TO POST
Variable used to group cases - Study Group Student Is In

Group 1   1
1 = Experimental Group

Mean	=	1.6923
Variance	=	58.8974
Standard deviation	=	7.6745
Standard error of the mean	=	2.1285

Group 2   2
2 = Traditional Group

Mean	=	1.8333
Variance	=	73.6061
Standard deviation	=	8.5794
Standard error of the mean	=	2.4767

T-Test Statistics

Difference (Mean X - Mean Y)	=	-0.1410
Standard error of the difference	=	3.2505
T-statistic	=	0.0434
Degrees of freedom	=	23
Probability of t (One tailed test)	=	0.4829
Probability of t (Two tailed test)	=	0.9658

in the change in computer anxiety scores based on prior
computer experience regardless of study group assigned to,
no such difference was indicated by the t test analysis of
the scores of the control group versus the experimental
group. The data from the t test analysis of change in
computer anxiety scores of these two groups are shown in
Table 13. The experimental group had 23 students and the
traditional (control) group had 22 students. Both groups
had 26 students when the study began, but three students
dropped out of the experimental group and four dropped out
of the traditional group before the end of the semester.
The difference in the group means was -0.8103 and the t
statistic was 0.3866. The probability of t (two-tailed
test) was 0.7010 indicating that there was no difference
between the control and treatment groups which was
statistically significant at the .05 level. Consequently,
the null hypothesis was retained for hypothesis one.

The second hypothesis for which this study was
conducted was that there would be a significant difference
between the learning gain of students in a traditional
introductory college level computer course, and students in
an introductory college level computer course where anxiety
reducing teaching methods were used. For the purpose of
reporting data, this hypothesis will be referred to as
hypothesis two. Results of the analysis for hypothesis two
are summarized in Tables 14 through 24. In order to

TABLE 13

CHANGE IN COMPUTER ANXIETY
SCORES BY GROUP

T-TEST ANALYSIS OF CHANGE IN COMPUTER
ANXIETY SCORES BY GROUP

Variable under analysis - FROM PRE TO POST
Variable used to group cases - Study Group Student Is In

Group 1   1
1 = Experimental Group

Mean	=	0.8261
Variance	=	50.7866
Standard deviation	=	7.1265
Standard error of the mean	=	1.4860

Group 2   2
2 = Traditional Group

Mean	=	1.6364
Variance	=	47.9567
Standard deviation	=	6.9251
Standard error of the mean	=	1.4764

T-Test Statistics

Difference (Mean X - Mean Y)	=	-0.8103
Standard error of the difference	=	2.0961
T-statistic	=	0.3866
Degrees of freedom	=	43
Probability of t (One tailed test)	=	0.3505
Probability of t (Two tailed test)	=	0.7010

complete a thorough analysis of hypothesis two, the
following objectives were accomplished:

1. compared the learning gain of students after
completion of the course categorized by age group;

2. compared the learning gain of students after
completion of the course categorized by gender;

3. compared the learning gain of students after
completion of the course categorized by prior computer
experience;

4. compared the learning gain of students after
completion of the course categorized by group.

Tables 14 through 17 contain descriptive statistics
from the computer literacy tests on the control group and
the experimental group. Table 14 shows the pretest scores
on the computer literacy test for the control group. The
control group consisted of 22 students whose scores ranged
from 11 to 38 with a mean of 24.6818. The confidence
interval calculated for the .05 significance level revealed
that the lower limit of the control group score was 21.5590
and the upper limit could be as high as 27.8046 indicating
that the true mean could fall at either of these extremes
or anywhere in between them. The confidence level was also
calculated for the .01 significance level. If a comparison
is made between the pretest scores (Table 14) and the
posttest scores (Table 15) on the computer literacy test
for the control group it can be seen that the maximum and

TABLE 14

DESCRIPTIVE STATISTICS FOR PRETEST SCORES
PRETEST SCORES ON THE COMPUTER LITERACY TEST
THE CONTROL GROUP

<u>Posttest</u>

Minimum	=	11
Maximum	=	38
Range	=	27
Sum	=	543
Mean	=	24.6818
Median	=	24
Modes (Bimodal)	=	16
Variance	=	53.3079
Standard deviation	=	7.3012
Standard error of the mean	=	1.5933

95 Percent confidence interval around the mean =
        21.5590 - 27.8046

99 Percent confidence interval around the mean =
        20.5792 - 28.7845

Variance (unbiased)	=	55.8463
Standard deviation (unbiased)	=	7.4730
Skewness	=	0.0389
Kurtosis	=	2.0192

Kolmogorov-Smirnov statistic for normality = 0.5352

Valid cases	=	22
Missing cases	=	0
Response percent	=	100.0 %

TABLE 15

DESCRIPTIVE STATISTICS FOR POSTTEST SCORES

POSTTEST SCORES ON THE COMPUTER LITERACY TEST
FOR THE CONTROL GROUP

<u>Posttest</u>

Minimum	=	13
Maximum	=	38
Range	=	25
Sum	=	551
Mean	=	25.0455
Median	=	23
Modes (Bimodal)	=	23 & 29
Variance	=	51.6798
Standard deviation	=	7.1889
Standard error of the mean	=	1.5687

95 Percent confidence interval around the mean =
            21.9707 - 28.1202

99 Percent confidence interval around the mean =
            21.0060 - 29.0850

Variance (unbiased)	=	54.1407
Standard deviation (unbiased)	=	7.3580
Skewness	=	-0.1686
Kurtosis	=	2.0105

Kolmogorov-Smirnov statistic for normality = 0.7944

Valid cases	=	22
Missing cases	=	0
Response percent	=	100.0 %

minimum scores were very close to the same on both tests.
In fact there was very little difference between the
pretest and posttest on computer literacy for the control
group except for the skewness of the distributions. Note
that the distribution for the pretest was positively skewed
while the posttest distribution was negatively skewed.

Tables 16 and 17 contain descriptive statistics from
the computer literacy tests on the experimental group.
Comparison of these two tables reveal some interesting
figures. The first figures that just "jump out at you" are
the minimum of 13 on the pretest and the minimum of 4 on
the posttest. The second set of figures that "stood out"
were those for the confidence interval around the means.
The confidence interval around the mean calculated
for the .05 significance level of the pretest (Table 16)
was 19.0501 to 24.4282. The confidence interval around the
mean calculated for the .05 significance level of the
posttest (Table 17) was 16.7346 to 22.5698. These figures,
along with the means of the two test scores show that the
scores on the computer literacy test went down over the
course of the semester for the experimental group. One
other item also should be noted on Tables 16 and 17. The
Kolmogorov-Smirnov statistic for normality is high enough
on both the pretest and the posttest to indicate that the
data on both do not approximate a normal distribution. The
distribution is non-normal at the .05 level of significance

TABLE 16

DESCRIPTIVE STATISTICS FOR PRETEST SCORES

PRETEST SCORES ON THE COMPUTER LITERACY TEST
FOR THE EXPERIMENTAL GROUP

<u>Pretest</u>

Minimum	=	13
Maximum	=	33
Range	=	20
Sum	=	500
Mean	=	21.7391
Median	=	19
Modes	=	19
Variance	=	41.4102
Standard deviation	=	6.4351
Standard error of the mean	=	1.3720

95 Percent confidence interval around the mean =
19.0501 - 24.4282

99 Percent confidence interval around the mean =
18.2063 - 25.2719

Variance (unbiased)	=	43.2925
Standard deviation (unbiased)	=	6.5797
Skewness	=	0.4056
Kurtosis	=	1.8177

Kolmogorov-Smirnov statistic for normality = 0.9259

Valid cases	=	23
Missing cases	=	0
Response percent	=	100.0 %

TABLE 17

DESCRIPTIVE STATISTICS FOR POSTTEST SCORES

POSTTEST SCORES ON THE COMPUTER LITERACY TEST
FOR THE EXPERIMENTAL GROUP

<u>Posttest</u>

Minimum	=	4
Maximum	=	33
Range	=	29
Sum	=	452
Mean	=	19.6522
Median	=	18
Modes	=	13
Variance	=	48.7486
Standard deviation	=	6.9820
Standard error of the mean	=	1.4886

95 Percent confidence interval around the mean =
16.7346 - 22.5698

99 Percent confidence interval around the mean =
15.8191 - 23.4852

Variance (unbiased)   =   50.9644

Standard deviation (unbiased)   =   7.1389

Skewness   =   0.1991

Kurtosis   =   2.7273

Kolmogorov-Smirnov statistic for normality   =   0.9400

Valid cases   =   23
Missing cases   =   0
Response percent   =   100.0 %

if the K-S statistic is greater than 0.895. The K-S value
for the pretest was 0.9259, and for the posttest it was
0.9400. It will be important to keep these figures in mind
when drawing conclusions from the data.

If a comparison is made between the computer literacy
test scores for the experimental group (Tables 16 and 17)
and the computer literacy test scores for the control group
(Tables 14 and 15) it can be seen that the mean score of
the experimental group went down over the course of the
semester, while the mean score of the control group went
up. Interesting, even though it was not statistically
significant. Also, both the pretest and posttest scores
from the experimental and the control groups were below the
average scores for undergraduate students reported by
Michael Simonson on the normative data (Simonson et al.,
1984, 48). Simonson's average score for undergraduate
students was 37.23. The average scores for the control
group and the experimental group in this study were in the
20 to 25 range. In order to thoroughly analyze the data
for testing hypothesis two, seven separate t tests were
used. The data were broken down into subsets based on (1)
age group, (2) gender, (3) prior computer experience, and t
tests were conducted on each of the subsets of data to
determine if any significant differences existed if the
differences in computer literacy scores from pretest to
posttest were considered using the above three variables to
group them. This provided the information to determine if

any significant differences in the change in computer literacy scores existed, based on age group, gender, or prior computer experience, between the control and experimental groups. The results of the t test analysis based on those three variables are summarized in Tables 18 through 24.

The t test analysis of change in computer literacy scores based on age group is shown in Tables 18 and 19. The figures in Table 18 are for the age group of 17-22. There were 13 students within this age range in the experimental group and 10 in the traditional group. The difference in the means was -4.5000 and the t statistic was 1.6301. The probability of t (two-tailed test) was 0.1180 indicating no difference between the groups which was significant at the .05 level. Table 19 represents data for the age group of 23 and older. There were 10 students within this age range in the experimental group and 12 in the traditional group. The difference in the means was -0.6500 and the t statistic was 0.3021. The probability of t (two-tailed test) was 0.7657 indicating no difference between the groups which was significant at the .05 level.

The data for the t test analysis of change in

TABLE 18

CHANGE IN COMPUTER LITERACY SCORES
BY AGE GROUP

T-TEST ANALYSIS OF CHANGE IN COMPUTER LITERACY
FOR AGES 17-22

Variable under analysis - FROM PRE TO POST
Variable used to group cases - Study Group Student Is In

Group 1   1
1 = Experimental Group

Mean	=	-3.0000
Variance	=	23.1667
Standard deviation	=	4.8132
Standard error of the mean	=	1.3349

Group 2   2
2 = Traditional Group

Mean	=	1.5000
Variance	=	69.6111
Standard deviation	=	8.3433
Standard error of the mean	=	2.6384

T-Test Statistics

Difference (Mean X - Mean Y)	=	-4.5000
Standard error of the difference	=	2.7605
T-statistic	=	1.6301
Degrees of freedom	=	21
Probability of t (One tailed test)	=	0.0590
Probability of t (Two tailed test)	=	0.1180

TABLE 19

CHANGE IN COMPUTER LITERACY
SCORES BY AGE GROUP

*T-TEST ANALYSIS OF CHANGE IN COMPUTER
LITERACY FOR AGES 23 AND OVER*

Variable under analysis - FROM PRE TO POST
Variable used to group cases - Study Group Student Is In

Group 1   1
1 = Experimental Group

Mean	=	-0.9000
Variance	=	13.8778
Standard deviation	=	3.7253
Standard error of the mean	=	1.1780

Group 2   2
2 = Traditional Group

Mean	=	-0.2500
Variance	=	34.5682
Standard deviation	=	5.8795
Standard error of the mean	=	1.6973

T-Test Statistics

Difference (Mean X - Mean Y)	=	-0.6500
Standard error of the difference	=	2.1519
T-statistic	=	0.3021
Degrees of freedom	=	20
Probability of t (One tailed test)	=	0.3829
Probability of t (Two tailed test)	=	0.7657

computer literacy scores by gender are shown in Tables 20 and 21. Table 20 represents data for male students. There were 10 males in the experimental group and 10 in the traditional group. The difference between the means was -4.6000 and the t statistic was 1.3562. The probability of t (two-tailed test) was 0.1918 indicating no difference between the two groups which was statistically significant at the .05 level. It is worthwhile to note that computer literacy scores for the experimental group went down, but the scores went up for the traditional group. Table 21 represents data for female students. There were 13 females in the experimental group and 12 in the traditional group. The difference in the means was -1.0833 and the t statistic was 0.6703. The probability of t (two-tailed test) was 0.5094 indicating no difference between the two groups which was statistically significant at the .05 level.

Tables 22 and 23 contain data from the t test analysis of the change in computer literacy scores of students classified by prior computer experience. For the purpose of this t test analysis the levels of prior computer experience were collapsed to show students with experience up to 225 hours (Table 22) and students with no prior computer experience (Table 23). Thirteen students with prior computer experience up to 225 hours were in the experimental group and 12 were in the traditional group.

TABLE 20

CHANGE IN COMPUTER LITERACY
SCORES BY GENDER

T-TEST ANALYSIS OF GROUP 1 AND 2
OF MALE STUDENTS

Variable under analysis - FROM PRE TO POST
Variable used to group cases - Study Group Student Is In

Group 1   1
1 = Experimental Group

Mean	=	-3.5000
Variance	=	28.5000
Standard deviation	=	5.3385
Standard error of the mean	=	1.6882

Group 2   2
2 = Traditional Hours

Mean	=	1.1000
Variance	=	86.5444
Standard deviation	=	9.3029
Standard error of the mean	=	2.9418

T-Test Statistics

Difference (Mean X - Mean Y)	=	-4.6000
Standard error of the difference	=	3.3918
T-statistic	=	1.3562
Degrees of freedom	=	18
Probability of t (One tailed test)	=	0.0959
Probability of t (Two tailed test)	=	0.1918

TABLE 21

CHANGE IN COMPUTER LITERACY
SCORES BY GENDER

T-TEST ANALYSIS OF GROUP 1 AND 2
OF FEMALE STUDENTS

Variable under analysis - FROM PRE TO POST
Variable used to group cases - Study Group Student Is In

Group 1   1
1 = Experimental Group

Mean	=	-1.0000
Variance	=	11.3333
Standard deviation	=	3.3665
Standard error of the mean	=	0.9337

Group 2   2
2 = Traditional Hours

Mean	=	0.0833
Variance	=	21.7197
Standard deviation	=	4.6604
Standard error of the mean	=	1.3454

T-Test Statistics

Difference (Mean X - Mean Y)	=	-1.0833
Standard error of the difference	=	1.6163
T-statistic	=	0.6703
Degrees of freedom	=	23
Probability of t (One tailed test)	=	0.2547
Probability of t (Two tailed test)	=	0.5094

TABLE 22

CHANGE IN COMPUTER LITERACY SCORES
BY PRIOR COMPUTER EXPERIENCE

T-TEST ANALYSIS OF GROUP 1 AND 2 OF STUDENTS
WITH EXPERIENCE TO 225 HOURS

Variable under analysis - FROM PRE TO POST
Variable used to group cases - Study Group Student Is In

Group 1   1
1 = Experimental Group

Mean	=	-2.9167
Variance	=	20.2652
Standard deviation	=	4.5017
Standard error of the mean	=	1.2995

Group 2   2
2 = Traditional Group

Mean	=	0.4615
Variance	=	81.6026
Standard deviation	=	9.0334
Standard error of the mean	=	2.5054

T-Test Statistics

Difference (Mean X - Mean Y)	=	-3.3782
Standard error of the difference	=	2.8942
T-statistic	=	1.1672
Degrees of freedom	=	23
Probability of t (One tailed test)	=	0.1275
Probability of t (Two tailed test)	=	0.2551

The difference in the means was -3.3782 and the t statistic was 1.1672. The probability of t (two-tailed test) was 0.2551 indicating no difference between the two groups which was significant at the .05 level. Table 23 represents data for students with no prior computer experience. There were 11 students with no prior computer experience in the experimental group and 9 in the traditional group. The difference in the means was -1.8485 and the t statistic was 1.1464. The probability of t (two-tailed test) was 0.2666 indicating no difference between the groups which was statistically significant at the .05 level.

Table 24 contains a summary of the results of the t test analysis of the change in the computer literacy scores between the experimental group and the control group. There were 23 students in the experimental group and 22 were in the traditional (control) group. The difference in the means was -2.6324 and the t statistic was 1.5194. The probability of t (two-tailed test) was 0.1360 indicating no difference between the two groups which was statistically significant at the .05 level. Consequently, the null hypothesis was retained for hypothesis two.

TABLE 23

CHANGE IN COMPUTER LITERACY SCORES BY
PRIOR COMPUTER EXPERIENCE

T-TEST ANALYSIS OF GROUP 1 AND 2 STUDENTS
WITH NO EXPERIENCE

Variable under analysis - FROM PRE TO POST
Variable used to group cases - Study Group Student Is In

Group 1   1
1 = Experimental Group

Mean	=	-1.1818
Variance	=	18.7636
Standard deviation	=	4.3317
Standard error of the mean	=	1.3061

Group 2   2
2 = Traditional Group

Mean	=	0.6667
Variance	=	5.5000
Standard deviation	=	2.3452
Standard error of the mean	=	0.7817

T-Test Statistics

Difference (Mean X - Mean Y)	=	-1.8485
Standard error of the difference	=	1.6124
T-statistic	=	1.1464
Degrees of freedom	=	18
Probability of t (One tailed test)	=	0.1333
Probability of t (Two tailed test)	=	0.2666

TABLE 24

CHANGE IN COMPUTER LITERACY SCORES
BY GROUP

T-TEST ANALYSIS OF CHANGE IN COMPUTER LITERACY
SCORES BY GROUP

Variable under analysis - FROM PRE TO POST
Variable used to group cases - Study Group Student Is In

Group 1   1
1 = Experimental Group

Mean	=	-2.0870
Variance	=	19.4466
Standard deviation	=	4.4098
Standard error of the mean	=	0.9195

Group 2   2
2 = Traditional Group

Mean	=	0.5455
Variance	=	48.7359
Standard deviation	=	6.9811
Standard error of the mean	=	1.4884

T-Test Statistics

Difference (Mean X - Mean Y)	=	-2.6324
Standard error of the difference	=	1.7325
T-statistic	=	1.5194
Degrees of freedom	=	43
Probability of t (One tailed test)	=	0.0680
Probability of t (Two tailed test)	=	0.1360

CHAPTER 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

This study was conducted to determine if the use of
anxiety reducing teaching methods would significantly
decrease the anxiety level of students in a college level
introductory computer science course as compared to the use
of traditional teaching methods. The study also attempted
to determine if the use of computer anxiety teaching
methods would significantly increase the learning gain of
the students as compared to the use of traditional teaching
methods.

The study included a total of 45 students who were
attending the Henderson County campus of Trinity Valley
Community College during the 1992 spring semester. Since
the groups were not randomly formed, the research design
was the non-equivalent control group design. Twenty-three
students were in the control group and twenty-two were in
the experimental group. Both groups were taking an
introductory level computer science course. Those students
in the experimental group were taught using anxiety
reducing teaching methods which included the use of "user
friendly" software consisting of the integrated software
package PFS First Choice. The control group was taught

72

using traditional teaching methods which included the use of "user hostile" software consisting of WordPerfect 5.1, Lotus 1-2-3 version 2.2 and dBase IV version 1.1. The students in both groups were administered a pretest and a posttest to measure computer anxiety levels before and after completion of the course. Both groups were also administered a pretest and a posttest to measure computer literacy before and after completion of the course. The tests used were the Standardized Test of Computer Literacy (STCL) and Computer Anxiety Index (CAIN) developed by Michael R. Simonson and associates at Iowa State University. The pretest and posttest scores were studied to determine learning gain and change in computer anxiety levels of the two groups. The data from the tests were collected, organized into a spreadsheet and prepared for analysis. The statistical analysis was done using the StatPac Gold Statistical Analysis Package for the IBM computer. The null hypothesis was developed and tested for the following research hypotheses:

1. students in an introductory college level computer science class using computer anxiety reducing teaching methods show a greater reduction in computer anxiety levels than students in an introductory college level computer science class using traditional teaching methods;

2. students in an introductory college level computer science class using computer anxiety reducing teaching methods show a greater learning gain than students in an

introductory college level computer science class using traditional teaching methods. The data were analyzed using the t test for independent groups with the significance level set at the .05 level. The null hypothesis was retained when the probability of t was .05 or greater. Conversely, the null hypothesis was rejected when the probability of t was less than .05.

The results of the data analysis for hypothesis one are presented in the following discussion. Eight separate t tests were used for the analysis of data for hypothesis one. The t tests were conducted on the data to determine if any significant differences in change in computer anxiety scores existed between males and females in the study, between age groups (17-22 and 23 and over), or between students who had no prior computer experience and students with prior computer experience. A t test was also conducted to determine if any significant difference in change in computer anxiety scores existed between the total students in the experimental and control groups. In summary, the results of the t test analysis for hypothesis one were:

1. the probability of t for the change in computer anxiety scores between the experimental and control groups was 0.7010 (Table 13) which justified retention of the null hypothesis;

2. the probability of t for the change in computer anxiety scores between the control group and the

experimental group for students ages 17-22 was 0.8420
(Table 6) which justified retention of the null hypothesis;

3. the probability of $\underline{t}$ for the change in computer
anxiety scores between the control group and the
experimental group for students ages 23 and over was 0.8502
(Table 7) which justified retention of the null hypothesis;

4. the probability of $\underline{t}$ for the change in computer
anxiety scores between the control group and the
experimental group for students with no prior computer
experience was 0.7698 (Table 8) which justified retention
of the null hypothesis;

5. the probability of $\underline{t}$ for the change in computer
anxiety scores between the control group and the
experimental group for students with prior computer
experience up to 225 hours was 0.6552 (Table 9) which
justified retention of the null hypothesis;

6. the probability of $\underline{t}$ for the change in computer
anxiety scores between the control group and the
experimental group for male students was 0.5132 (Table 11)
which justified retention of the null hypothesis;

7. the probability of $\underline{t}$ for the change in computer
anxiety scores between the control group and the
experimental group for female students was 0.9658 (Table
12) which justified retention of the null hypothesis.

The seven $\underline{t}$ tests listed above to check for
statistically significant differences in the change in
computer anxiety scores between the control group and the

experimental group were conducted to test hypothesis one. All seven tests justified retention of the null hypothesis. In addition to these seven t tests, an additional t test was conducted to investigate the possibility that a statistically significant difference in the change in computer anxiety scores may have occurred between students who had no prior computer experience and had some prior computer experience, regardless of whether they were in the control group or the experimental group. Interestingly the results of this test indicated that a statistically significant difference did exist between these two groups. The results of this t test are shown in Table 10. Table 10 shows the t tests analysis for the change in computer anxiety scores between students who had no prior computer experience and those who had prior computer experience up to 225 hours. The probability of t for this comparison was 0.0434 indicating a difference between the two groups which was statistically significant at the .05 level. While these figures do not have any relevance to the rejection or the retention of the research hypothesis number one of this study, they are important for possible future research.

The results of the data analysis for hypothesis two are presented in the following discussion. Seven separate t tests were used for the analysis of the data for hypothesis two. The t tests were conducted on the data to determine if any significant differences in change in

computer literacy scores existed between males and females
in the study, between age groups (17-22 and 23 and over),
or between students who had no prior computer experience
and students who had some prior computer experience. A t
test was also conducted to determine if any significant
difference in change in computer literacy scores existed
between the total students in the experimental and control
groups. In summary, the results of the t tests analysis
for hypothesis two were:

1. the probability of t for the change in computer
literacy scores between the experimental and control groups
was 0.1360 (Table 24) which justified retention of the null
hypothesis;

2. the probability of t for the change in computer
literacy scores between the experimental group and the
control group for students ages 17-22 (Table 18) was 0.1180
which justified retention of the null hypothesis;

3. the probability of t for the change in computer
literacy scores between the experimental group and the
control groups for students ages 23 and over (Table 19) was
0.7657 which justified retention of the null hypothesis;

4. the probability of t for the change in computer
literacy scores between the experimental group and the
control group for male students (Table 20) was 0.1918 which
justified retention of the null hypothesis;

5. the probability of t for the change in computer
literacy scores between the experimental group and the

control group for female students (Table 21) was 0.5094
which justified retention of the null hypothesis;

6. the probability of t for the change in computer
literacy scores between the experimental group and the
control group for students with prior computer experience
up to 225 hours (Table 22) was 0.2551 which justified
retention of the null hypothesis;

7. the probability of t for the change in computer
literacy scores between the experimental group and the
control group for students who had no prior computer
experience (Table 23) was 0.2666 which justified retention
of the null hypothesis. All seven of the t tests results
justified retention of the null hypothesis for hypothesis
number two.

<u>Conclusions</u>

Based on the findings of the study, the following
conclusions were drawn:

1. The findings of this study do not support the idea
put forth in hypothesis one that students in an
introductory college level computer science class where
computer anxiety teaching methods are used will show a
greater reduction in computer anxiety levels than students
in an introductory college level computer science class
where traditional teaching methods are used.

2. The findings of this study do not support the idea
put forth in hypothesis two that students in an
introductory college level computer science class where

computer anxiety reducing teaching methods are used will show a greater learning gain than students in an introductory college level computer science class where traditional teaching methods are used.

While the findings did not support the ideas put forth in either of the hypotheses, it is worthwhile to give some consideration to some facts that surfaced as a result of the analysis of the data from this study. The first revelation was that the change in computer anxiety scores decreased for students with prior computer experience while the change in computer anxiety scores increased for students with no prior computer experience. Upon further analysis of the data it was shown that the difference in the change in computer anxiety levels between students with prior computer experience and those with no prior computer experience was statistically significant at the .05 level. The second fact revealed by analysis of the data was that the mean anxiety level of both the control group and the experimental group went up over the course of the semester. At the same time, the mean computer literacy level of the control group went up slightly and the mean computer literacy level of the experimental group went down about two points. These figures raise the question that perhaps too little computer anxiety may not be conducive to learning, just as too much computer anxiety may be counterproductive for the learner. Keeping this information in mind, it is noteworthy that examination of

Tables 18 through 24 reveal that the change in computer literacy figures are all negative for the experimental group and all positive for the control group. Table 24 shows that the mean change in computer literacy scores for the experimental group was -2.0870 while the mean change in computer literacy scores for the control group was 0.5455. Each t test analysis of the subsets for change in computer literacy scores showed the same pattern between the scores of the control group and those of the experimental group. The results of this study has contributed to the body of knowledge about computer anxiety by building and expanding upon prior research. Consequently, the knowledge gained from the results of this study can form an additional starting point for further investigations into the nature of computer anxiety and its effects on learning.

<u>Recommendations for Further Study</u>

Findings from this study indicate a need for further research into the phenomenon of computer anxiety. The phenomenon itself has many facets each of which constitute a valid subject of study. The results of the analysis of data from this study revealed some facts about computer anxiety, but it also served to provide few conclusive facts about this illusive subject. Instead, it provided additional opportunities for further research about the subject. One phenomenon that surfaced as this study was conducted was that of apathy among the students as the semester came to a close. The attitudes of the students in

general were observed to be more and more apathetic as the end of the semester neared. The students involved in this study were no different than most of the other junior college students, and their attitudes seemed to become more and more negative toward the end of the semester. Many of them could have probably done better on the posttest in computer literacy if they had been willing to put forth a little more effort. It appeared that attitudes may possibly play a major role in the learning gain of students in a college level introductory computer science class. It is important to note that attitudes in this case do not refer to just attitudes towards computers and computer use, but includes overall attitudes toward college, work, and life in general Therefore, attitudes should be a major consideration in planning a computer science class. Studies should be conducted to learn what correlation may exist between attitudes and learning. There are many possible avenues to take in search of more knowledge about computer anxiety and computer literacy, and the results of this study served to open more of them for further scrutiny. The following recommendations are just that "recommendations" for further study, and nothing more. There is an abundant number of questions that could be asked, and plenty of other opportunities for further study, but the following are presented for consideration.

1. Further research should be conducted to follow-up on the fact that there was a statistically significant

difference in the change in computer anxiety scores between
students with prior computer experience and those who had
no prior computer experience.

2. Further research should be conducted to follow up
on the fact that the mean anxiety level of both the
experimental group and the control group went up over the
course of the semester.

3. Further research should be conducted to follow up
on the fact that the change in computer literacy figures
were all negative for the experimental group and all
positive for the control group.

It is essential that educators and decision-makers in
business and industry whose responsibility is to provide
quality instruction in computer use become more
knowledgeable about computer anxiety and computer
literacy. The nature of computer anxiety appears to be
more difficult to ascertain than that of computer literacy.

Consequently, it is imperative that further research
be conducted to learn more about the subject of computer
anxiety and how it affects learning. The results of this
study have hopefully provided information helpful for
additional research on the subject.

APPENDIX A

LETTER OF APPROVAL

APPENDIX B

COMPUTER OPINION SURVEY

85

PLEASE NOTE

Copyrighted materials in this document have
not been filmed at the request of the author.
They are available for consultation, however,
in the author's university library.

86-87,89-104

University Microfilms International

APPENDIX C

STANDARDIZED TEST OF COMPUTER LITERACY

88

APPENDIX D

RAW DATA FROM THE CONTROL GROUP

RAW DATA FROM THE CONTROL GROUP

ID#	SEX	AGE	PRIOR EXP	COMP SYSTEMS PRE	POST	COMP APPS PRE	POST	COMP ANXIETY PRE	POST	LITERACY PRE	POST	SYSTEMS CHANGE	APPS CHANGE	LITERACY CHANGE	ANXIETY CHANGE
201	F	2	0	8	10	8	11	90	89	16	21	+2	+3	+5	-1
202	M	1	1	11	11	19	9	88	96	30	20	0	-10	-10	+8
203	M	1	1	5	14	6	19	97	94	11	33	+9	+13	+22	-3
204	M	1	5	19	19	14	19	95	95	33	38	0	+5	+5	0
205	M	1	4	14	15	12	16	92	86	26	31	+1	+4	+5	-6
206	F	1	4	13	12	11	11	95	101	24	23	-1	0	-1	+6
207	M	2	5	18	13	20	13	96	96	38	26	-5	-7	-12	0
208	M	2	2	18	14	9	15	86	86	27	29	-4	+6	+2	0
209	F	2	0	9	10	13	12	82	91	22	22	+1	-1	+0	+9
210	F	1	2	16	18	19	17	100	96	35	35	+2	-2	0	-4
211	F	2	1	11	14	11	16	88	86	22	30	+3	+5	+8	-2
212	F	2	5	17	19	17	13	97	88	34	32	+2	-4	-2	-9
213	F	2	5	11	10	19	19	87	108	30	29	-1	0	-1	+21
214	M	2	0	6	13	15	10	82	83	21	23	+7	-5	+2	+1
215	F	2	0	11	14	7	15	88	89	28	29	+3	+8	+1	+1
216	F	2	0	18	17	16	15	84	86	34	32	-1	-1	-2	+2
217	F	2	1	9	7	15	6	97	95	24	13	-2	-9	-11	-2
218	F	1	2	9	8	7	5	90	81	16	13	-1	-2	-3	-9
219	M	1	0	12	10	9	10	73	82	21	20	-2	+1	-1	+9
220	F	2	0	10	12	10	11	83	93	20	23	+2	+1	+3	+10
221	M	1	0	8	9	7	6	83	88	15	15	+1	-1	0	+5
222	M	1	0	8	8	8	6	77	77	16	14	0	-2	-2	0

AGE CODE 1=AGES 17-22
2=AGES 23 AND OVER

PRIOR COMPUTER EXPERIENCE CODE 0=0 HOURS
1=1-45 HRS
2=46-90 HRS
3=91-135 HRS
4=136-180 HRS
5=181-225 HRS

APPENDIX E

RAW DATA FROM THE EXPERIMENTAL GROUP

107

RAW DATA FROM THE EXPERIMENTAL GROUP

ID#	SEX	AGE	PRIOR EXP	COMP SYSTEMS PRE	POST	COMP APPS PRE	POST	COMP ANXIETY PRE	POST	LITERACY PRE	POST	SYSTEMS CHANGE	APPS CHANGE	LITERACY CHANGE	ANXIETY CHANGE
101	F	1	5	17	17	16	16	107	99	33	33	0	0	0	-8
102	M	1	0	8	9	7	8	84	88	15	17	+1	-1	+2	+4
103	F	1	0	3	5	10	8	83	101	13	13	+2	-2	0	+18
104	M	1	1	11	8	8	5	96	90	19	13	-3	-3	-6	-6
105	M	2	0	6	6	7	9	80	85	13	15	0	+2	+2	+5
106	F	2	2	10	10	11	9	100	91	21	19	0	-2	-2	-9
107	M	1	0	8	2	8	2	88	99	16	4	-6	-6	-12	+11
108	F	2	1	8	7	8	6	73	72	16	13	-1	-2	-3	-1
109	M	2	0	10	8	10	11	93	94	20	19	-2	+1	-1	+1
110	M	1	1	17	11	14	12	97	93	31	23	-6	-2	-8	-4
111	F	2	0	10	9	9	8	89	91	19	17	-1	-1	-2	+2
112	F	1	0	9	9	5	6	92	92	14	15	0	+1	+1	0
113	F	2	0	12	11	5	6	86	83	17	17	-1	+1	0	-3
114	F	2	0	14	16	19	17	83	89	33	33	+2	-2	0	+6
115	M	1	1	12	12	16	7	93	85	28	19	0	-9	-9	-8
116	M	1	0	11	7	8	6	87	77	19	13	-4	-2	-6	-10
117	M	2	0	8	14	16	13	103	104	24	27	+6	-3	+3	+1
118	F	1	4	14	16	16	11	93	105	30	27	+2	-5	-3	+12
119	F	2	2	4	10	15	13	91	92	19	23	+6	-2	+4	+1
120	M	1	1	12	10	6	8	83	86	18	18	-2	+8	0	+3
121	F	1	4	16	11	9	18	97	93	25	29	-5	+9	+4	-4
122	F	2	2	13	11	14	7	92	92	27	18	-2	-7	-9	0
123	F	2	4	13	11	17	16	81	89	30	27	-2	-1	-3	+8

AGE CODE 1-AGES 17-22
2-AGES 23 AND OVER

PRIOR COMPUTER EXPERIENCE CODE 0=0 HOURS
1=1-45 HRS
2=46-90 HRS
3=91-135 HRS
4=136-180 HRS
5=181-225 HRS

108

REFERENCES

Arden, Eugene. "Beyond Computer Literacy," <u>The College Board Review</u>, No. 139, Spring 1986, pp. 27-28.

Banks, Mark J., and Havice, Michael J. "Strategies for Dealing With Computer Anxiety: Two Case Studies," <u>Educational Technology</u>, January 1989, pp. 22-26.

Barnes, Cynthia C. "Teaching Computer Literacy: A Nontraditional Approach," <u>Journal of Education for Business</u>, April 1986, pp. 311-314.

Beebe, D.D. "Towards a Perspective on Micro-Technology Within Business Education: Relieving Techno-anxiety," <u>Journal of Business Education</u>, Vol. 59, 1983, pp. 121-123.

Bloom, A.J. "An Anxiety Management Approach to Computer Phobia," <u>Training and Development Journal</u>, January 1985, pp. 90-94.

Bloom, A.J. and Hautaluoma, Jacob, E. "Anxiety Management Training as a Strategy for Enhancing Computer User Performance," <u>Computers in Human Behavior</u>, Vol. 6 (4), 1990, pp. 337-349.

Borg, Walter R., and Gall, Meredith D. <u>Educational Research: An Introduction</u>. New York: Longman, 1983.

Cambre, Marjorie A., and Cook, Desmond L. "Measurement and Remediation of Computer Anxiety," <u>Educational Technology</u>, December 1987, pp. 15-20.

Campbell, N. Jo. "Computer Anxiety of Rural Middle and Secondary Students," Journal of Educational Computing Research, Vol. 5(2) 1989, pp. 213-220.

Campbell, N. Jo, and Dobson, Judith E. "An Inventory of Student Computer Anxiety," <u>Elementary School Guidance and Counseling</u>, December 1987, pp. 149-155.

Campbell, William G., and Ballou, Stephen V. <u>Form and Style-Thesis, Reports, Term Papers</u>. Boston: Houghton Mifflin Company, 1974.

Chen, M. "Gender and Computers: the Beneficial Effects of Experience on Attitudes," <u>Journal of Educational Computing Research</u>, Vol. 2(3), 1986, pp. 265-282.

Chu, P.C. and Spires, Eric E. "Validating the Computing Anxiety Rating Scale: Effects of Cognitive Style and Computer Courses on Computer Anxiety," Computers in Human Behavior, Vol. 7 (1-2), 1991, pp. 7-21.

Collis, B.A. "Sex Related Differences in Attitudes Toward Computers: Implications for Counselors" The School Counselor, Vol. 32(2), 1985, pp. 120-130.

Collis, B.A. "Sex Differences in Secondary Students' Attitudes Toward Computers," The Computing Teacher, Vol. 12(7), 1985, pp. 33-36.

Coovert, M.D., and Goldstein, M. "Locus of Control as a Predictor of User's Attitudes Toward Computers, Psychological Reports, Vol. 47, 1980, pp. 1167-1173.

Dambrot, F.H., Watkins-Malek, M.A., Silling, S.M., Marshall, R.S., and Garver, J.A. "Correlates of Sex Differences in Attitudes Toward and Involvement with Computer," Journal of Vocational Behavior,Vol. 27(1), 1985, pp. 71-86.

Ferguson, George A. Statistical Analysis in Psychology and Education. New York: McGraw-Hill, 1981.

Fetler, M. "Sex Differences on the California Statewide Assessment of Computer Literacy," Sex Roles Vol. 13(3/4), 1985, pp. 181-191.

Gibaldi, Joseph, and Achtert, Walter S. MLA Handbook for Writers of Research Papers. New York: The Modern Language Association of America, 1988.

Gressand, C.P. and Loyd, B.H. "An Investigation of the effects of Math Anxiety and Sex on Computer Attitudes," School Science and Mathematics, Vol. 87, 1987, pp. 125-135.

Griswold, P.A. "Differences Between Education and Business Majors in Their Attitudes about Computers," Association for Educational Date Systems Journal, Vol. 18, 1985, pp. 131-138.

Hawkins, J. "Computers and Girls: Rethinking the Issues: Sex Roles, Vol. 13 (3/4), 1985, pp. 165.180.

Hayek, Linda M. and Stephens, Larry. "Factors Affecting Computer Anxiety in High Schocl Computer Science Students," Journal of Computers in Mathematics and Science Teaching, Vol. 8 (4), 1989, pp. 73-76.

Honeyman, David S., and White, Warren J. "Computer Anxiety
in Educators Learning to Use the Computer: A
Preliminary Report, "Journal of Research on
Computingin Education, Winter 1987, pp. 129-138.

Howard, Geoffrey S., Murphy, Catherine M., and Thomas,
Glenn N. "Computer Anxiety Considerations for Design
of Introductory Computer Courses," Educational
Research Quarterly, Vol. 11, No. 4, 1987, pp. 13-22.

Howard, G.S., and Smith, R.D. "Computer Anxiety in
Management: Myth or Reality?" Communications of the
ACM, Vol. 29(7), 1986, pp. 611-615.

Jay, T.B. "Computerphobia: What to do about it,"
Educational Technology, Vol. 21(1), 1981, pp. 47-48.

Jordan, E.W., and Stroup, D.F. "The Behavioral Antecedents
of Computer Fear," Journal of Data Education, Vol.
22, 1982, pp. 7-8.

Kennedy, Charles E. II, "Techniques and Technology:
Computerphobia," The School Counselors, March 1988,
pp. 297-298.

Koohang, Alex A. "A Study of Attitudes Toward Computers:
Anxiety, Confidence, Liking, and Perception of
Usefulness," Journal of Research on Computing in
Education, Vol. 22 (2), 1989, pp. 137-150.

Lacoton, J., and Gerschner, V.T. "A Review of the
Literature on Attitudes Towards Computers and
Computerized Instruction," Journal of Research and
Development in Education, Vol. 16, 1982, pp. 50-55.

Lambert, Matthew E. and Lenthall, Gerard. "Effects of
Psychology Courseware Use on Computer Anxiety in
Students," Computers in Human Behavior, Vol. 5 (3),
1989, pp. 207-214.

Lewis, Linda H. "Adults and Computer Anxiety: Fact or
Fiction," Lifelong Learning: An Omnibus of Practice
and Research, Vol. 11, No. 8, 1988, pp. 5-8.

Lockheed, M.E. and Frakt, S.B. "Sex Equity: Increasing
Girls' Use of Computers," The Computing Teacher,
Vol. 18, August 1984, pp. 16-18.

Longstreet, Wilma S., and Sorant, Peter E. "Computer
Literacy-Definition?" Educational Horizons, Spring
1985, pp. 17-120.

Loyd, B.H., and Gressand, C.P. "The Effects of Sex, Age, and Computer Experience on Computer Attitudes," <u>Association for Educational Data Systems Journal</u>, Vol. 18(27), 1984, pp. 67-77.

Loyd, B.H., Loyd, D.E. and Gressard, C.P. "Gender and Computer Attitudes of Middle School Students," <u>Journal of Early Adolescence</u>, Vol. 7, 1987, pp. 13-19.

Livermann, A. "Computer Literacy: A National Crises and a Solution For It," <u>Byte</u>, Vol. 7, 1980, pp. 98-102.

Mahmood, Mo Adams, and Medewitz, Jeanette N. "Assessing the Effect of Computer Literacy on Subjects' Attitudes, Values, and Opinions Toward Information Technology: An Exploratory Longitudinal Investigation Using the Linear Structural Relations (LISREL) Model," <u>Journal of Computer-Based Instruction</u>, Vol. 16, No. 1, Winter 1989, pp. 20-28.

Malpiedi, Barbara J. "In Pursuit of Computer Literacy," <u>Vocational Education Journal</u>, March 1989, pp. 24-27.

Marcoulides, G.A., "The Relationship Between Computer Anxiety and Computer Achievement," <u>Journal of Educational Computing Research</u>, Vol. 4, 1988, pp. 151-158.

Massey, Tom K., and Engelbright, James W. "Empirical Effects of Selected Antecedent Computer Literacy Skills on Computer Orientation of College Students," <u>Computer Education</u>, Vol. 11, No. 3, 1987, pp. 177-180.

Mertens, Donna M., and Wang, Zhuli. "Attitudes Toward Computers of Preservice Teachers of Hearing-Impaired Students," <u>American Annals of the Deaf</u>, March 1988, pp. 40-42.

Munger, Gail F., and Loyd, Brenda H. "Gender and Attitudes Toward Computers and Calculators: Their Relationship to Math Performance," <u>Journal of Educational Computing Research</u>, Vol. 5(2), 1989, pp. 167-177.

Nairbitt, John. <u>Megatrends</u>. New York: Warner Books Inc., 1984.

Rosen, Larry D. and Weil, Michelle M. "Computers, Classroom Instruction, and the Computerphobic University Student," Collegiate Microcomputer, Vol. 8 (4), November 1990, pp. 275-283.

Rottier, J. "Reducing Comptuer Tension," Instructional Innovator, Vol. 27 No. 3, March 1982, p. 28.

Rubin, C. "Some People Should Be Afraid of Computers," Personal Computing, Vol. 7 No. 8, August 1983, pp. 55-57, 163.

Seidel, R.J., Anderson, R.E., and Hunter, B. (eds.) Computer Literacy: Issues and Directions for 1985. New York: Academic Press, 1982.

Simonson, Michael R., Maurer, Matthew, Montage-Torardi, Mary M., and Whitaker, Mary. "Development of a Standardized Test of Computer LIteracy and a Computer Anxiety Index," Journal of Educational Computing Research, Vol. 3(2), 1987, pp. 231-247.

Smith, Myra N. and Lotrlik, Joe W. "Computer Anxiety Among Extension Agents: A Barrier That Can Be Reduced," Journal of Extension, Vol. 28, Winter 1990, pp. 14-16.

Turner, Judith Axler. "Familiarity With New Technology Breeds Changes in Computer-Literacy Courses," The Chronicle of Higher Education, July 22, 1987, pp. 9-12.

Turner, Terilyn C. "An Overview of Computers in Adult Literacy Programs," Lifelong Learning: An Omnibus of Practice and Research, Vol. 11, No. 8, 1988, pp. 9-12.

Walonick, David S. StatPac Gold-Statistical Analysis Package for the IBM. Walonick Associates, Inc. 1988.

Walter, S. "Dispelling an Old Myth: Managers Aren't Really Afraid of Those Big, Gray Machines," Management Technology, Vol. 2 No. 12, April 1983, pp. 71-72.

Watkin, Edward. "Computer Literacy: An Executive Education," Today's Office, July 1984, pp. 61-64.

Weil, Michelle M. and Others. "The Etiology of Computerphobia," Computer in Human Behavior, Vol. 6 (4), 1990, pp. 361-379.

Wesley, B.E., Krockover, G.H., and Hicks, C.R. "Locus of
    Control and Aquisition of Computer Literacy," Journal
    of Computer-Based Instruction, Vol. 12, 1985, pp. 12-16.

Widmer, C., and Parker J. "Micro Anxiety: How to Beat it
    Before You Get It," Electronic Education, Vol. 3 No.
    3., 1983, pp. 23-24.

Wilder, G., Mackie, D., and Cooper, J. "Gender and
    Computers: Two Surveys of Computer-Related Attitudes,"
    Sex Roles, Vol. 13 (3/4), 1985, pp. 215-228.