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

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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.

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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).

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, 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.

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

Analysis of Data

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 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 *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 *t* test statistics which included the difference between means of the control and experimental groups, the standard error of the difference, a *t* statistic, degrees of freedom, and probabilities of *t* for both one-tailed and two-tailed tests. These figures are included in the tables summarizing analysis results.

The *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

Posttest

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 _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 _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

Posttest

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 0.9658 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

Posttest

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

Posttest

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

Pretest

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 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 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 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 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 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 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 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.

Conclusions

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.

Recommendations for Further Study

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

Wayne Taylor
108 Brentwood Circle #10
Athens, TX 75751

Dr. Michael R. Simonson
Instructional Resource Center
LAGOMARCINO HALL
College of Education
Iowa State University
Ames, Iowa 50011

Dear Dr. Simonson,

In accordance with our telephone conversation of February 22, this letter is to confirm that I intend to use the COMPUTER OPINION SURVEY for the purpose of gathering data for my doctoral dissertation. Please send me the key, and confirm your permission for me to use the survey for this purpose.

I am very grateful for your assistance. I am enclosing $10.00 as you indicated I should do, and I will provide you with a copy of my dissertation upon completion. If I can ever return the favor or be of assistance to you, please do not hesitate to call on me.

Sincerely Yours,

Wayne Taylor

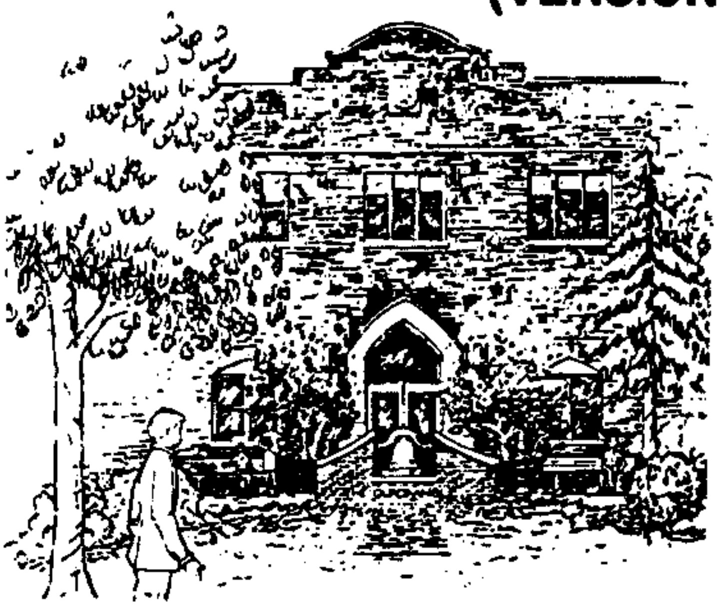
Wayne Taylor

Permission granted
M Simonson

APPENDIX B

COMPUTER OPINION SURVEY

COMPUTER OPINION SURVEY (VERSION AZ) REV



by
Matthew Maurer, M.S.
Michael R. Simonson, Ph.D.
Instructional Resources Center
LAGOMARCINO HALL
College of Education
Iowa State University
Ames, Iowa
(515) 294-6840

Directions: •Use black lead pencil only.
•Do *not* use ink or ballpoint pens.
•Make heavy black marks that fill the circle completely.
•Erase cleanly any answer you wish to change.
•Make no stray marks on the answer sheet.

Name. Last, First, and middle initial - (Fill in the circles, too.)

Sex: Male or Female

Grade: Your grade in school (Example: Senior in High School = 12)

Birth Date: Month, Day, Year (fill in circles)

Special Codes:

K. Have you ever taken a course in computer literacy and/or computer programming?
1 = no
0 = yes

L. If your reponse to question K was yes, how many semesters of total course work in computer literacy have you had?
0 = less than a full semester
1 = one semester
2 = two semesters
3 = three semesters
4 = four semesters
5 = five semesters
6 = six semesters
7 = seven semesters
8 = eight semesters
9 = nine semesters

TURN TO THE BACK OF THIS PAGE AND CONTINUE.

COMPUTER OPINION SURVEY

Instructions: Please indicate how you feel about the following statements. Use the scale below to indicate your feelings. Mark the appropriate circle on the answer sheet.

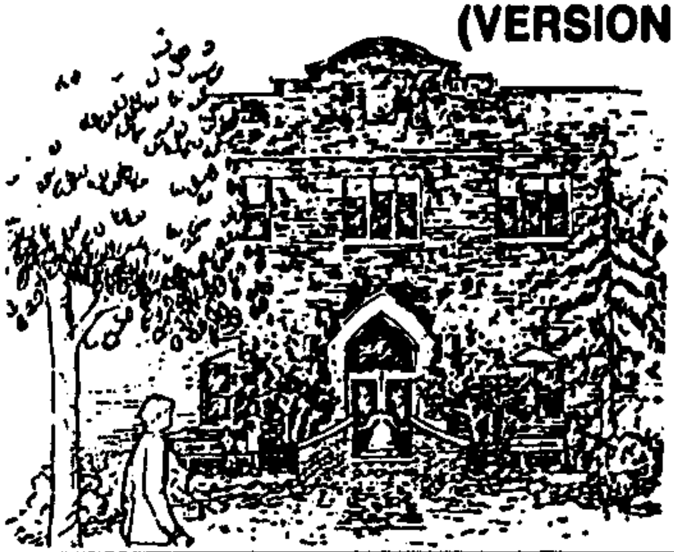
1 = Strongly agree
2 = Agree
3 = Slightly agree
4 = Slightly disagree
5 = Disagree
6 = Strongly Disagree

1. Having a computer available to me would improve my productivity.	1 2 3 4 5 6
2. If I had to use a computer for some reason, it would probably save me some time and work.	1 2 3 4 5 6
3. If I use a computer, I could get a better picture of the facts and figures.	1 2 3 4 5 6
4. Having a computer available would improve my general satisfaction.	1 2 3 4 5 6
5. Having to use a computer could make my life less enjoyable.	1 2 3 4 5 6
6. Having a computer available to me could make things easier for me.	1 2 3 4 5 6
7. I feel very negative about computers in general.	1 2 3 4 5 6
8. Having a computer available to me could make things more fun for me.	1 2 3 4 5 6
9. If I had a computer at my disposal, I would try to get rid of it.	1 2 3 4 5 6
10. I look forward to a time when computers are more widely used.	1 2 3 4 5 6
11. I doubt if I would ever use computers very much.	1 2 3 4 5 6
12. I avoid using computers whenever I can.	1 2 3 4 5 6
13. I enjoy using computers.	1 2 3 4 5 6
14. I feel that there are too many computers around now.	1 2 3 4 5 6
15. Computers are probably going to be an important part of my life.	1 2 3 4 5 6
16. A computer could make learning fun.	1 2 3 4 5 6
17. If I were to use a computer, I could get a lot of satisfaction from it.	1 2 3 4 5 6
18. If I had to use a computer, it would probably be more trouble than it was worth.	1 2 3 4 5 6
19. I am usually uncomfortable when I have to use computers.	1 2 3 4 5 6
20. I sometimes get nervous just thinking about computers.	1 2 3 4 5 6
21. I will probably never learn to use a computer.	1 2 3 4 5 6
22. Computers are too complicated to be of much use to me.	1 2 3 4 5 6
23. If I had to use a computer all the time, I would probably be very unhappy.	1 2 3 4 5 6
24. I sometimes feel intimidated when I have to use a computer.	1 2 3 4 5 6
25. I sometimes feel that computers are smarter than I am.	1 2 3 4 5 6
26. I can think of many ways that I could use a computer.	1 2 3 4 5 6

APPENDIX C

STANDARDIZED TEST OF COMPUTER LITERACY

STANDARDIZED TEST OF COMPUTER LITERACY (VERSION AZ) revised



by
Mary Montag, M.S.
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(515) 294-6840

Directions: •Use black lead pencil only.

- •Do *not* use ink or ballpoint pens.
- •Make heavy black marks that fill the circle completely.
- •Erase cleanly any answer you wish to change.
- •Make no stray marks on the answer sheet.

Name: Last, First, and middle initial - (Fill in the circles, too.)

Sex: Male or Female

Grade: Your grade in school (Example: Senior in High School = 12)

Birth Date: Month, Day, Year (fill in circles)

Special Codes:

K. Have you ever taken a course in computer literacy and/or computer programming?

0 = no
1 = yes

L. If your reponse to question K was yes, how many semesters of total course work in computer literacy have you had?

0 = less than a full semester
1 = one semester
2 = two semesters
3 = three semesters
4 = four semesters
5 = five semesters
6 = six semesters
7 = seven semesters
8 = eight semesters
9 = nine semesters

DO NOT OPEN TEST BOOKLET UNTIL INSTRUCTED TO DO SO.

SECTION #1

Instructions: Read each question carefully and then select the most appropriate answer from the five choices and mark the appropriate circle on the answer sheet. If you do not know the answer, try to make an educated guess if possible, otherwise leave the item blank.

1. Which of the following is the primary reason that program instructions and data are handled by modern digital computers in binary form?

    a. A given value may be represented in binary form using fewer place values than would be required in base ten.
    b. Binary numbers are easier for the operator to enter into the keyboard than are base ten numbers.
    c. It is simplest to design circuits which operate in only two logical states rather than ten separate states.
    d. Binary numbers more accurately represent logical operations than would the far preferable base 8 system.
    e. The binary number system is a traditional, though unnecessary, holdover from the days of vacuum tube technology.

2. Computer systems are commonly used to perform "data processing" functions. This term may best be described as

    a. the process of critically analyzing large sets of data and making subjective decisions based on that data.
    b. a type of information management used primarily in business and government applications, usually involving statistical operations.
    c. the exclusive domain of mainframe computers--data processing is beyond the capabilities of a microcomputer because of its limited memory.
    d. the process of handling information, including such operations as sorting, calculating, recording, classifying, and summarizing.
    e. the process of adding, subtracting, multiplying, and dividing numbers in base two.

3. Place in order from first to last the operations that take place as a problem is being solved with the aid of a computer.

    1. print a report
    2. read data into the computer
    3. develop and program an algorithm
    4. calculate results
    5. code the data onto input medium

    a. 1,2,3,4,5
    b. 2,1,5,4,3
    c. 3,5,2,4,1
    d. 5,4,3,2,1
    e. 3,5,1,2,4

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4. The major purpose of a computer software program is to

   a. supply instructions to the computer.
   b. read punched cards into the computer.
   c. develop an algorithm for problem solving.
   d. design input data for the computer.
   e. output the results of the operation of the computer.

5. Computer hardware represents only a portion of the cost of a complete computer system because

   a. disk drives, printers and other peripheral devices are quite expensive.
   b. quality computer systems, such as the Apple IIe or the IBM PC, require extra interface cards and controller cards in order to be fully functional.
   c. a computer's true cost must be weighed against the eventual savings in time and human resources that the computer makes possible.
   d. the operating system and other machine language programs resident in ROM must be obtained at extra cost.
   e. computer hardware cannot function without adequate software, that represents an additional expense.

6. Computers and certain computer peripherals may be classified as either digital or analog devices. Which of the following groups includes <u>exclusively digital hardware</u> devices?

   a. CPU, RAM chip, game paddle
   b. ROM chip, serial interface card, microprocessor
   c. CPU, compiler, word processing program
   d. RAM chip, ROM chip, operating system
   e. BASIC, integrated circuit, interpreter

7. Batch processing refers to a processing mode in which

   a. a program is run with direct interaction between the computer and the user, usually with the program on magnetic tape or disk.
   b. a batch of data is collected over an extended period and then processed concurrently using multiple processing units.
   c. a program is run without interaction between the computer and the user. The program with its data is submitted to the computer usually on punched cards, and results are then inserted as required by the program.
   d. many computers are networked together so many programs can be processed at one time.
   e. microcomputers are connected to mainframe computers in a time-sharing situation.

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8. Which of the following groups of computer terms does <u>not</u> refer exclusively to computer hardware?

   a. CRT, CPU, RAM chip
   b. speech synthesizer, disk drive, graphics digitizing pad
   c. letter quality printer, ROM chip, I/O connector
   d. integrated circuit, BASIC, diskette, power supply
   e. keyboard, disk drive, video monitor

9. Which of the following best depicts a special purpose computer system?

   a. microcomputers in a network configuration for classroom use
   b. a mainframe computer with time-share terminals
   c. a personal computer with a printer for wordprocessing
   d. a climate control computer for a building
   e. a minicomputer with dedicated terminals

10. Which of the following groups of computer hardware and software are representative characteristics of a MICROCOMPUTER system?

    a. 5 1/4 inch floppy disk, 5 megabytes of read only memory, card reader
    b. microprocessor, BASIC, 5 1/4 inch floppy disk
    c. dual disk drives, microprocessor, time-sharing system
    d. BASIC, 5 megabytes of read only memory, time sharing system
    e. card reader, microprocessor, 5 megabytes of read only memory

11. Which of the following best reflects the relationship between microcomputers, minicomputers, and mainframe computers in terms of the average memory capacity? (ordered from least to greatest average memory capacity)

    a. mainframe, microcomputer, and minicomputer
    b. microcomputer, mainframe, minicomputer
    c. microcomputer, minicomputer, mainframe
    d. They all are capable of having equal memory capacity.
    e. The memory capacity depends on the cost of the system, so it is not possible to order them by category of computer.

12. Several microcomputers connected together with communication lines in order to access the same programs and data is an example of

    a. time-sharing.
    b. multiple-processor.
    c. networking.
    d. interface interaction.
    e. modulation-demodulation.

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13. Serial communication refers to

    a. transferring information from one computing device to another eight bits at a time.
    b. transferring information from one computing device to another one bit at a time.
    c. communicating with the computer via a series of bit to byte interactions.
    d. communicating with the computer via a series of programming statements.
    e. transferring information from the program to the central processor one bit at a time.

14. Which of the following is a common function of operating systems?

    a. Providing an orderly and consistent input/output environment for the various elements of the computer.
    b. Permitting compatibility among all microcomputers, regardless of the microprocessors they incorporate.
    c. Controlling the voltage levels supplied by the power supply.
    d. Determining the number of bits in each of the computer's data words.
    e. Providing a list of user-friendly commands so the user can operate the system.

15. Computer hardware failures are most often caused by

    a. dusty operating environment.
    b. cold operating environment.
    c. physical abuse of the hardware.
    d. power line spikes, dropouts, and surges.
    e. defective software.

16. Which of the following is not necessary for the proper care and maintenance of computer systems?

    a. the use of voltage-controlled and filtered circuits when supplying power to the computer.
    b. maintaining a relative humidity of 40 - 60% to minimize static electricity
    c. providing adequate air circulation around the computer
    d. maintaining a dust-free operating environment
    e. maintaining a room temperature of at least 68 degrees

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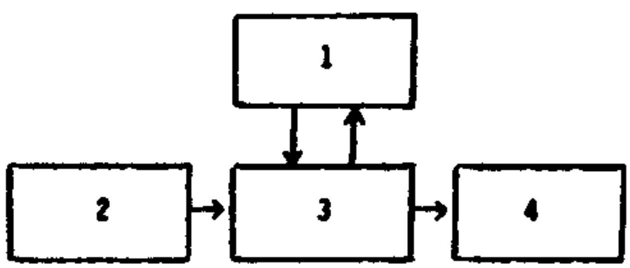
17. A microcomputer system is not well suited for performing complex statistical functions on large data sets because

    a. the built-in video displays of most microcomputers would be too small to show the many values and formulas in a typical statistical software package.
    b. microcomputer systems generally do not have sufficient memory for storage of elaborate programs and large amounts of data.
    c. no microcomputer system can handle such functions. To do any kind of number-crunching work, you need a larger computer.
    d. microcomputers are not equipped with disk drives and thus cannot load large statistical programs from disks.
    e. microcomputers represent an inexpensive, very limited class of computers and are good for little more than arcade-type games.

18. A primary function of the Central Processing Unit of a computer is to __________ information.

    a. store
    b. input
    c. output
    d. input/output
    e. analyze/manipulate

19. Below is a block diagram of a computer system with the arrows indicating the sequence of data movement within the system. Which of the following are the most appropriate labels for the components?



    a. 1-memory
       2-input
       3-processor unit
       4-output

    b. 1-input/output device
       2-CPU
       3-RAM
       4-ROM

    c. 1-video display
       2-keyboard
       3-disk drive
       4-printer

    d. 1-processor unit
       2-input device
       3-memory
       4-output device

    e. 1-arithmetic/logic unit
       2-control unit
       3-operating system
       4-input/output device

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20. Which of the following statements is not true concerning RAM and ROM?

    a. Information stored in RAM can be changed by the user, while information stored in ROM cannot be changed by the user.
    b. Information stored in both RAM and ROM will be destroyed if the power to the computer is turned off.
    c. ROM stores the control program of the computer.
    d. The amount of RAM in a computer determines the memory density of the computer.
    e. RAM is volatile and ROM is nonvolatile.

21. The type of memory that is most likely to be of interest to a prospective microcomputer buyer (for the reason given) is:

    a. EPROM, because the ability to erase and reprogram memory is needed if one is to run application programs.
    b. PROM, because all memory units in a computer are erased each time the power is shut off or a new disk is booted.
    c. ROM, because the amount of ROM in a computer determines the size of programs a computer can run and the amount of data which can be stored on disks.
    d. RAM, because a computer with an insufficient amount of RAM may not be able to load and run some of the application programs.
    e. Stringy-floppy storage, because the ability to link (string) files is important to many microcomputer users.

22. A disk operating system is a special category of software that allows the computer to

    a. use magnetic disks for long term memory storage.
    b. operate disks that allow several computers to be connected to one another.
    c. receive disk information from devices such as modems.
    d. present computer disk operation information to the user.
    e. expand the usefulness of Read Only Memory in a disk.

23. Which of the following statements concerning computer software is false?

    a. Computer software could be defined as the programs, procedures and associated documentation concerned with the operation of computer hardware systems.
    b. A program written in BASIC to add numbers together and print their total is an example of computer software.
    c. The information coded on Read Only Memory chips in a microcomputer is actually software.
    d. Lists of instructions to the computer are called software.
    e. When peripheral boards and other devices intended to expand a computers capabilities are added to a microcomputer they are defined as software expansions.

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Questions 24 and 25 each describe a historical computing device. Identify the correct device for each description.

24. This item was the first device that used punched cards of instructions to control the operation on a machine.

    a. Mark I
    b. Analytical engine
    c. ENIAC
    d. Hollerith's tabulating machine
    e. Jacquard's loom

25. This device was the first automatic electronic digital computing device to be developed, but did not receive recognition until years later.

    a. UNIVAC
    b. Atanasof-Berry Computer (ABC)
    c. EDVAC
    d. Analytical engine
    e. Pascal's calculating machine

26. Four generations of modern computers can best be characterized by which group of words?

    a. punched cards, printed lines, control panels, diskettes
    b. math tables, difference engine, analytical engine, calculator
    c. vacuum tubes, transistors, integrated circuits, microprocessors
    d. Aiken, Mauchly, Eckert, Jobs
    e. relays, electromechanical, vacuum tubes, transistors

27. Formatting a magnetic floppy diskette is the process of

    a. telling the computer how to set the top and side margins for final printing of a document.
    b. copying a set of programs you have written onto a backup data disk.
    c. checking to see if the disk you have purchased is the proper size for your computer's disk drive.
    d. organizing the disk into tracks and sectors to enable the computer to store information on it.
    e. instructing the disk drive to accept the diskette.

28. You have inserted a disk into the disk drive of a microcomputer. What is the usual next step in running a program stored on the disk?

    a. type the command that results in a listing of the program statements.
    b. type the command that results in the program being loaded into the computer's memory.
    c. type the command that results in the execution of the program.
    d. type the command that results in saving the program on the disk.
    e. type the command that "boots" the disk operating system.

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29. Which of the following Disk Operating System commands would you expect to result in a list of programs on a disk?

   a. LIST
   b. RUN then LIST
   c. UNLOCK, then RUN, then LIST
   d. CATALOG
   e. LOAD CATALOG, then RUN

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SECTION #2

30. Artificial intelligence is being used in which of the following ways?

    a. the industrial field in the use of robots on assembly lines
    b. the business field to collect and sort data
    c. the education field to teach individualized lessons
    d. the music industry to produce and record sounds
    e. the medical field to diagnose illness and prescribe treatments

31. Which of the following is the least accurate characteristic of a task appropriate for a computer application?

    a. requires rapid processing of information
    b. involves repetitious operations
    c. involves manipulating large amounts of information
    d. requires continuous interaction with the user
    e. requires ease in storing and retrieving data

32. Which of the following factors would you consider least important to consider when making a decision whether to use a computer to perform a specific task?

    a. Does the available computer system possess the appropriate hardware requirements to perform the necessary operations?
    b. Is the computer the most appropriate tool to perform the task?
    c. Is an appropriate program available that is compatable with the computer hardware system that is available?
    d. What knowledge and skills are required of the computer user to implement the application?
    e. Does the task involve complex mathematical operations?

33. Consider the following situation:

    Mr. Brown received a computer generated bill for $37.50 for merchandise he bought on credit. However, he has already paid the full amount.

    What is the most likely cause of the error?

    a. computer hardware malfunction
    b. human error
    c. printer malfunction
    d. tape or disk damage
    e. power surges in the computer

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34. Which of the following does <u>not</u> describe a case of computer crime?

a. Bill purchased a copyrighted computer program for figuring his income tax. His friend, John expressed a desire to use the program, so Bill copied it for him and gave it to him for Christmas.
b. Sam used a password to gain access to the computer owned by his former employer. Over long distance phone lines, he used the computer to direct the operation of machines owned by his present employer.
c. An employee of a Motor Vehicle Department added 1000 names to a computerized list of approved applicants for driver's licenses. The employee then sold the licenses.
d. A computer analyst at a Wall Street brokerage house programmed a computer to sell nonexistent securities through fictitious accounts.
e. A school teacher who used a computer in the classroom wrote educational programs and then made copies of them to sell to other teachers.

35. Which of the following computer-related job titles is the <u>most</u> appropriate for this job description?

Starts the computer system when necessary.
Mounts tapes or disks to provide computer with proper data.
Loads programs into the computer.
Performs sequential activities necessary to run programs.
Supplies printers with paper and ribbons.

a. applications programmer
b. systems Analyst
c. systems programmer
d. computer scientist
e. computer operator

36. Which of the following computer-related job titles is the most appropriate for this job description?

Knows one or more computer languages.
Writes flowcharts and instructions for user programs.
Tests and revises programs until correct.
Explains programs to users through documentation.

a. applications programmer
b. system analyst
c. system programmer
d. computer scientist
e. computer operator

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37. One of the main advantages of writing with any word processing system, over writing with a typewriter, is that during editing and correction

   a. print quality is improved.
   b. hyphenation of words is automatic.
   c. the unchanged portions of the text need not be retyped by hand.
   d. different display systems can be used.
   e. spelling can be corrected automatically.

38. Fred has a letter on file in which he wants to change the name, address, and date before making a printout. Using a word processing system, what would be the most likely sequence of his actions?

   a. Load, edit, save, print
   b. Load, save, print, edit
   c. Edit, save, print, reedit
   d. Edit, save, print, run
   e. load, print, save, edit, reprint

39. Which of the following is <u>not</u> a function of most data-base management programs?

   a. The ability to create a new file
   b. The ability to add, delete, or change records within a file
   c. The ability to word process documents
   d. The ability to sort file records
   e. The ability to retrieve records from a file

40. Which of the following is the most accurate description of a use for any data-base management computer software program?

   a. With a data-base management system, data can be analyzed statistically.
   b. With a data-base management system information is organized and stored efficiently so retrieval is faster and more reliable than manual filing systems.
   c. Term papers can be written using data-base management programs and stored for later retrieval and printing.
   d. Interactive educational lessons can be written and stored using data-base management systems.
   e. Program that teach problem solving skills can be written with a data-base management system.

41. Mike wants to purchase a software package for his personal computer that can be used to create templates for projecting production costs on his dairy farm. What type of software package would be the most appropriate for his needs?

   a. spreadsheet
   b. data-base management
   c. word processing
   d. statistical
   e. graphics

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42. Spreadsheet programs can be used to create

  a. business letters with extra wide horizontal margins.
  b. files that can keep track of and sort information about students such as student attitudes and attendance.
  c. a personal budget that can be used for projections of savings and expenditures.
  d. a mailing list that can be sorted alphabetically.
  e. extra wide lesson plans.

43. Which of the following types of computer applications would be the most appropriate for visualizing the percentage of people voting for each candidate in an election?

  a. word processor
  b. spreadsheet
  c. data-base management
  d. computer graphics
  e. statistical package

44. Which of the following types of computer applications would be the most appropriate for analyzing the amount of difference between students' scores on a test?

  a. word processor
  b. spreadsheet
  c. data-base management (grade book)
  d. artificial intelligence
  e. statistical package

45. Ms. Jones is using a software package that will list class scores and average scores. It can also be used to assist the instructor in choosing various lessons for different achievement levels. This is an example of using the computer for

  a. Computer-managed instruction.
  b. Computer-assisted instruction.
  c. tutorial programs.
  d. simulation programs.
  e. strengthening problem solving skills.

46. Which type of computer software is the most capable of recreating situations such as the electoral process, the operation of nuclear power plants, and the lunar landing to allow students to experience the situation?

  a. administrative
  b. tutorial
  c. simulation
  d. computer managed instruction
  e. drill and practice

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47. Which of the following best describes an application of computer managed instruction?

   a. Mr. Smith uses a computer in his classroom as a reward for students who complete their work quickly and accurately.
   b. Ms. Jones uses a computer and a software program that keeps track of course goals and objectives, student grades, student progress through lessons, and prescribes the instructional program for individual students.
   c. Mr. Johnson uses a computer in a business class to provide drill and practice for touch typing.
   d. Ms. Brown uses a computer and a simulation program to teach her science class about the space program.
   e. Principal Anderson uses an electronic spreadsheet to keep track of the school budget.

48. As an elementary teacher, with little programming experience, you have a gifted student needing accelerated lessons. Which of the following languages would be the most appropriate for you to use to write a simulation?

   a. FORTRAN
   b. COBOL
   c. BASIC
   d. PILOT
   e. PASCAL

49. When programming with LOGO, a student is <u>not</u> capable of

   a. directing a computer-generated turtle to draw on a video screen.
   b. writing BASIC programs that display graphics.
   c. programming music to accompany graphic displays.
   d. writing stories and printing them on the screen or paper.
   e. programming the turtle to do recursive actions.

50. As a teacher, which of the following programs would you expect to be the <u>most</u> effective computer-assisted instruction program to teach a new concept to students with a wide range of abilities.

   a. the program presents questions about the concept repeatedly until the student answers correctly.
   b. the program presents large amounts of information for the student to read, and then quizzes them over their comprehension of the information.
   c. the program presents information in a linear programming fashion, so all students receive the same information in the same order.
   d. the program presents information in a branching programming fashion, so students receive information based on their individual responses.
   e. the program contains many color graphics and makes sounds for reinforcement of correct answers.

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51. Which of the following would be the most appropriate first step in the development of a computer-assisted instruction program for use in a classroom?

    a. flowchart the lesson
    b. identify and organize the content to be taught
    c. select an instructional strategy
    d. identify specific objectives
    e. program the lesson with a programming language

52. Which of the following is the least important criterion to consider when evaluating and selecting a computer-assisted instruction program to teach a particular concept to a particular student or group of students?

    a. Does the program utilize the unique capabilities of the computer?
    b. Is the content accurate and properly sequenced?
    c. Does the program provide positive reinforcement and feedback to the students?
    d. Does the program keep record of the students' correct responses?
    e. Is the language used appropriate for the abilities of the students?

53. Mary wants to write some letters to prospective employers. She would also like to keep files on each of these employers detailing the size of the company, the type of position, and the job offers. Which personal computer hardware setup contains only the essential components to meet her needs?

    a. computer keyboard, printer, monitor, disk drive
    b. computer keyboard, disk drive
    c. computer keyboard, disk drive, printer
    d. printer, computer keyboard
    e. monitor, disk drive, printer

54. What software is the most appropriate to meet Mary's needs?

    a. a word processing package
    b. a data base management package
    c. both a word processing and a data base management package
    d. both a word processing and a spreadsheet package
    e. both a spreadsheet and a data base management package

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55. As a special education coordinator for math, every three weeks you receive a list of students from all the math teachers, grades 3-6, involved with remedial math sections. These lists state which modules their students have passed. You want to find a computer software package to print and update a master record of all students on the individual lists. Which feature would be least essential to have in the software package you'd select?

a. An arithmetic option that allows computing the average for a set of numeric data.
b. An option that allows files/records to be changed nonsequentially.
c. An option that allows files/records to be sorted numerically.
d. An option for sorting files/records character by character.
e. The ability to select and print a series of individual files/records.

56. As the owner of a small business, you have decided to use a microcomputer for word processing of such items as invoices, letters to customers, billing information, and annual reports. Which of the following hardware devices would not be essential to accomplish your needs?

a. a typewriter keyboard
b. a disk or tape drive
c. a video display
d. a dot matrix printer
e. a letter quality printer

57. As the director for computing services for a large business, what of the following criteria would you consider to be the least important when evaluating and selecting computer software programs for a specific purpose, such as record keeping, that will be used by a large number of personnel?

a. Is the program written in a user-friendly format?
b. Is it possible to easily modify the program to better meet the needs of the users?
c. How much time and energy will be required for the personnel to learn to use the software accurately.
d. What are the needs of the computer users, and does the program meet those needs?
e. Is the program written in a computer language that most of the users are proficient at?

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APPENDIX D

RAW DATA FROM THE CONTROL GROUP

RAW DATA FROM THE CONTROL GROUP

ID#	SEX	AGE	PRIOR EXP	COMP SYSTEMS PRE	COMP SYSTEMS POST	COMP APPS PRE	COMP APPS POST	COMP ANXIETY PRE	COMP ANXIETY POST	LITERACY PRE	LITERACY 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

RAW DATA FROM THE EXPERIMENTAL GROUP

ID#	SEX	AGE	PRIOR EXP	COMP PRE	SYSTEMS POST	COMP PRE	APPS POST	COMP PRE	ANXIETY POST	LITERACY PRE	LITERACY 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

REFERENCES

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

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

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

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

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

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

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

Cambre, Marjorie A., and Cook, Desmond L. "Measurement and Remediation of Computer Anxiety," Educational Technology, 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," Elementary School Guidance and Counseling, December 1987, pp. 149-155.

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

Chen, M. "Gender and Computers: the Beneficial Effects of Experience on Attitudes," Journal of Educational Computing Research, 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 School 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," Association for Educational Data Systems Journal, 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," Journal of Early Adolescence, Vol. 7, 1987, pp. 13-19.

Livermann, A. "Computer Literacy: A National Crises and a Solution For It," Byte, 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," Journal of Computer-Based Instruction, Vol. 16, No. 1, Winter 1989, pp. 20-28.

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

Marcoulides, G.A., "The Relationship Between Computer Anxiety and Computer Achievement," Journal of Educational Computing Research, 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," Computer Education, Vol. 11, No. 3, 1987, pp. 177-180.

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

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

Nairbitt, John. Megatrends. 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.