THE ASSOCIATION BETWEEN EXPOSURE TO COMPUTER INSTRUCTION
AND CHANGES IN ATTITUDES TOWARD COMPUTERS

DISSERTATION

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By

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The problem with which this study was concerned is the association between exposure to computer instruction and changes in attitudes toward computers.

The study had a two-fold purpose. The first was to determine the attitudes of undergraduate students toward computers. The second was to determine whether exposure to information about computers and their uses is associated with changes in students' attitudes toward computers.

A computer literacy test was administered to subjects as a pre-and post-test. The major findings of the study indicate that there were significant, positive attitude changes among students exposed to computer instruction. There were also significant increases in knowledge about computers among participants exposed to computer instruction. The major conclusions are that attitudes are not fixed and develop in the process of need satisfaction. Participants in the study experienced attitude changes, which supports the suggestion that attitudes are developmental. Furthermore, the attitude
changes observed in the study occurred in the process of learning about computers, a process assumed to be rooted in the educational and/or career needs of the participants. Attitudes are shaped by the information to which people are exposed. Attitude modification seldom, if ever, occurs in a vacuum. Instead, it most often takes place in the context of information dissemination and exposure. In this study, attitudes toward computers changed positively and significantly as participants were exposed to information about computers.
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CHAPTER I

INTRODUCTION

The computer revolution is here, and the arrival of a computerized society is being announced (5, p. 1). From the pages of news magazines and daily papers, on radio and television, the same message is heard: the computer revolution has begun. Toffler, writing about the development and power of the modern computer, stated,

The computer burst upon the scene around 1950. With its unprecedented power for analysis and dissemination of extremely varied kinds of data in unbelievable quantities and at mind-staggering speeds, it has become a major force behind the latest acceleration in knowledge acquisition (10, p. 31).

Computers appear to be revolutionizing every aspect of modern life. The stores in which people shop, the offices where they work, the cars they drive, the banks that handle their money, the games they play, and even their television sets are being radically altered by computers. Burck described the change when he wrote,

No other technical innovation has changed so many human activities in so short a time. An extension of man's brainpower, it is transforming science, medicine, government, education, defense, and business. It may transform man himself (3, p. 101).

Couger and McFadden, in 1981, writing about the uses of computers, reported that
as recently as 10 years ago, the average person rarely had direct contact with a computer system. However, that situation has dramatically changed. Today we are affected by computer systems in almost every part of our lives -- educational, business, social, service, religious and recreational (6, p. 3).

As technological developments continued to increase, computers became cheaper, smaller, and faster. With the decrease in cost and size, more and more governmental agencies, businesses, and educational institutions began using computers. This increase in computer usage created a great demand for personnel trained as systems analysts, programmers, and operators. This was evidenced by the following statement from Data Processing: Atlanta.

One of the most serious limitations on the rapid growth in the nationwide use of computers in business is the shortage of qualified people to operate machines, prepare data, and analyze business problems so they can be stored by computers (2, p. 13).

In 1981 Zimmerman cautioned that by the year 2000 those who cannot use a computer will be unable to perform many computerized day-to-day activities. This will also exclude those same people from the corridors of power (12, pp. 355-367).

The demand for trained personnel in computer science has been increasing. According to a 1984 report from the Labor Department (11, p. 178), in 1982 there were 266,000 people working as computer programmers. Furthermore, there was no universal training for computer programmers; most computer programmers were college trained. When computers were first implemented, systems analysts were trained on the job (1, p. 214). Only later did community and junior colleges begin
training people to work with computers (2, p. 214). During the 1960s, colleges and universities began offering degrees in computer science. The article in Data Processing: Atlanta stated that the employment for computer programmers is expected to grow faster than the average for all occupations through the mid-1990s, as computer usage expands (2, p. 179). The report further noted that 254,000 persons worked as systems analysts in 1982 (2, p. 59).

Thomas Miller of Control Data Corporation predicted correctly in 1983 that four of the five professions that would experience the greatest growth in the next five years would deal with computers (8). Naisbitt noted that "75 percent of all jobs by 1985 will involve computers in some way" (9, p. 33).

The computer revolution is making itself felt in every area of society, and the educational world is certainly no exception. Networks now allow students and instructors access to a quantity and quality of information formerly too expensive to obtain. The expanding use of computers in society, combined with increased public awareness of their importance, has put pressure on educators to introduce programs such as computer-managed instruction (CMI) and computer-assisted instruction (CAI). Computers are now used for many functions in higher education. Campus maps show buildings labeled "Computer Center." University organization charts show high-level administrators with responsibility for
computing or data processing. Terminals, keypunches, and minicomputers can be seen in laboratories and work areas. A glance into trash baskets and recycling bins provides tangible evidence of much computing activity.

The demand for computer courses in education is particularly noticeable at large universities. The computer science curriculum at any educational institution should be flexible and broad enough to meet the interests and needs of the students. It is an administrative responsibility to evaluate the activities offered in the curriculum. In order to measure the curriculum's flexibility, attitudes should be assessed. The results may be used to indicate students' attitudes toward specific activities and toward computer science in general. The importance of attitudes has been expressed by Allport.

Attitudes determine for each individual what he will see and hear, what he will think and what he will do. To borrow a phrase from William James, they "engender meaning upon the world"; they draw lines about and segregate an otherwise chaotic environment; they are our methods for finding our way about in an ambiguous universe (1, p. 806).

Many people seem to feel that computers are not readily accepted by the public at large. Lirtzman (7), for example, has observed that "you go into the street and ask anybody what he or she feels about an automobile and you will get certain kinds of warm rumblings. You ask the same individual what he or she thinks about computers and you take your life in your hands" (7, pp. 7-11). Automobiles are a casually
accepted part of our lives, but computers, which may affect us more than our automobiles, are feared and often hated. People need to overcome their fear of computers in order to more easily deal with them in the school, home, and business world.

The current widespread use of computers demands that human attitudes toward computers be studied for at least two reasons: first, to correct the fallacious notion that computers are something to be feared; and second, to aid researchers in the development of computers.

Problem

The problem of this study was the association between exposure to computer instruction and changes in attitudes toward computers.

Purposes of the Study

The purposes of the study were (1) to determine the attitudes of undergraduate students toward computers, and (2) to determine whether exposure to information about computers and their uses is associated with changes in students' attitudes toward computers.

Hypothesis

There will be no difference between the post-instruction and pre-instruction attitudes of students toward computers.

Delimitations of the Study

The following limitations affected this study.
1. The study was limited to students enrolled in introductory computer science courses at North Texas State University, Denton, Texas.

2. The individual teaching styles of the instructors involved were not an experimental variable.

3. No control group was included in the research.

Research Design

Since there was no control group to compare the results of those receiving the treatment, the research design was quasi-experimental (4). The design can be used to show that changes in attitudes are associated with exposure to computer instruction, but it cannot be used to prove that an attitudinal change is caused by exposure to information about computers.

Significance of the Study

A good way to find out how people feel about something is to ask them. Most computer science departments do not know how the typical college student feels about computer science. The results of this study will be valuable to the Department of Computer Science in making future plans and decisions concerning service programs at North Texas State University.

One important principle of education is that teachers should set the stage for learning and for the performance of desired practices. To assist them in accomplishing this goal, they should endeavor to create a favorable attitude toward the
learning situation and toward the desired practices. Attitudes play a role of major importance in changes that occur during the learning experience. Attitudes existing at the end of any given period of instruction are no less important than the attitudes existing at the beginning and throughout instruction. The development of favorable attitudes toward computer science is an implied objective of most professional teachers in the field. It is hoped that a favorable attitude will influence a desire for learning more about computers in this society.

Summary

The purposes of this study were (1) to determine the attitudes of undergraduates toward computers, and (2) to determine whether or not exposure to information about computers and their uses is associated with changes in students' attitudes toward computers.

The hypothesis for this study stated that there would be no difference between the pre-instruction and post-instruction attitudes of students toward computers.

Organization of the study

The remainder of this study is divided into four chapters. Chapter II contains a review of the literature related to attitudes of people toward computers. Chapter III describes the methodology used for data collection and
treatment of the data. Chapter IV reports the analysis of data collected and includes a discussion of the findings. Chapter V includes summaries of the study and the data findings, conclusions, and recommendations for future research.


CHAPTER II

REVIEW OF RELATED LITERATURE

This review of the literature presents a coverage of relevant areas providing a theoretical frame of reference. Literature concerning each topic is discussed as it pertains to the purposes of the study.

Theoretical Frame of Reference

The concept of attitude has played a major role in the development of American social psychology. Kiesler and others explained that before World War II, social psychologists devoted their efforts to attitude measurement and scaling (20). Thomas and Znaniecki first studied attitudes formally in 1918. People have attitudes for many reasons. Attitudes help people understand their world by organizing input from their environment, and they allow us to express fundamental values (43).

In the English language the word "attitude" has more than one meaning. The word is derived from the Latin "aptus," meaning "fitness" or "adaptableness." Attitudes are related to our beliefs and include our likes and dislikes. Attitudes are structural reminders for our responses to various situations, objects, persons, groups, or any identifiable
concept in the environment. Likes and dislikes have roots in individuals' cognition, emotions, behavior, and social influences (7).

"Attitude" is defined by Triandis as "an idea charged with emotion which predisposes a class of actions to a particular class of social situations" (43, p. 2). The term "attitude" is composed of cognitive, affective, and behavioral components. The cognitive component is an "idea which is generally some category used by humans in thinking. Categories are inferred from consistencies in responses to discriminably different stimuli" (43, p. 3). The affective component is "the emotion which charges the idea" (20, p. 3). The behavioral component is "a predisposition to action" (43, p.3).

Other definitions of "attitudes" have been given by other psychologists, such as Allport (2), Krech and Crutchfield (22), Newcomb (36), and Rokeach (39), all of whom emphasized referents of attitudes. However, Allport's definition is generally considered to be the most viable.

An attitude is a mental and neural state of readiness organized through experience, exerting a direct and dynamic influence upon the individual's response to all objects and situations with which it is related (18, p. 412).

Attitudes can be described as internal states that affect one's choices of behavior within a given situation. For example, a person's attitude toward computers could have an influence on a person's response to computers. Authorities
generally agree that attitudes are true indicators of behavior, although there is nearly always a certain amount of discrepancy between the two. Attitudes are of great importance from an educational standpoint because of their potential influence on learning.

Attitudes, as suggested by Allport (3), are dependent upon experience which reveals that attitudes are learned. If this is true, one could then ask the question, where are attitudes learned? Possible influences on attitudes could be schools or peer group pressure. Another question is whether or not experience is necessary before a person can form an attitude about something. Can a student, for example, have an attitude about computers without having seen or used one? What factors have contributed to attitude formation in students who have used computers?

According to Allport, the attitudes displayed by an individual determine what an individual sees, hears, thinks, and does. An attitude toward any object, if that attitude is fully internalized, will be very difficult to change (3).

Attitudes are composed of beliefs and values, and all attitudes share common elements. All have a psychological basis. That is, they are related in their operations. Beliefs consist of assumptions that may or may not have any basis in fact. Values are basically a desire for the truthfulness of a belief.
Formation of Attitudes

Krech and others (23, pp. 180-214) have suggested how attitudes are formed. Attitudes develop in the process of want satisfaction (23, p. 181). Favorable attitudes develop when the want is satisfied. Unfavorable attitudes develop when the achievement of goals is blocked.

Attitudes of individuals are shaped by the information to which they are exposed (23, p. 186). Therefore, information has a definite impact on attitude formation. Acceptance of information depends on the authority of the source and the wants of the individual. If information lacks validity, negative attitudes develop. Negative attitudes can also develop from insufficient information. Group affiliations of individuals help determine the formation of their attitudes (23, p. 191). For a certain attitude to persist, an individual must have the support of like-minded persons.

Attitudes of the individual reflect his or her personality (23, p. 199). Attitudes diversify because of the existence of personality differences among individuals. As Gagne suggested (13), attitude formation occurs upon identification of a human model. One cannot suggest that the computer can be modelled by a human, but one could suggest that the attitudes shown could possibly be a reflection of the attitudes of the instructor who provided the computer. The students see the instructor's positive attitude to the
computer and model their own attitude on his. Another suggestion is that the learner recalls pleasant learning situations when the special attributes of the computer are emphasized.

Changing of Attitudes

The basis for change, according to social psychologists, is interaction among human beings. The definition of interaction is the process by which people influence one another through mutual interchange of thought and feelings (24). There are three forces that affect interactions: (1) change forces, which motivate people to change, creating satisfaction and favorable judgment of potential future situations; (2) resistance forces, which motivate people not to change; and (3) interference forces, which obstruct change without being directly related to it (29, p. 6).

Therefore, in order to introduce attitude change successfully, the instructor relies upon the quality of the change program and the degree of acceptance by the students who will implement the change. There must be a perceived discrepancy in order to stimulate a needed change between the change target and performance (47). This discrepancy creates what is known as a performance gap and is used as a stimulus then to search for alternative ways of responding. This performance gap may be identified either within or outside the change target.
The instructor often fails to recognize the importance of learner acceptance, increasing the probability of learner resistance. Individuals learn to resist change, which is not a natural response (33). It is well-known that unsatisfied needs are the primary motivators of human behavior (25). Change in a person's life produces an environment full of unsatisfied needs. The learner, when faced with a change situation, may find it impossible to satisfy dominant needs. This may result in a state of negative tension, producing other negative consequences such as frustration, anxiety, and fear. Because of the negative tension state individuals learn to resist change (33).

If a person believes he is in a change state, or fears potential changes, then he will act as if there have been changes. Resistance takes many different forms and is a result of many different situations. There is no list of typical behavior which can be described as the symptoms of resistance (48). Some behavior is an attempt to protect oneself from the consequences of change in order to avoid negative tension. However, not all opposition to change is merely a defensive mechanism. If the opposition to change is logical and grounded on well-supported reasons, then it should not be dismissed as resistance. Zander's concept, based on psychotherapy, states that resistance occurs when an individual is faced with the unpleasant necessity of giving up behavior. This resistance manifests itself in the form of
hostility, either openly or implied. This aggression may be
directed either at the change itself or at the initiator of
the change (48).

Misunderstandings can arise if the nature of the
change is not clear to the learner (48). Resistance is
likely to occur if the learner is unfamiliar with the relevant
facts (33). Poorly defined goals create ambiguity,
uncertainty, and anxiety for those that will be affected by
the change (47). Unless the instructor reveals the learners'
misunderstandings and clarifies them rapidly, they can lead to
resistance. This resistance can surprise the instructor, who
may not realize that misunderstandings exist (21, pp. 106-
114).

The learner may assert the fact that change, even change
for the better, can cause a disruption of the status quo, and
this can even have negative consequences. An example of this
might be that increased use of the computer in society
eliminates jobs, or that use of computers in education results
in less personal interaction between teacher and student. As
in every major objective, the pros and cons have to be
weighed. People will always disagree, because their
motivational attitudes are different. To be able to overcome
resistance, instructors must first learn to recognize it among
their students. Different people see different meanings in
any proposed change (48).

Students also resist change because of a low tolerance for
change. They feel they will not be able to develop the new skills and behavior required of them. They believe that the computer is both strange and frightening.

Review of the Literature

Computers as we know them arrived on the scene less than forty years ago. Their development has spanned a long line of technological advances. Computers have a beginning with early counting devices and mechanical calculating units.

The vacuum tube was a major technological development for computers. The transistor followed as the next major advance, developed in 1947 by Bell Laboratory scientists (32, pp. 2-12). The most recent technological development is the use of microelectronics, and the placement of thousands of circuits on a chip no larger than a fingernail. Initially, the public viewed the computer either as a toy or a scientist's tool, or a thing to be feared (32). In 1977, some computers became known as amusing toys when Tandy Corporation marketed the first complete personal computer, the TRS-80. Today there are millions of computers in use in the United States alone. It was forecast that there would be at least forty-eight million computers in the United States by 1995. In addition, it was predicted that the number of users would increase (32).

In the first three decades of the computer age, we have witnessed the computerization of society. The computer revolution has also had some negative consequences, such as problems concerning individuality, privacy, uses of power,
and automation. The computer has become the prime symbol of our rapidly changing world. Many people have computers thrust upon them in the workplace, the marketplace, and even at home. How do these individuals feel? What is their attitude toward computers? What should people know to be able to function as a contributing member of a society which uses computers in the school, home, and business?

The widespread use of computers today demands that we study human attitudes toward computers for at least two reasons. First, we need to better understand and correct the fallacious attitudes some people have toward this integral component of modern life. Second, we must understand those attitudes so that we may be better able to correct those negative attitudes and aid the research and development of computer technology. In 1978, reports of the National Council of Supervisors of Mathematics included the following statement.

*It is important for all citizens to understand what computers can and cannot do. Students should be aware of the many uses of computers in society. Such as their use teaching/learning, financial transactions and information storage and retrieval. The "mystique" surrounding computers is disturbing and can put persons with no understanding of computers at a disadvantage. The increasing use of computers by government, industry, and business demands an awareness of computer uses and limitations (14, p. 613).*

Educators believe that a good way to reduce computer misunderstandings and fears is to introduce children to computers in school. In a pilot study in 1979, sixth-
grade students were introduced to microcomputers in order to develop "logical thinking skills." The students were given instructions on how to program the Apple II microcomputer to draw color graphic designs. They were then given similar problems to solve using the commands they had learned. Each lesson consisted of a simple program with a short explanation of the new statements, a sample run, and a series of simple program changes for the student to follow. These activities allowed the student to discover how the statements in the program affect its outcome. Also, problems were posed that required the student to combine statements in a sequential order in order to solve a problem. As a result of working on these questions, the student received a working understanding of practical problem-solving skills. Piele found that boys and girls were equally interested in learning programming skills. Interest in microcomputers was so high that the students wanted to participate in a large number of facilities. Students arrived early and left late from the school in order to spend more time with computers. Students in sixth-grade classes were very enthusiastic about working with a microcomputer (38).

In contrast, students at a nearby high school who had not been exposed to computers were not interested in learning how to use them. Perhaps by this time, the older students had other activities that were more relevant (38, pp. 132-134). Piele further found that two variables affecting attitudes...
about computers at first contact were gender and age. He also found that in a nearby high school in which computers had not been displayed to students, tenth-graders expressed little interest. It was indicated that gender and age have related patterns (38, p. 132).

Lee, in 1970 conducted a survey of the views of the American public toward the computer and its significance in terms of two independents beliefs and attitudes. He used a sample of three thousand people, aged eighteen or older. His twenty-item questionnaire, divided by factor analysis, yielded two independent factors. Factor I, the "positive factor," the "Beneficial Tool of Man Perspective," described a positive set of beliefs that computers are beneficial in science, industry, and business. This factor represented the majority view. Factor II, the "negative factor," captured the science fiction view of the computer. Because these machines challenge one's concept of the superiority of human thought, the subjects felt inferior. Lee centered on the second factor because of the disquieting and emotional significance of this anthropomorphic view of computers (26, pp. 53-59).

Six psychosocial attitude scales were developed by Lee. They included familiarity with the world of business, interest in current affairs, respect for the new and different, intolerance of uncertainties and ambiguities, trusting optimism, and alienation. Intolerance of ambiguity accounted for 23 percent of the variance in Factor II. Also,
in Factor II the strongest social-class indicator was education. Lee suggested that education increases a person's ability to tolerate ambiguity and uncertainty. Lee suggested that the computer was an object of social perception. "How individuals perceive it and give meaning to it depends very much on their fundamental values, on their personality dynamics, and on their basic orientations toward life" (26, P. 59).

Ahl, in 1976, conducted surveys of attitudes of educators and the general public toward computers. He found that most people were optimistic about the benefits the computer can bring to society. Ahl classified his general public sample of 843 subjects into adults (those twenty-one years and older) and youths (those twenty years and younger). Ahl's questionnaire used a five-point Likert-type format, later modified to twenty-three questions by Litchman in 1976, used to measure the general public's attitude toward computers in society. The seventeen items were arranged into four categories: (1) Computer Impact on the Quality of Life, (2) Understanding the Role of Computers, (3) Computer Threat to Society, and (4) Understanding the Computer Itself. He simply described results item by item and made no attempt to create a scale which might be used to generate a composite score reflecting a person's beliefs about computers (1, pp. 77-70).

On the whole, respondents felt that the computer would improve the quality of life in the areas of education, law
enforcement, health care, and prevention of fraud. Young people and students saw somewhat less improvement from the use of computers than adults. Respondents were mixed in their feelings about the threatening nature of computers. Most felt they were unable to escape the influence of the computer. Nearly half of them saw computer predictions influencing the outcome of elections. More than one-third felt that computers dehumanize society to some extent. About fourth of them saw the computer taking more jobs than it created. About one-fifth of them saw the computer as having an isolating effect on programmers and operators. Respondents saw computers replacing low skilled jobs and creating just as many jobs as they eliminated. Young people were not as optimistic (1, p. 79).

Lichtman (28) modified Ahl's questionnaire about public attitudes by adding six statements to make it more applicable to educators. Educators were separated into two groups loosely referred to as "teachers" and "administrators." Lichtman did not calculate significance tests for the differences among the four groups (adults, youths, teachers, and administrators). Comparison of the percentages implied a trend of teachers toward more negative responses to computers than the other three groups. For example, the teachers regarded computers as a more isolating influence in society. They did not feel confident in their ability to handle computers, nor in their ability to protect the privacy of
individuals. They also questioned to a greater extent the computer's favorable impact on law enforcement, health care, and education. Teachers did not believe that computers would eliminate their jobs. Lichtman provided no explanation for the differences among the groups (28, pp. 44-50).

Instructors of computer science should not only be able to detect resistant students in computer science but should be able to remind those students of Atchison's statement that "many of the so-called methods of computer science are really methods used by good mathematics teachers through the years" (6, p.95). Perhaps if students realized the possible personal benefits to be gained by studying computer science, they would lose some of their negative attitudes about computers. Common activities in mathematics and computer science include problem organization and analysis, algorithm construction, use of literative processes, solution refinement, and use of problem-solving heuristics in general. However, some activities and methods, although useful in mathematics, are more commonly employed in the area of computer science, e.g., flowcharting and top-down design.

The value of a computer science course to mathematical thinking is great. It also has unique benefits in mathematics, and it also has unique benefits of its own. Students should be reminded that, through a computer program, certain heuristics or problem-solving methods which are often difficult in the abstract become viable in the applied
computer science setting. The value of programming to
mathematics education in general has been well-reported by
Milner (1972).

In writing programs, students get the opportunity to
apply their knowledge, manipulate subject matter, and
engage in active learning. Through the writing of
algorithms, which are unambiguous statements of processes,
and the subsequent computer programs, students can
explicate their thought and articulate their intellectual
activities (34, p. 4183).

One attitude about the computer that has become
significant can be called computer anxiety. This phenomenon
is closely related to one that is common in the field of
mathematics. The difficulty or complexity of adapting to
computerized technology has resulted in problems for other
implementation processes. Numeracy is a relevant problem of
computer technology associated with this complexity (37, pp.
8-10). People who perceive themselves as non-numerate
associate anxiety and fear with all things mathematical. The
non-numerate does not have the same perception of mathematics
as the numerate. Feelings of hostility and negative responses
are experienced by the non-numerate when exposed to training
that explains the idea of mathematics. These same attitudes
are associated with the lack of acceptance of computer
technology because of fear and anxiety based on their
individual perceptions (37). There is a definite parallel
between those who avoid mathematics because of anxiety and
those who avoid computers because of anxiety. There are
gender differences in mathematics ability, but that does not
change the fact that fears are a result of situational anxiety and a product of cultural norms (42).

The non-numerate exhibit varying degrees of anxiety when required to learn about or use computers, and therefore have more than the usual difficulty in mastering computer skills. Jay (19) explained the negative attitudes as computer anxiety or "computerphobia." Computer anxiety has many forms. Some of these anxieties take the form of hostility or fear. Such feelings would certainly hold a person back from learning how to manipulate a computer program. In 1978, Pennema and Sherman described how a similar fear of mathematics held back a participant's progress in mathematical study (12, pp. 47-48). Unfortunately, the existence of computer anxiety has only been described anecdotally from observation of the difficulties of individual students (19).

A strong relation between mathematical competency and probable success in beginning computer science courses was found by Wileman and Stephens in 1982. The subjects of their study were students enrolled in an introductory course in computer science during the fall semester of 1980. This technical computer science course included computer utilization, structured programming, algorithms, data representation, and computer organization. The results of the study indicated that students who score high on mathematical instruments are more likely to succeed in introductory computer science courses (46, pp. 20-22).
Griswold, in 1983, considered the effects of sex, age, number of college mathematics courses, and mathematics skills, on awareness of computer applications. The subjects were 119 graduate and undergraduate education students. The focus of control was found to be a better determinant of computer awareness. Mathematics skills as related to computer awareness was partially supported. According to the results, not the basic mathematics courses but the number of mathematics courses was related to awareness of computer applications (15, pp. 92-103).

Hannafin and Cole in 1983 (16) conducted a survey that attempted to identify the factors affecting the voluntary selection of computer courses and to examine differences among such factors as a function of prior computer courses experience and gender of students. The subjects included 115 students. The results showed significant differences in computer experience and in perceptions of science and mathematics. The study indicated that students who have experience in science and mathematics have less difficulty in computer classes than students who have no experience in science or mathematics. This tendency could be the result of increased sensitivity to the types of work in computer courses, due to the experiences in science and mathematics. It could also be that those students were simply brighter academically and did not perceive the mathematics or science components of introductory computing as especially difficult.
It is important to note, however, that inexperienced students may have miscalculated the complexity of the courses and failed the course as a result.

The Hannafin and Cole study appeared to show that students identified computer courses with science courses, rather than any other areas in their study. The computer courses offered by the schools in that study were taught in computer science departments. Therefore, inexperienced students would most likely be affected by departmental affiliation and linguistic labels such as "computer science." This was unfortunate, because it probably was a discouragement to selection of courses.

Students in the Hannafin and Cole study, from a practical standpoint, displayed significant differences in academic skills and intellectual ability. The study also indicated that students who had varied computer experience do not perceive the computer as the domain of the intellectually gifted, but more as an area for students with higher mathematics and science skills. Therefore, the need to resolve students' misunderstandings of the academic demands of introductory level computer courses appears to be genuine.

It has become apparent that certain computer-related perceptions vary with experience. However, it is not known to what degree these perceptions are modified. The study found that student approval is not formed exclusively by a person's experience in computer courses. Initially students with
positive attitudes migrate toward computer courses. In the same sense that positive perceptions attract students, negative perceptions very likely discourage students (16).

Traditionally, mathematics has been viewed as a predominantly male occupation. Unfortunately, computer science may also fall into this pattern because many women have various degrees of anxiety about mathematics (30, pp. 16-18). Mathematics and technology generally have been regarded as male domains (4, pp. 10-12). Recent attempts to end traditional inequities through access to education and employment have kindled a new awareness of gender differences in these areas. In particular, the field of computer technology has improved its record of the number of female graduates. According to The Chronicle of Higher Education, in 1980, over 11,000 baccalaureate degrees were conferred in computer science in the United States. Of these, only thirty percent were awarded to women.

Vredenburg and others (1984) conducted a study to investigate gender differences in attitudes, feelings, and thoughts toward computers. The subjects included 157 male and 305 female undergraduate students who were asked to complete a self-report questionnaire. The critical findings of the study were found in the patterns of similarities and differences between male and female subjects. Individuals of both sexes felt equally strongly that there existed a real need for computers, that computers were extremely capable, and that it
was vitally important for schools to have them. Moreover, there were no gender differences reported about access to computers. Neither were there any gender differences in intent to enroll in computer courses in the future, nor in the preference to use a computer versus reading a book, watching television, or seeing friends. Thus, males and females perceived themselves as having equal opportunity to work with computers. They appeared to differ in their general attitudes, beliefs, and knowledge with regard to computers. The differences seemed rather startling. Males were more likely to have actually used a computer, to have been currently enrolled in a computer course, to be in favor of having a computer in the home, to be able to recall a greater number of computer brand names, and to have expressed an intention to purchase a computer (44, pp. 24-28).

According to the Minnesota assessment (5), significant differences have been found in computer literacy and computer use by race. Hueftle, Rakow, and Welch in 1983 reported that black students are much less likely than white students to report engaging in science related activities (17).

A letter to Education Week stated that "there is a great danger that computers may simply add to the inequity of our society by being adopted only in suburban upper class districts and in private schools with boys being the favored users" (27).

Watt, in 1982, came to similar conclusions. He found that
Computers were more likely to be used for programming in affluent suburbs than in less affluent urban and rural areas. He concluded that computers, as currently used, may reinforce existing socio-economic inequities and might not foster educational equity (45). Thus, literature has described gender differences among computer students, and ethnic differences, and geographic and socio-economic differences.

Computers are used more often by English-speaking students than by minority students, for many reasons. First, and perhaps most importantly, the minority students often have less access to computers. Growing numbers of students are learning about computers at private computer camps after school or on weekends. Again, almost all of the students who attend these programs are white, native English speakers. Most minority parents do not have the resources to allow their children to participate in these programs (8, pp. 30-31). However, computer use is limited. If the computer serves primarily white, English-speaking males, from higher socio-economic backgrounds, then we are increasing the schism between different socio-economic groups of students (8).

Lack of knowledge and experience with computers can decrease a student's feelings of self-confidence in computer competency. Fear results from resistance to the change involved in dealing with computers. Resistance to computers has also been evinced in a lack of training. Grossnickle, Laird, Cutter, and Tufft (10) assessed the efforts to
implement microcomputers at Palatine High School in suburban Chicago. One hundred and fifty-three questionnaires were sent to the faculty, seventy-four were completed and returned. Of those faculty members responding, only twenty-two reported use of microcomputers, with fourteen of those reporting that it was used seldom. There were twelve departments within the school, with seven reporting some use of microcomputers. These departments were primarily those that have traditionally been exposed to the use of the computer.

When respondents were asked why they did not use microcomputers, 66 percent responded with "lack of training," 30 percent reported "lack of ability," and 12 percent responded with "computer phobia." These responses may also be an attempt to rationalize an overriding lack of desire to change established teaching routines (10, pp. 17-20).

The formation of positive attitudes is a process for instructors of all disciplines. The idea that exposure to anything, even computers, positively affects attitudes has been supported. Some scholars believe that computer experience is significantly related to more positive attitudes by the user (35). Others only emphasize the demonstrated relation between use and attitudes (31).

Zoltan and Chapanis, in 1982, conducted a survey to investigate the attitudes of certified public accountants (CPA's), lawyers, pharmacists and physicians toward computers. This study involved a sixty-four-item
questionnaire distributed through the mail to these professionals in order to determine their experience with, and attitudes toward, computers. In the study, 161 respondents indicated that they had received some form of computer training, and 360 respondents indicated that they had never learned how to use the computer. Statistical analysis revealed significant attitudinal differences between persons who have learned to use computers and those who have not. Those who have learned to use them show a more positive attitude toward computers than those who have not learned to use them. The respondents who participated in the study felt strongly that computers needed to be easier to use, and that computer programs needed to be simplified and altered to allow the use of familiar language (31, pp. 55-68).

Computer experience may also be related to attitudes toward the computer. The amount of experience with computers is expected to be a significant factor in computer attitudes because anxiety is produced in part by a lack of familiarity. As students become more familiar with computers, it is expected that computer anxiety will decrease and that computer confidence will increase.

Loyd and Gressard, in 1985, described their study of 354 high school and college students, examining the effects of age, sex, and computer experience on the attitudes (computer anxiety, computer confidence, and the like) measured by a computer attitude scale. Computer experience was found to be
significantly related to more positive attitudes. In general, the results suggested that the students had fairly positive attitudes toward computers. Computer experience was found to be a major factor in all three computer attitudes (computer anxiety, computer confidence, and computers, and the like). An increase in computer experience corresponded to a more positive attitude. Neither the amount nor the nature of computer experience was experimentally controlled. Therefore, it was not possible to determine whether or not more computer experience was directly related to computer anxiety (31, pp. 67-77).

Late in 1982 a committee of experts on computer technology in California was drawn from the public school system, universities, and industry. The committee designed and constructed a test that assessed a wide variety of instructional objectives in the area of computer studies as well as attitudes towards computer technology and relevant experience with computers. The test permitted reliable reporting of scores for thirty district objectives in the areas of computer literacy and computer science. The tests were completed and returned by a representative sample of 17,861 students in December, 1982. This report concluded that a large majority of students had no experience programming a computer. The more optimistic conclusion of this study was that programming experience, particularly in school, but at home as well, was associated with markedly
higher test scores. This conclusion reflects substantial progress in implementing programs in computer studies (9, pp. 68-70).

Enochs, in 1984, conducted a study that investigated the effect of beginning computer instruction on the general attitudes of fifth grade students. Results indicated that the group receiving the instruction in computer programming showed more positive attitudes toward computers following the instruction (11, pp. 24-25).

Swadener and Hannafin, in 1987, conducted a study of the similarities and differences in computer-related attitudes between sixth grade boys and girls of different mathematics achievement levels. Subjects for the study included thirty-two randomly selected sixth grade students. They were selected from two schools in a moderately sized, middle-class, suburban/rural school district. The community had a combined Spanish origin and non-white minority population of about 15 percent of the population. The students were stratified according to gender of student, and level of mathematics achievement high or low. Mathematics performance was determined based upon the level of achievement among the students on a district-wide criterion referenced mathematics skill test. The study tentatively suggested that boys and girls at this level respond with far greater similarity than difference. Furthermore, self-confidence may be an important factor in regard to computer participation (41, pp. 37-41).
In 1981 Stephens identified group differences in computer aptitude based upon the factors of age, gender, number of years in college, hours worked, previous computer experience, estimated high school performance, and estimated current college performance. Significant group differences were found for the factors of age, previous computer experience, and both estimated performances (40, pp. 84-95).

Summary

The coming of the computer age has affected the educational, business, and even recreational areas of our lives. Several studies discussed the importance of different variables in regard to their influence on an individual's attitude toward computers. These variables included age, gender, computer experience, computer anxiety, and mathematics skills. Gender, age, and race differences have shown to be important factors affecting computer competency. The social significance follows from the impact that inequities in economic and educational opportunities will have on the career lives of individuals who do not have the requisite technological skills. There are many possible explanations for these differences in the access and use of computers. Since experience variables accounted for some variance in computer literacy, it is possible that with greater access and more use, the overall gender differences would disappear.

This review of the literature showed that lack of computer experience was a cause for computer anxiety. Some studies
suggested that fear of computer technology was a major component of computer anxiety. In other words, although computer anxiety and experience levels were significantly related to one another, it was not clear which variable was the cause and which the effect. The amount of experience with computers was expected to be a significant factor in computer attitudes because anxiety was produced, in part, by lack of familiarity. As students became more familiar with computers, it was expected that computer anxiety would decrease, and computer confidence increase. An increase in computer experience corresponded to a more positive attitude towards computers. It was not possible to determine from the literature, whether or not more computer experience directly related to a more positive attitude toward computers.
CHAPTER BIBLIOGRAPHY


12. Fennema, E., and J. Sherman, "Sex-Related Differences in Mathematics Achievement and Related Factors: A


CHAPTER III

Procedures of the Study

This study was conducted to determine the association between exposure to computer instruction and changes in attitudes toward computers. This chapter discusses the methodology utilized in conducting the research. All procedures and techniques used are discussed in detail. These include the sources of data, techniques for collecting the data, the preparatory steps which made the study possible, and methods of analyzing the data.

Population and Sample

The population consisted of 500 students voluntarily enrolled in computer science courses. Of 500 students, only 160 questionnaires were administered. The students were enrolled in Computer Science 1100: "Introduction to Computer Science," an introductory course for all computer science non-majors at North Texas State University, during the Spring semester of 1986. There were fourteen classes of Computer Science 1100. The classes were taught by eight different instructors. The subjects for this study constituted an availability sample from students enrolled in these classes.
An availability sample is one in which subjects are chosen because they are easily accessible to the researcher. Availability samples represent a kind of purposive sample and are the most typical type of non-probability sample used in research (9, p.437). One hundred and sixty pre-test questionnaires were administered from an initial pool of 500 population. This pool was later reduced to 109 students who completed both the pre-test and post-test.

Collection of Data

To collect the data, all graduate teaching fellows and faculty members who taught Computer Science 1100 at North Texas State University during Spring, 1986, were given instructions for administration of the test. A memorandum from the coordinator of the Department stressed the importance of teacher cooperation. Follow-up memoranda reminded the teachers of their testing responsibilities at appropriate times throughout the semester. The pre-tests were administered to all subjects during the first two weeks of the semester. The pre- and post-tests were collected according to the last four digits of each student's social security number. The post-tests were administered to all subjects during the last two weeks of the semester.

The Survey Instrument

The instrument used in the study was developed from an existing questionnaire. The questionnaire contains 3 parts:
demographic information, attitude statements, and cognitive statements. A copy of the instrument is found in Appendix A.

The instrument was derived from the Minnesota Computer Literacy and Awareness Assessment (1). The Minnesota Computer Literacy and Awareness Assessment was designed for computer literacy assessment of students. There are two forms of this instrument: Form 1, used in testing students in grade eleven; and Form 8, intended for grades eight and higher. The Minnesota Computer Literacy and Awareness Assessment was developed as part of a computer literacy project. The Computer Literacy Project was the special projects Division of the Minnesota Educational Computing Consortium (MECC). The purpose of the MECC Computer Literacy Project was to determine the influence of several instructional and background variables on the development of computer knowledge and attitudes among students. The instrument was developed to measure several cognitive and affective domains of computer literacy.

An original version of the instrument was field-tested using a pool of over 2,000 test items and objectives that relate to computer literacy attitudes and cognitions about computers (1).

Structure of the Instrument

The structure of the MECC instrument, from which the derived instrument for this study was developed, consists of
three parts that include affective assessment (items 1 to 30), a cognitive test (items 31 to 83), and a background survey (items 84 to 120).

The affective part had two forms. Form 8 consisted of twenty items, all of which were statements to which the student was asked to respond on a Likert Scale ranging from strongly disagree, disagree, undecided, agree, to strongly agree. Attitudes and values were associated with the single affective domain of computer literacy. The focus of this domain was upon feelings and attitudes toward computers. Affective items were designed to assess the attitudinal component of computer awareness and computer literacy. Form 8 concentrated on four attitudinal dimensions.

1. Enjoyment (items 1, 5, 6, 7, 10). "The degree to which a student enjoys computers or learning about computers" (1, p.5).

2. Anxiety (items 2, 3, 4, 8, 9). "The level of anxiety or stress that is associated with dealing with computers" (1, p.5).

3. Efficacy (items 11 to 15). "The extent to which a student feels confident about his or her ability to deal with computers" (1, p.5).

4. Educational Computer Support (items 16 to 20). "The degree to which a student feels positive toward the integration of computers into the educational system" (1, p.5).
The cognitive questionnaire was composed up of true-false or multiple-choice items, all containing an "I don't know" option. The purpose of the items was to show the core objectives included under the five cognitive dimensions of computer literacy referred to above. These five dimensions and their respective content domains are described below.

1. Hardware. "The hardware domain consists, in large part, of computer hardware definitions and related concepts. The basic components of a computer and their functional interdependence are also included" (1, p.3).

2. Software and Data Processing. "This domain includes such things as knowledge of how data is organized and processed by computers; the fact that computers are controlled by people who write instructions in a specific programming language; a realization that computers store both instructions (program) and data within memory; and recognition that computers process data by searching, sorting, deleting, updating, summarizing." (1, p.3).

3. Applications. "Computers are used in every sector of society---in work, in government, in people's homes, and in school. Questions in this domain concern when and where computers are being used and whether or not their use is appropriate" (1, p.3).

4. Impact. "This category differs from the applications domain in that it deals with social and psychological effects of applying computers. Issues of primary concern in this
domain include privacy, crime, careers, and employment" (1, p.3).

5. Programming and Algorithms. "This domain includes the ability to follow, modify, correct, and develop algorithms expressed both as a set of English language instructions and in the form of a computer program" (1, p.3).

The subtests consist of items associated with each cognitive dimension of computer literacy. These are called a priori subtests. The five a priori cognitive subtests are provided in Appendix B.

**Validation and Reliability of the Instrument**

Content validation of both the affective and cognitive objectives was obtained from an earlier study. The study consisted of computer content randomly sampled from a statewide inventory of computer-related high school courses in 1978. Twenty-nine computer programming teachers were identified. At the end of their course, they were asked to indicate whether or not their course included each of the objectives. The instrument was evaluated by professional teachers. Their opinions obtained were favorable.

For both the cognitive and affective sections, the construct validity of the instrument was tested using factor analysis. A principal factor extraction was rotated to an orthogonal varimax solution. Alpha reliabilities of the cognitive and affective sub-tests were .89 and .78, respectively (1).
The use of the MECC instrument is reported by Anderson, Krohn, and Sandman (1), Johnson (5), Battista (3), and Russel (8). All of the studies indicated that the items significantly discriminated between positive and negative attitudes and the levels of cognitive ability.

The Treatment

Introduction to Computer Science (CSCI 1100) is a basic course covering logical operations and organization of a digital computer, development of basic algorithms, number systems, boolean algebra, flow charting techniques and programming in the BASIC computer language. A prerequisite for this course is two years of high school algebra or geometry or three hours of mathematics.

During the Spring, 1986, there were fourteen classes taught by eight different instructors. The textbook, *COMPUTER MATHEMATICS: BASIC Programming With Applications* by Cathleen A. Norris and James L. Poirot (7), was used in all classes. In addition to using the conventional text, homework problems were processed by a computer.

Analysis of Data

Because there was no control group to compare the results of those receiving the treatment, the techniques for the analysis of data include chi-squares and Wilcoxon tests. Chi-square is a test that can be used to evaluate whether or not differences which have been empirically obtained differ
significantly from those which would be expected under a specified set of assumptions. Three assumptions must be met for a chi-square analysis: a) the level of measurement is nominal, b) the samples are independent, and c) no differences among the two samples exist (4). Wilcoxon tests require higher than an ordinal-scale level of measurement. The Wilcoxon test does not assume a normal population. However, the efficiency of the test is substantially higher than that of the chi-square.

Procedures for Treating Data

To analyze the data effectively the following steps were taken.

1. The data obtained from the instrument were keyed in, verified, and analyzed using the facilities at the North Texas State University Computing Center.

2. The demographic data were assembled in tabular form.

3. The SPSS crosstabs (6) procedure was employed to determine the percentages of the respondents for demographic data.

4. To test the hypothesis, non-parametric chi-squares were executed on pre-test scores, and Wilcoxon tests were performed on pre- and post-tests scores.

Summary

This chapter gives a description of the population and sample. The process for collecting the data for this study
was also described. In addition, the instrument used in the study and the instrument from which it was derived (Minnesota Computer Literacy and Awareness Assessment) were described, along with the content, structure, and supporting reliability and validity data. The method used for administering both the pre- and post-tests was explained. The chapter outlines the procedures used in analyzing the data.
CHAPTER BIBLIOGRAPHY

   the Minnesota Computer Literacy and Awareness
   Assessment, St. Paul, Minnesota Educational Computing

   Klassen, Minnesota Computer Literacy and Awareness
   Assessment, Form 8, St. Paul, Minnesota Educational

3. Battista, M. T., "Computer Literacy of Fifth Grade
   Students and Preservice Elementary Teachers Involved
   in Computer Programming Instruction," The Computing

   1972.

5. Johnson, D. C., and others, "The Impact of CAI on Computer
   Literacy in Schools," Computers in Education,
   New York, North Holland Publishing Company, 1981,
   517-524.

6. Nie, N. H., Statistical Package for the Social Sciences

7. Norris, C. A., and J. L. Poirot, Computer Mathematics:
   BASIC Programming with Applications, Austin, TX,

8. Russel, J. P., "Modifying Attitudes of Public School
   Teachers toward Computers and Their Use in the
   Classroom through Computer Literacy Workshops,"
   unpublished doctoral dissertation, College of
   Education, North Texas State University, Denton,
   Texas, 1983.

9. Walizer, M. H., and L. P. Wienir, Research Methods and
   Analysis Searching for Relationships, New York,
CHAPTER IV

PRESENTATION AND ANALYSIS OF THE DATA

Introduction

The purpose of this chapter is to present the results of the study of the association between exposure to computer instruction and changes in attitudes toward computers.

Students who participated in the study were administered a computer literacy test derived from the Minnesota Educational Computing Consortium's Computer Literacy Assessment (see Chapter III). The instrument measured student attitudes toward computers. A pre-test was administered to all subjects during the first two weeks of the Spring semester, 1986. Students subsequently received instruction throughout the semester in introductory computer science courses at North Texas State University. Finally a post-test was administered to all participants during the last two weeks of the semester.

The instrument consisted of twenty questions pertaining to attitudes toward computers and eighteen questions pertaining to the participants' understanding about computers and programming.
Characteristics of the Sample

Demographic characteristics of respondents are presented in Table I. Included are descriptions of the sample by gender, age, class standing, prior computer experience, and nature of the course (required versus elective).

Of the 109 students who participated in the study, 49 (45 percent) were male and 60 (55 percent) were female. Of the 109 subjects, 76 (69.7 percent) were between the ages of seventeen and twenty-two years. Twenty-five respondents (22.9 percent) were between the ages of twenty-three and thirty. Only 7.3 percent were in the age group thirty-one to fifty years.

The various classifications of the respondents are in Table I. According to class standing, there were 31.2 percent freshmen, 30.3 percent sophomore, 24.8 percent junior, 7.3 percent senior, and 6.4 percent graduate level. The nature of instruction received according to whether students received the instruction as an elective or as a requirement is summarized in Table I. Slightly more than three-fourths (75.9 percent) of the 109 respondents enrolled because the course was required. The remaining 24.1 percent enrolled for some other reason.

According to the summary in Table I, only 19 (17.4 percent) of the participants in the study had prior computer experience when the study commenced. Ninety (82.6 percent) of the respondents had no prior computer experience.
<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
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<td><strong>Gender:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>49</td>
<td>45%</td>
</tr>
<tr>
<td>Female</td>
<td>60</td>
<td>55%</td>
</tr>
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<td>100%</td>
</tr>
<tr>
<td><strong>Age:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17-22</td>
<td>76</td>
<td>69.8%</td>
</tr>
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<td>23-30</td>
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<tr>
<td>41-50</td>
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<td>.9%</td>
</tr>
<tr>
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</tr>
<tr>
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<td></td>
</tr>
<tr>
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</tr>
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<tr>
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</tr>
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</tr>
<tr>
<td>Graduate</td>
<td>7</td>
<td>6.4%</td>
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<td>100%</td>
</tr>
<tr>
<td><strong>Course Required?</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>83</td>
<td>75.9%</td>
</tr>
<tr>
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<td>26</td>
<td>24.1%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>109</td>
<td>100%</td>
</tr>
<tr>
<td><strong>Prior Computer Experience?</strong></td>
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</tr>
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</tr>
<tr>
<td><strong>Total</strong></td>
<td>109</td>
<td>100%</td>
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</tbody>
</table>
The students in this study represented an availability, rather than a random, sample. For this reason, non-parametric chi-square tests with specified expected frequencies were performed using data derived from the administration of the pre-test. These tests represent situations in which the expected numbers of responses per instrument item are specified by the null hypothesis. The attitude portion of the instrument used a Likert-type scale with five response categories ranked from "strongly disagree" (1) to "strongly agree" (5). The null hypothesis specified that with five response categories the probabilities for each category were one-fifth each, or 20 percent per category. In the calculation of all pre-test chi-squares, these probabilities constituted the expected frequency distributions against which the actual, observed distributions were plotted. The purpose of computing these preliminary significance tests was to determine the extent to which the availability sample selected approximated a normal one.

In Table II are data concerning students' responses to each instrument item and the calculated chi-square for each.

Two observations can be made. First, all twenty calculated chi-squares were significant, clearly indicating that the students differed in their pre-instruction attitudes toward computers from what had been expected under the null
TABLE II
PRE-INSTRUCTION ATTITUDES OF STUDENTS CONCERNING COMPUTERS

<table>
<thead>
<tr>
<th>Number Responses</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Undecided</th>
<th>Agree</th>
<th>Strongly agree</th>
<th>Chi square with 4</th>
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<tr>
<td>1</td>
<td>0.9</td>
<td>0.9</td>
<td>5.5</td>
<td>63.3</td>
<td>29.4</td>
<td>158.11*</td>
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<td>2</td>
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<td>12.8</td>
<td>16.5</td>
<td>3.7</td>
<td>107.26*</td>
</tr>
<tr>
<td>3</td>
<td>8.3</td>
<td>58.7</td>
<td>11.9</td>
<td>17.4</td>
<td>3.7</td>
<td>107.65*</td>
</tr>
<tr>
<td>4</td>
<td>9.2</td>
<td>47.7</td>
<td>11.9</td>
<td>25.7</td>
<td>5.5</td>
<td>64.99*</td>
</tr>
<tr>
<td>5</td>
<td>1.8</td>
<td>7.3</td>
<td>15.6</td>
<td>46.8</td>
<td>28.4</td>
<td>70.77*</td>
</tr>
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<td>6</td>
<td>3.7</td>
<td>11.9</td>
<td>10.1</td>
<td>58.7</td>
<td>15.6</td>
<td>106.18*</td>
</tr>
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<td>7</td>
<td>2.8</td>
<td>6.4</td>
<td>19.3</td>
<td>53.2</td>
<td>18.3</td>
<td>86.55*</td>
</tr>
<tr>
<td>8</td>
<td>14.7</td>
<td>65.1</td>
<td>9.2</td>
<td>9.2</td>
<td>1.8</td>
<td>143.34*</td>
</tr>
<tr>
<td>9</td>
<td>9.2</td>
<td>48.6</td>
<td>16.5</td>
<td>21.1</td>
<td>4.6</td>
<td>64.72*</td>
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<tr>
<td>10</td>
<td>0.9</td>
<td>10.1</td>
<td>22.0</td>
<td>56.9</td>
<td>10.1</td>
<td>104.90*</td>
</tr>
<tr>
<td>11</td>
<td>7.3</td>
<td>22.0</td>
<td>22.0</td>
<td>43.1</td>
<td>5.5</td>
<td>49.76*</td>
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<tr>
<td>12</td>
<td>11.9</td>
<td>56.0</td>
<td>17.4</td>
<td>11.0</td>
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<td>93.33*</td>
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<td>13</td>
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<td>11.0</td>
<td>74.3</td>
<td>10.1</td>
<td>205.27*</td>
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<td>25.7</td>
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<td>18.3</td>
<td>161.96*</td>
</tr>
<tr>
<td>17</td>
<td>0.0</td>
<td>10.1</td>
<td>36.7</td>
<td>43.1</td>
<td>10.1</td>
<td>76.83*</td>
</tr>
<tr>
<td>18</td>
<td>0.0</td>
<td>3.7</td>
<td>5.5</td>
<td>68.8</td>
<td>22.0</td>
<td>177.83*</td>
</tr>
<tr>
<td>19</td>
<td>1.8</td>
<td>1.8</td>
<td>6.4</td>
<td>63.3</td>
<td>26.6</td>
<td>150.59*</td>
</tr>
<tr>
<td>20</td>
<td>45.9</td>
<td>45.9</td>
<td>6.4</td>
<td>1.8</td>
<td>0.0</td>
<td>122.79*</td>
</tr>
</tbody>
</table>

*significant at p=0.05
hypothesis. Second, the responses from "strongly disagree" to "strongly agree" were heavily weighted in a positive direction from "disagree" to "agree." The subjects in this study were clearly positive in their attitudes toward computers prior to receiving instruction about them.

Post-Instruction Attitudes of Students

A useful test for determining the significance of differences between two related samples according to some measured trait is the Wilcoxon-Matched-Pairs-Signed-Ranks test. This study represents an appropriate application of the test, because respondents acted as their own controls in a pre-treatment/post-treatment design.

Affective Changes

Prior to the commencement of instruction, each participant was administered an attitudinal test to determine pre-instructional attitudes toward computers. At the conclusion of instruction, the same attitudinal test was administered to the students, this time as a post-test measure of attitudes toward computers. A Wilcoxon matched-pairs signed-ranks test was used to determine the significance of the differences between pre-instruction and post-instruction attitudes. Test results are presented in Table III.
TABLE III

SUMMARY OF WILCOXON MATCHED-PAIRS-SIGNED-RANK DIFFERENCES BETWEEN PRE-INSTRUCTION AND POST-INSTRUCTION ATTITUDES TOWARD COMPUTERS

<table>
<thead>
<tr>
<th>Number</th>
<th>Rank of Difference</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>46</td>
<td>-</td>
<td>-.3792*</td>
</tr>
<tr>
<td>52</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>ties</td>
<td></td>
</tr>
<tr>
<td>Total=109</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The calculated Z of -.3792 was greater than required at the .025 level (two-tailed test). Therefore, in this study, the change between pre-and post-instruction attitudes was significant.

Cognitive Changes

The treatment in this study consisted of a full semester's exposure to computer content in formal computer courses. One hundred and nine students were administered the pre-test and post-test and received the instruction. All participants in the study were administered a pre-test to determine pre-instruction levels of computer knowledge. A post-test was administered at the conclusion of instruction. A Wilcoxon Matched-Pairs-Signed-Ranks test was used to determine the significance of the difference between student pre-test and post-test scores.

The results of the Wilcoxon matched-pairs-signed-ranks
tests of differences between pre/post test performance are presented in Table IV.

### TABLE IV

SUMMARY OF WILCOXON-MATCHED-PAIRS-SIGNED-RANK DIFFERENCES BETWEEN PRE AND POST TEST KNOWLEDGE ABOUT COMPUTERS.

<table>
<thead>
<tr>
<th>Number</th>
<th>Rank of Difference</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>36</td>
<td>-</td>
<td>-3.25</td>
</tr>
<tr>
<td>64</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>ties</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The observed Z of -3.25 was greater in magnitude than that required at the .025 level (two-tailed test). Therefore, it was concluded that the instruction to which the students were exposed was effective at producing significant change in student knowledge about computers.

**Summary of major findings**

The following findings are derived from the analyses of the data for this study.

1. There were significant, positive attitude changes among students exposed to computer instruction.

2. There were significant increases in knowledge about computers among participants exposed to computer instruction.
CHAPTER V

SUMMARY, FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The purpose of the study was to determine the attitudes of students toward computers, and to determine whether exposure to information about computers and their uses is associated with changes in students' attitudes toward computers.

The questionnaires used in this study were derived from two subtests of Form 8 of the Minnesota Computer Literacy and Awareness Assessment. Twenty items were used to measure attitudes and eighteen items measured cognitive change. Data were collected on 109 students enrolled in introductory computer science courses at North Texas State University in Denton, Texas.

The statistical procedures used for data analyses were determined by the requirements of the hypothesis and the nature of the sample. The hypothesis indicated the use of the Wilcoxon match-pairs-signed-rank test.

Findings

A summary of the major findings of this study follows.

1. Significant positive attitude changes occurred
among students exposed to computer instruction.

2. Significant increases occurred in the knowledge acquired by participants exposed to computer instruction.

Conclusions

Because an availability sample, empirically demonstrated to be significantly different in attitudes toward computers from what would otherwise have been the case under the null hypothesis, was used in the present research, definitive conclusions cannot be reached. However, three tentative conclusions may be drawn which are consistent with the literature in social psychology related to attitudes, attitude formation, and attitude change.

1. Attitudes are not fixed and develop in the process of need satisfaction. Participants in this study experienced attitude change, which supports the suggestion that attitudes are developmental. Furthermore, the attitude changes observed in this study occurred in the process of learning about computers, a process assumed to be rooted in the educational and/or career needs of the participants.

2. Attitudes are shaped by the information to which people are exposed. Attitude modification seldom, if ever, occurs in a vacuum. Instead, it most often takes place in the context information dissemination and exposure. In this study, attitudes toward computers changed positively as participants were exposed to information about computers.

3. New information is frequently used to form attitudes
consonant with pre-existing relevant attitudes. In this study, it was observed at the time of the administration of the attitude pre-test that the participants were already positive in their attitudes toward computers. The new information about computers to which they were subsequently exposed was used to increase the valence or intensity of these pre-existing positive attitudes. In this study, familiarity with computers through information assimilation and hands-on experience affected attitudes positively, not negatively.

Delimitations of the Study

Several factors limit the generalization of this study. The survey was conducted in one department and limited to students enrolled in introductory computer science courses at a single university. The individual teaching styles of the cooperating instructors were not an experimental variable. The sample was an availability one.

Recommendations for Future Research

The following recommendations are made on the basis of this study:

1. A time schedule should be set up so that attitude studies might be undertaken periodically and utilized as a means of program development in computer education programs. Attitude is a variable which is subject to change in a period of time series; therefore, studying this variable in different time schedules is recommended.
2. Replication of this study with a larger random sample would reduce the possibility that small differences in results might produce inaccurate but large shifts in the significance of results.

3. The study should be replicated with a more diverse population. To do so would likely increase the sample variance.

4. Comparisons between genders and across different socio-economic backgrounds should be made. This would provide additional insight with respect to other factors which potentially can affect the attitude.

5. This study needs to be replicated among a sample of subjects known to be negative in their pre-treatment attitudes toward computers. Initially, the majority of the students in this study had positive attitudes. The effects of exposure to computer instruction could then be assessed more thoroughly.
APPENDIX A
Demographic Information

PART I

Please respond to each item by circling the appropriate number.

SSN (last four digits only)----

1. Sex:
   ___1. Male
   ____2. Female

2. Age:
   ___1. 17-22
   ____2. 23-30
   ___3. 31-40
   ____4. 41-50
   ___5. 51-60
   ____6. 60+

3. Ethnic Origin:
   ___1. Caucasian
   ____2. Black
   ___3. Hispanic
   ____4. Mid-Eastern Nations
   ___5. American Indian
   ____6. Oriental
   ___7. African Nations
   ____8. Others

4. Marital Status:
   ___1. Single
   ____2. Married

5. Is this course required?
   ___1. Yes
   ____2. No

6. Have you taken any computer courses before?
   ___1. Yes
   ____2. No

7. What is your current enrollment status?
   ___1. Full-time
   ____2. Part-time

8. What is your current student classification?
   ___1. Freshman
   ____2. Sophomore
   ___3. Junior
   ____4. Senior
   ___5. Graduate

9. Are you now majoring in computer science?
   ___1. Yes
   ____2. No

10. Department or school in which you are majoring or intend to major?
    NTSU:
    ___1. Arts and Sciences
    ____2. Humanities
    ___3. Social Sciences
    ____4. Education
    ___5. Business Administration
    ____6. Home Economics
    ___7. Music
    ____8. Other
11. Residence during School:
   1. On campus
   2. 0-20 miles away
   3. 21-50 miles away
   4. over 50 miles

12. How much time did you work at gainfully employed position (during the school year) while enrolled?
   1. No job
   2. 1-20 hours a week
   3. 21-40 hours a week
   4. Over 40 hours a
PART II

Please respond to each item by circling the appropriate number.

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Undecided</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I would like to learn more about computers.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Working with a computer would probably make me feel uneasy or tense.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. I feel helpless around a computer.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Computers sometimes scare me.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. I would very much like to have my own computer.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. I like the idea of taking computer courses.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. I enjoy (or think I would enjoy) using computers in my classes.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Walking through a room filled with computers would make me feel uneasy.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. I feel uneasy when I am with people who are talking about computers.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. I enjoy (or think I would enjoy) working with computers.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. I feel confident about my ability to use computers.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. It is my guess that I am not the kind of person who works well with computers.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. On the whole, I can cope with computers in my daily living.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
14. I am able to work with computers as well as most others my age.

15. Computers are gaining too much control over my life.

16. Every secondary school student should know something about computers.

17. Every secondary school student should be able to write a simple computer program.

18. Every secondary school student should learn about the role that computers play in our society.

19. Computers can be useful in learning many subjects besides mathematics.

20. Computers are of little use in education.
PART III

Please circle the correct response.

1. Computers cannot be used to assist in teaching English grammar.
   a. true
   b. false
   c. I don't know

2. Computers are not really used very much yet except by scientists.
   a. true
   b. false
   c. I don't know

3. Computers are used to commit crimes, especially stealing money and stealing or falsifying information about citizens.
   a. true
   b. false
   c. I don't know

4. Use of computers in education always results in less personal treatment of students.
   a. true
   b. false
   c. I don't know

5. The increased use of computers in our society both eliminates and creates jobs.
   a. true
   b. false
   c. I don't know

6. Computers are able to think in every way just like people.
   a. true
   b. false
   c. I don't know
7. In order to use a computer, a person must know how to program.
   a. true
   b. false
   c. I don't know

8. The main duty of a computer programmer is to:
   a. operate a computer
   b. prepare instructions for a computer
   c. schedule jobs for a computer
   d. design computers
   e. I don't know

9. Which of the following persons is the most likely to help in designing computers?
   a. keypunch operator
   b. computer operator
   c. computer programmer
   d. computer scientist
   e. I don't know

10. Which of the following is a limiting consideration for using computers?
    a. cost
    b. software availability
    c. storage capacity
    d. all of the above
    e. I don't know

11. A computer program is a:
    a. course on computers
    b. set of instructions to control the computer
    c. show given by computer
    d. piece of computer hardware
    e. I don't know

12. Choose the correct output for the computer program shown below:

    10 LET C=6
    20 LET D=8
    30 LET E=C+D+2
    40 PRINT E
    50 END
Output
a. 6
b. 14
c. 8
d. 16
e. I don't know

13. Computer software is a term describing:
   a. computer programs
   b. electronic components covered with soft plastic or rubber
   c. people who work with computers
   d. mechanical and electronic parts of a computer system
   e. I don't know

14. A computer system is best described as:
   a. processing
   b. programming, input, and output
   c. input and output
   d. input, processing, and output
   e. I don't know

15. Choose the correct output for the computer program shown below:

   10 LET A=3
   20 LET B=4
   30 LET C=A
   40 LET B=C
   50 LET A=B
   60 PRINT A,B
   70 END

   output
   a. 3 4
   b. 4 3
   c. 3 3
   d. 4 4
   e. I don't know

16. What is the main purpose of the following program:

   10 INPUT A,B,C,D,E
   20 LET S=A+B+C+D+E
   30 LET M=S/5
   40 PRINT S,M
   50 END

   a. store A,B,C,D, and E in the computer
   b. print the letters S and M
   c. print the sum and average of five numbers
   d. calculate large sums
   e. I don't know
17. At any given moment, a computer's memory unit can store:

a. programs
b. data
c. answers
d. all of the above
e. I don't know

18. When the following program is run, the user enters numbers for A and B. The computer will:

```
10 INPUT A,B
20 LET A=A+B
30 LET B=A-B
40 LET A=A-B
50 PRINT A,B
60 END
```

a. print the two input numbers, the smallest first
b. print the two input numbers, the largest first
c. print the two input numbers in reverse order from the way they were input
d. print the two input numbers in the same order as they were input
e. I don't know
APPENDIX B

MINNESOTA COMPUTER LITERACY AND AWARENESS ASSESSMENT

PART I

DIRECTIONS: Indicate how much you AGREE or DISAGREE with each of the following statements by marking the appropriate letter on the answer sheet. Mark "a" if you STRONGLY DISAGREE with the statement. Mark "b" if you DISAGREE with the statement a little. Mark "c" if you are UNDECIDED about whether you agree or disagree with the statement. Mark "d" if you AGREE with the statement a little. Mark "e" if you STRONGLY AGREE with the statement.

As an example, if you AGREE a little that computers are noisy, then mark "d" on the answer sheet as shown below:

Computers are noisy  a  b  c  d  e

Or, if you are UNDECIDED about whether computers are noisy, mark "c" on the answer sheet as shown below:

Computers are noisy  a  b  c  d  e

If you have any questions, ask the test administrator.

Please mark your answers on the answer sheet.

1. I would like to learn more about computers .... a  b  c  d  e

2. Working with a computer would probably make me feel uneasy or tense ............... a  b  c  d  e

3. I feel helpless around a computer ............ a  b  c  d  e

4. Computers sometimes scare me .............. a  b  c  d  e

5. I would very much like to have my own computer .............. a  b  c  d  e

6. I like the idea of taking computer courses .... a  b  c  d  e
Please mark your answers on the answer sheet.

7. I enjoy (or think I would enjoy) using computers in my classes
   a  b  c  d  e

8. Walking through a room filled with computers would make me feel uneasy
   a  b  c  d  e

9. I feel uneasy when I am with people who are talking about computers
   a  b  c  d  e

10. I enjoy (or think I would enjoy) working with computers
    a  b  c  d  e

11. I feel confident about my ability to use computers
    a  b  c  d  e

12. It is my guess that I am not the kind of person who works well with computers
    a  b  c  d  e

13. On the whole, I can cope with computers in my daily living
    a  b  c  d  e

14. I am able to work with computers as well as most others my age
    a  b  c  d  e

15. Computers are gaining too much control over my life
    a  b  c  d  e

16. Every secondary school student should know something about computers
    a  b  c  d  e

17. Every secondary school student should be able to write a simple computer program
    a  b  c  d  e

18. Every secondary school student should learn about the role that computers play in our society
    a  b  c  d  e

19. Computers can be useful in learning many subjects besides mathematics
    a  b  c  d  e

20. Computers are of little use in education
    a  b  c  d  e
DIRECTIONS: Indicate whether you think each of the following values is UNIMPORTANT, IMPORTANT, or EXTREMELY IMPORTANT by marking the appropriate letter on the answer sheet. Mark "a" if you think the value is UNIMPORTANT. Mark "b" if you think the value is IMPORTANT. Mark "c" if you think it is EXTREMELY IMPORTANT.

As an example, if you think saving money is EXTREMELY IMPORTANT, mark "c" on the answer sheet as shown below:

Saving Money

Please mark your answers on the answer sheet.

21. Freedom

22. World Peace

23. Economic Growth

24. Science

25. Privacy

26. Technology

27. Love and Friendship

28. Respecting Yourself

29. Saving Energy

30. Protecting the Environment

PART II

DIRECTIONS: For each of the following questions, choose the best answer and mark it on the answer sheet. If you do not know the answer to a question, do not leave the item blank; mark the letter for "I don't know." Use the "I don't know" response only when you don't even have a guess about the best answer. Do NOT leave any item blank that you attempt; either mark the letter for an answer or "I don't know."
31. Police sometimes use computers to help identify stolen cars.
   a. true
   b. false
   c. I don't know

32. Most nurses give infections by computer.
   a. true
   b. false
   c. I don't know

33. Computers cannot be used to assist in teaching English grammar.
   a. true
   b. false
   c. I don't know

34. Computers are not really used very much yet except by scientists.
   a. true
   b. false
   c. I don't know

35. Government officials use computers to store and retrieve large amounts of information about citizens.
   a. true
   b. false
   c. I don't know

36. People often use computers to store large amounts of information they wish to use over and over again.
   a. true
   b. false
   c. I don't know

37. Computers help people make decisions by providing correct answers to any question.
   a. true
   b. false
   c. I don't know

38. Computers help people make decisions by telling them if their problem is important.
   a. true
   b. false
   c. I don't know
39. Computers have been used to make more information and products available to the public.
   a. true
   b. false
   c. I don't know

40. Computers are used to commit crimes, especially stealing money and stealing or falsifying information.
   a. true
   b. false
   c. I don't know

41. Identification numbers and passwords are common ways to control the use of computer files.
   a. true
   b. false
   c. I don't know

42. Some computers know just about everything.
   a. true
   b. false
   c. I don't know

43. Use of computers in education always results in less personal treatment of students.
   a. true
   b. false
   c. I don't know

44. Privacy is an issue whenever there are files containing personal information about people.
   a. true
   b. false
   c. I don't know

45. The increased use of computers in our society both eliminates and creates jobs.
   a. true
   b. false
   c. I don't know
46. Almost all people in our society are affected in some way by computers.
   a. true
   b. false
   c. I don't know

47. In order to use a computer, you would have to be in the same building as the computer.
   a. true
   b. false
   c. I don't know

48. Computers are able to think in every way just like people.
   a. true
   b. false
   c. I don't know

49. Using computers can free one to do more creative tasks, but may also lead to more dependence upon machines.
   a. true
   b. false
   c. I don't know

50. In order to use any computer, you would have to use a telephone.
   a. true
   b. false
   c. I don't know

51. In order to use a computer, a person must know how to program.
   a. true
   b. false
   c. I don't know

52. Some computers have good and bad feelings like people.
   a. true
   b. false
   c. I don't know

53. Computers are not good for tasks that require:
   a. speed
   b. accuracy
   c. intuition
   d. something to be done over and over again
   e. I don't know
54. If your charge account bill has an error, it was probably caused by:
   a. breakdown of the computer
   b. mistakes made by people
   c. poor design of the computer
   d. general weaknesses of machines
   e. I don't know

55. The main duty of a computer programmer is to:
   a. operate a computer
   b. prepare instruction for a computer
   c. schedule jobs for a computer
   d. design computers
   e. I don't know

56. The computer-related job closest to that of a typist is:
   a. computer operator
   b. keypunch operator
   c. systems analyst
   d. computer programmer
   e. I don't know

57. Which of the following persons is the most likely to help in designing computers?
   a. keypunch operator
   b. computer operator
   c. computer programmer
   d. computer scientist
   e. I don't know

58. A basic use of computers in libraries involves:
   a. information storage and retrieval
   b. simulation and modelling
   c. process control
   d. computation
   e. I don't know

59. A basic use for computers in the design of airplanes is:
   a. simulation and modelling
   b. process control
   c. making reservations
   d. keeping inventory
   e. I don't know
60. Many people disagree about using large computer files in:
   a. government planning
   b. research
   c. checking on people
   d. carrying out social programs
   e. I don't know

61. Which of the following is a limiting consideration for using computers?
   a. cost
   b. software availability
   c. storage capacity
   d. all of the above
   e. I don't know

62. In order to program a computer, a person:
   a. can use any English language words
   b. can use any English or foreign language words
   c. must use programming language numbers, not words
   d. must use the words from a programming language
   e. I don't know

63. A computer program is a:
   a. course on computers
   b. set of instructions to control the computer
   c. show given by the computer
   d. piece of computer hardware
   e. I don't know

64. Which is not a characteristic of most information systems?
   a. a large amount of data is stored and used
   b. the data are organized
   c. the basic purpose is to provide reports and summaries of the data
   d. letters of the alphabet are used to represent all the data
   e. I don't know

65. Choose the correct output for the computer program shown below:
   
   `10 LET C = 6
   20 LET D = 8
   30 LET E = C+D+2
   40 PRINT E
   50 END`
Output

a. 6
b. 14
c. 8
d. 16
e. I don't know

66. When were computers first manufactured in large numbers?

a. 1860's
b. 1890's
c. 1920's
d. 1950's
e. I don't know

67. Computer software is a term describing:

a. computer programs
b. electronic components covered with soft plastic or rubber
c. people who work with computers
d. mechanical and electronic parts of a computer system
e. I don't know

68. In addition to input and output equipment, computers contain:

a. terminals, paper, transistors
b. memory units, control units, arithmetic units
c. printers and typewriters
d. telephones, keyboards, television screens
e. I don't know

69. A computer system is best described as:

a. processing
b. programming, input, and output
c. input and output
d. input, processing, and output
e. I don't know

70. Choose the correct output for the computer program shown below:

10 LET A = 3
20 LET B = 4
30 LET C = A
40 LET B = C
50 LET A = B
60 PRINT A,B
70 END
Output

a. 3 4
b. 4 3
c. 3 3
d. 4 4
e. I don't know

71. The physical parts of a computer are referred to as:

a. programs
b. hardware
c. software
d. manuals
e. I don't know

72. When in operation, a computer:

a. follows a set of instructions written by people
b. thinks just like a person
c. decides what to do with the data
d. translates data from digital to analog code
e. I don't know

73. Computer cannot run without:

a. blinking lights
b. keyboards
c. instructions
d. all of the above
e. I don't know

74. What is the main purpose of the following program:

10 INPUT A, B, C, D, E
20 LET S = A+B+C+D+E
30 LET M = S/5
40 PRINT S, M
50 END

a. store A, B, C, D, and E in the computer
b. print the letters S and M
c. print the sum and average of five numbers
d. calculate large sums
e. I don't know

75. At any given moment, a computer's memory unit can store:

a. programs
b. data
c. answers
d. all of the above
e. I don't know
76. Data processing is best described as:
   a. the collection of data
   b. producing reports
   c. manipulating data according to instructions
   d. using punched cards in a keypunch machine
   e. I don't know

77. This program instructs the computer to count by two.

```
10 LET M = 0
20 LET M = M + 2
30 PRINT M
40 IF M < 100 THEN 20
50 END
```

Which change will produce a program which can be used to count by A? (For example, A=3, 5, or 8.)

a. 5 READ A
   7 DATA 3, 5, 8

b. 5 LET M = A
   30 PRINT A

c. 5 INPUT A
   30 LET M = M + A

d. 5 LET X = A
   30 LET M = X + A

e. I don't know

78. Computer processing of data may involve:

   a. searching
   b. summarizing
   c. deleting
   d. all of the above
   e. I don't know

79. The computer must have two types of information to solve a problem:

   a. the problem and the answer
   b. the name of the program and user number
   c. the data and the instructions
   d. the name of the program and your name
   e. I don't know
80. When the following program is run, the user enters numbers for A and B. The computer will:

10 INPUT A, B
20 LET A = A+B
30 LET B = A-B
40 LET A = A-B
50 PRINT A,B
60 END

a. print the two input numbers, the smallest first
b. print the two input numbers, the largest first
c. print the two input numbers in reverse order from the way they were input
d. print the two input numbers in the same order as they were input
e. I don’t know

81. A newspaper publisher has the following information about subscribers stored in the computer. They are name, address and renewal date. How would you arrange the information to be most useful to the delivery person?

a. ordered by street name and house number
b. ordered by street name
c. ordered alphabetically by name of subscriber
d. ordered by renewal data
e. I don’t know

82. Choose the correct output for the procedure described below?

1. List the three names Brown, Anderson and Crane in alphabetical order.
2. Remove the last name from the list.
3. If only one name is left, stop. Otherwise, go on to step 4.
4. List the remaining names in reverse order.
5. Go back to step 2.

Output

a. Anderson, Brown, Crane
b. Brown
c. Anderson, Brown
d. Anderson
e. I don’t know
A flowchart to determine the weekly wages of employees in a bakery is shown below. Employees are paid $4 per hour up to 40 hours per week.

Start → Input total hours worked; call this H

Multiply H by 4; call this A

Print A → Stop

Employees are now to be paid "time-and-a-half" ($6 per hour) for overtime (hours worked over 40). How would you complete the flowchart below to include overtime pay? Select answer a, b, c, d, or e.

Start

Input total hours worked; call this H

Multiply H by 4; call this A

H > 40

Yes → Subtract 40 from H; call this T

No → Print A

Print A → Stop

ANSWERS

a. Multiply T by 6; call this B
   Print B

b. Multiply T by 6; call this B
   Print A+B

c. Multiply T by 2; call this B
   Print B

d. Multiply T by 2; call this B
   Print A+B

e. I don't know
BIBLIOGRAPHY

BOOKS


Atlanta Chamber of Commerce, Data Processing: Atlanta, Atlanta, Economic Development Department, 1969.


**Articles**


Letters to the Editor, Education Week, (March, 23, 1983), 14-16.


Unpublished Materials


