EFFECTS OF TIME SPENT ON COMPUTER-ASSISTED INSTRUCTION ON ATTITUDES OF SIXTH GRADE STUDENTS TOWARD COMPUTERS

DISSERTATION

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By

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The rapid growth and publicized success of computer-assisted instruction (CAI) have raised questions about the long-term effects of this new technology on the attitudes of students toward computers. Current research related to attitudes is primarily confirmed to short-term studies which simply report attitudes as positive or negative. The purposes of this study were threefold: (1) to examine the effects of time spent on CAI on student attitudes, (2) to examine the effects of time spent on CAI among ability groups, and (3) to determine whether initial attitudes would be maintained throughout a school year, and if not, determine variables associated with an attitude shift.

The subjects for this study were 171 sixth graders from 10 middle schools in a North Central Texas school district. The population was administered the Computer Attitude Scale (CAS) at three intervals throughout the year to measure computer attitudes. An interview schedule was designed to investigate students’ perceptions related to time and key variables influencing attitudes. Forty-eight students were interviewed based upon scores from the CAS. Analysis of
variance procedures were used to analyze the quantitative data while ethnographic procedures were used to analyze qualitative data.

Based upon data analysis, the following conclusions were made: (1) There was a significant difference among mean scores of the three ability groups after eight months of experience. Regular and honor students demonstrated higher positive responses than basic students. (2) There was a significant difference in mean scores among students with no experience, four months' experience, and eight months' experience. Variation was indicated between the fourth month and eighth month scores which decreased over time. (3) Variables associated with positive perceptions of computers were typing, games, easy content, teacher accessibility, word processing and creative writing. Variables associated with negative perceptions of computers were eye-strain, low quality courseware, downtime, physical discomfort, and program inaccuracies.
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CHAPTER I

INTRODUCTION

With the advent of computers in the classroom, there has been a renewed interest in students' reactions and attitudes toward the technology. Computer usage is rapidly becoming a routine experience for students despite the fact that little is known about their interests or views. In many cases computer usage is not an elective subject, but rather a curriculum demand imposed on all students. Currently, computer expansion is due to plummeting costs for hardware and improvements in the range, quality, and availability of software (Donhardt, 1984). The above factors, coupled with research suggesting a variety of gains through computer-assisted instruction (CAI), only serve to increase the attractiveness of computers as instructional tools. Furthermore, intense and relentless pressures from parents, school boards, and business communities to implement computer programs escalate yearly. It is projected that districts will adopt some form of computer-assisted instruction for widespread implementation in the years ahead (Bork, 1984).

One implication of expansion is that students will begin to spend increasingly greater amounts of time interacting with a computer terminal. A concern which is ex-
pressed by educators and researchers of CAI is whether extensive and prolonged interaction will alter student attitudes toward current and future use of computer technology (Griswold, 1984). When one considers the long-term routine use of CAI, student attitudes become significantly important because attitudes can either facilitate or hinder the attainment of educational goals. In addition, attitudes toward computers and interest in working with computers are likely to persist into post-school interactions with technology. For these reasons, there is a need to investigate the long-term effects of computer interaction on student attitudes and assess relevant factors which give rise to such attitudes.

Research to evaluate the computer movement has primarily focused on cognitive outcomes as opposed to affective responses to the technology. Generally, research tends to pit technology against traditional practices and compare the effects on achievement (Leiblum, 1982). In comparison, few studies have been generated which attempt to study affective responses. Even when such studies are conducted, results are reported as simply negative or positive with little effort to isolate factors which lead to attitude formation toward computers. Lesgold (1982) in describing paradigms for computer based instruction emphasized the need for substantial work on affective issues related to computer usage.
A major task of schools is to work toward the development of desirable student attitudes by providing appropriate learning experiences (Krathwohl, 1964). Whether long-term interaction with a computer is an appropriate experience that leads to desirable attitudes has not been established. The purpose of this study was to examine student attitudes toward computers.

Statement of the Problem

The problem of this study was the effects of time spent on computer-assisted instruction in English, reading, and mathematics on the attitudes of sixth grade students toward computers.

Research Hypotheses and Research Question

1. There will be no significant differences in mean scores obtained from the Computer Attitude Scale among low, average, and high ability students after eight months of computer experience.

2. There will be no significant differences in mean scores obtained from the Computer Attitude Scale among students with no experience, four-months' experience, and eight months of computer experience.

3. What are some specific variables that influence the attitudes of sixth graders toward computer-assisted instruction?
Significance of the Study

Attitudes toward computers and the educational significance of such attitudes have only recently become the focus of CAI inquiry. It has been determined that students generally have positive attitudes in their initial experiences, but the long-term effects of computer interaction have not been fully explored. The majority of studies have been conducted from one week to six week intervals, when the novelty effect was more of a variable than the treatment itself. Furthermore, many existing studies deal with atypical children and/or atypical computer curricula (Pulos, 1985). This study is significant because it focuses on long-term experience with computers by typical students after the newness has been transcended. In addition, it seeks to describe variables which influence attitude formation, both favorable and unfavorable. Because attitudes play a central role in the success or failure of widespread implementation plans, evaluation data are needed to assist educators in maximizing positive variables and reducing negative ones.

Definition of Terms

1. **Attitude.** In this study attitude was defined as a score indicating favorable or unfavorable responses as measured by the Computer Attitude Scale.

2. **Computer-Assisted Instruction (CAI).** In this study CAI was defined as the use of a computer for direct instruc-
tion; three modes of instruction are included in the definition: drill and practice, tutorials, and word processing.

3. **World Institute For Computer-Assisted Teaching (WICAT).** A minicomputer system which is used to deliver reading, mathematics, and writing instruction. It is a supplemental program and individualized in the sense that advancement is based on past performance.

4. **Long-term.** In this study long-term was defined as eight months of computer experience.

**Delimitations**

This study has been delimited to obtaining an understanding of the attitudes of sixth grade students about computer usage. The qualitative data dealt with self-reported attitudes of students toward a particular computer system (i.e., WICAT). It is not intended to extend to an ability to predict about other groups who use other computer systems.

**Instruments**

The instruments used to collect data included the **Computer Attitude Scale** (CAS) and an interview schedule. Attitudes of students toward CAI were measured by an instrument developed by Loyd and Gressard (1984) entitled **Computer Attitude Scale**. The scale is a Likert instrument that measures three categories of attitudes:

1. anxiety or fear of computers
2. liking of computers or enjoying working with computers

3. confidence in ability to use or learn from computers

The scale has thirty items and students are instructed to strongly agree, slightly agree, slightly disagree, or strongly disagree with a particular statement. Positively and negatively worded statements are used for each of the three domains in order to eliminate a response set. For scoring, the assigned values range from a "4" for "strongly agree" to a "1" for "strongly disagree." Scores can range from 30 to 120 depending on the weakness or strength of the attitude. In general, the higher score corresponds to positive attitudes. Administration time for the survey is approximately fifteen minutes.

Reliability coefficients for the Computer Attitude Scale are: .86 for Computer Anxiety, .91 for Computer Liking, .91 for Computer Confidence, and .95 for the Total Score. Mean scores from the norming group were 30.5 for anxiety, 30.7 for liking, 28.9 for confidence, and 90.1 for total score (Loyd and Gressard, 1984).

An interview schedule was designed for the purpose of interviewing students who reported the most and least favorable attitudes toward computers. Students who obtained the lowest scores (48-58) on the Computer Attitude Scale were defined as those holding the least favorable attitudes. Scores between 110 and 120 were used to define students who
held the most favorable attitudes.

Pilot interviews and their analysis were conducted prior to implementation of the study. Results from the pilot study were used to refine the Student Interview Guide in terms of clarity and completeness. Three interviews were conducted with the results analyzed and transcriptions validated by a researcher with expertise in this area.

Procedures for Collection of Data

The Population

The population for this study was sixth grade students from 10 middle school locations in a large suburban school district in North Central Texas. Initially it was proposed to select randomly 50 students from each ability group to administer the CAS; however, this population did not materialize due to a lower enrollment count than was projected for the 1986-87 school year. Therefore, the entire population of sixth grade students who were new enrollees in the district were surveyed. Three controls were placed on the type of students who participated in the study: the omission of bilingual students, special education students, and students who used computers for two or more classes in their former school. New students were identified by manually reviewing the records in each of the 10 middle schools. An ability level for each student was ascertained from the students' schedule cards. These cards are coded "B" for basic, "R"
for regular, and "H" for honor. A coding of "B" was assigned to those students who attended two or more basic classes throughout the day. The same process was used for a coding of "H." All other students were coded "R."

Research Design

This study examined the impact of a particular CAI program, WICAT, on the attitudes of students toward CAI. The WICAT program has been in operation since the 1984-85 school year and serves as a supplementary tool to traditional classroom instruction. It is primarily drill and practice in format and provides instruction for reading, mathematics, and English. Each WICAT laboratory houses a host computer that powers 30 student terminals, and there are approximately four laboratories in each of the 10 middle schools. Students have the opportunity to work independently at their own rate, but have the assistance of a teacher and a systems manager if the need arises. The WICAT program provides instruction in two primary modes: progress and practice. In the progress mode students automatically move through the curriculum if they achieve 80 percent mastery. If they achieve less than 50 percent mastery they are moved back to an easier level, and are placed on a review cycle if mastery is between 50 and 80 percent. In the practice mode, students drill at a specific level for varying lengths of time. The practice mode is primarily used to work on a new concept prior to moving into the progress mode. The
The computer curriculum consists of three visits to the WICAT laboratory weekly, with each child spending 50-minutes with the computer for each subject area.

The total number of students who were eligible to participate in the study was divided into three groups based on ability level. The Computer Attitude Scale was administered three times throughout the year. The first administration occurred during the second week of September, prior to having any exposure to the WICAT program. The second administration was held during the second week of January, 1987, and the final administration took place during the second week of May, 1987. This schedule allowed students to be surveyed when they had no experience with WICAT, four months of experience and eight months of experience.

At the end of the second and third rounds of attitude surveys, four basic, four regular, and four honor students who held the least favorable attitudes were interviewed. The same number of students who held the most positive attitudes were interviewed. The purpose of the interviews was to identify variables related to positive and negative attitudes toward computers. This resulted in a total of 24 students who were interviewed at the end of the January administration, and 24 who were interviewed at the end of the May administration of surveys. The total number of interviews conducted was 48.
Procedures for Analysis of Data

The data used for statistical analysis were mean scores from the Computer Attitude Scale. Hypothesis One was tested by the analysis of variance statistic to determine whether the differences among mean scores were significant for basic, regular, and honor students. A multiple analysis of variance was used to test Hypothesis Two. A post-hoc multiple comparison test was calculated when a significant F ratio was found.

Information obtained through student interviews was audiotaped and transcribed to written format. Each taped interview was then categorized and coded for statements related to attitude formation. Data analysis involved examining student responses to discern a trend or pattern in group responses to particular interview questions. Responses on a given topic were then analyzed according to negative or positive ideas expressed. Once the positive and negative factors were identified, a description and explanation of those factors were created.
CHAPTER BIBLIOGRAPHY


For the purposes of this study, the literature relating to students' attitudes toward computers will be divided into two major sections. Section I will discuss meta-analyses, syntheses, and reviews of research on CAI and computer effectiveness. In Section II, studies on technical and individual difference variables that influence attitudes will be reviewed.

Meta-Analyses, Reviews and Syntheses

There is an abundance of CAI research being conducted at the present time in an attempt to evaluate the CAI movement and its effectiveness. While many studies are being produced that provide basic understandings, results are mostly inconclusive and contradictory (Kulik, Bangert and Williams, 1983). Major reasons cited by Kulik et al. for the lack of clarity in understanding the message from CAI research are:

1) Each evaluation report is published separately.
2) Studies never exactly replicate one another; studies differ in design, setting, and application.
3) Results differ from one investigation to another.

In an effort to remedy the above problems, three research strategies have emerged recently in an attempt to coordinate the separately reported CAI findings. This section will
include a summary of the three research strategies: meta-analyses, syntheses of research, and reviews of the literature.

**Meta-Analyses**

Several researchers have utilized the meta-analysis technique to evaluate research on CAI. This technique allows researchers to compare dissimilar studies by translating them into comparable terms. Through the use of Effect Size (ES), the outcomes of separate studies can be quantified to integrate findings from independent evaluations.

Hartley (1977) and Burns and Bozeman (1981) were among the first researchers to conduct meta-analyses on the effectiveness of CAI. Their studies focused on mathematics achievement in elementary and secondary schools. Evidence suggested that a mathematics curriculum supplemented by CAI is more effective in increasing student achievement than a curriculum which utilizes traditional classroom methodologies alone. Both studies also showed CAI to be more effective with elementary, rather than secondary students. While CAI was reported to be most effective in increasing the achievement levels of elementary students, no insights were provided regarding students' attitudes toward CAI. However, in summarizing their findings Burns and Bozeman (1981) stated, "This research clearly points to other issues which must be addressed by both researchers and practitioners. One issue concerns the impact of CAI on attitudes . . .
Additional research with respect to these dimensions of the learning process is certainly essential" (p.37).

A recent meta-analysis of the effectiveness of computer-based instruction has been conducted by Kulik, Bangert and Williams (1983) at the University of Michigan. From an initial pool of three-hundred studies, Kulik and his colleagues selected fifty-one to subject to the meta-analysis technique. Criteria which all of the selected studies had to meet were: (a) studies had to take place in actual classrooms, (b) the studies had to report on measured outcomes in both computer-using and control classroom and (c) studies had to be free from methodological flaws. Their findings supported the work of Hartley (1977) and Burns and Bozeman (1981) in terms of academic achievement: student achievement gains rose from the 50th percentile to the 63rd percentile. In addition, findings showed that students who were taught by computers developed very positive attitudes toward the computer and gave favorable ratings to courses being taken. However, the researchers did note that studies of shorter duration produced stronger effects than studies of longer duration. It is possible that favorable attitudes and increased achievement may be a result of the Hawthorne effect; thus, not likely to be an accurate estimate of the true effects of CAI.

Bangert-Drowns, Kulik and Kulik (1985) conducted another meta-analysis on the effectiveness of computer-based instruction in secondary schools for the purpose of up-
dating the aforementioned study. This study, again, confirmed achievement gains, but further found evidence that CAI improved student attitudes toward subject matter, computers, and instruction. The effectiveness of CAI for younger children was also confirmed and it was found that younger students appear to profit more than older students from structured materials, small learning steps, and immediate feedback. A further finding was that CAI has its strongest effects in studies of disadvantaged and low-aptitude students; effects were smaller in studies of representative and talented populations. The analysis provided evidence that CAI has made especially positive contributions to high-school disadvantaged students and their attitudes toward computers.

While the results of meta-analyses are encouraging, it must be kept in mind that studies selected for review covered a wide range of computer applications, subject areas, age levels, and duration times. As a result, conclusions cannot be tied to any one grade level and caution should be taken in reaching final conclusions regarding the effectiveness of CAI based upon meta-analysis reports (Kulik, 1985).

Reviews of Research on CAI

Attempts to compile research data related to CAI results have often taken the form of reviews of research. Early reviews were focused on cognitive outcomes, while
affective outcomes received only cursory recognition. However, more recent studies are beginning to shift attention to affective, as well as cognitive outcomes. Reviews of research that specifically address attitudes toward computers will be reviewed in this section.

One of the earliest attempts to review research on CAI effectiveness was undertaken by Feldhusen and Szabo (1969). Their review covered four main topics: (a) major reviews of CAI research, (b) basic learning studies, (c) comparative studies, and (d) research on individual differences. Of the thirty-seven studies selected for review, only nine dealt with attitudes and seven of those nine reported favorable student attitudes toward CAI. Reasons cited for positive attitudes included: (a) active participation, (b) individual rates of progress, and (c) immediate feedback. From the review of research presented, Feldhusen and Szabo concluded that CAI teaches at least as well as a teacher or other media. A savings in the amount of time to learn and favorable student attitudes toward CAI were also reported.

Thomas (1979) completed a review of CAI effectiveness in the secondary schools with an emphasis on achievement, attitudes, retention, cost, and time savings. This review, conducted a decade after the study of Feldhusen and Szabo, surprisingly reported similar results: increased achievement, significant savings in learning time and favorable student attitudes. The few studies that reported empirical
evidence on attitudes showed that students exposed to CAI had higher levels of good feelings toward the instructional situation than non-exposed students.

In a review of literature related to affective considerations in CAI, Clements (1981) stated, "In general, students' attitudes toward computer-based instruction have been positive at all levels." Some of the reasons cited for positive student attitudes were:

1) self-paced materials
2) lack of embarrassment when mistakes are made
3) immediate feedback
4) lack of subjective teacher evaluations
5) a general feeling on the students' part that they learn better by computers

Clements' work focused primarily on the use of computers with college students and Air-Force trainees; therefore, it cannot be determined whether the above stated reasons also apply to a younger population.

Lawton and Gerscher (1982) reviewed the research on attitudes toward computers and computerized instruction. The objective of their review was to describe children's attitudes toward computers as opposed to simply using pre/post test techniques that reported achievement gains. The research repeatedly showed that children found computers to: (a) have infinite patience, (b) never get tired, (c) never get frustrated or angry, and (d) never forget to correct or praise.

Lawton and Gerschner (1982) extended the findings from
Clement's study by adding, "Other researchers noted that computers worked because: 1) computers were impartial to ethnicity, 2) computers were great motivators, 3) computers were excellent for drill and practice, and 4) the teaching process was structured to teach children in small increments" (p. 51).

From the studies examined, the authors cited numerous variables that were associated with positive students' attitudes toward CAI and computers. None of the studies selected for review revealed any negative attitudes or variables related to negativism. It was suggested that negative student attitudes (if they exist at all) are the result of teachers' fears of technology, negative adult reactions and/or unsupported assumptions regarding the dehumanizing effects of computers.

**Syntheses of Research**

While many exemplary CAI programs have been conducted over the past fifteen years, there has been a scarcity of research documents which report a synthesis of the independent efforts. The problem of making sense from the amassed CAI information has recently been undertaken by two researchers whose work will be reviewed.

Bracey (1982) in discussing research conducted by Educational Testing Service (ETS) in the Los Angeles Unified School District reported on the affective and motivational
outcomes of CAI. Students at all levels, K-6, reported favorable attitudes about learning from computers and learning about computers themselves. Reasons stated for positive attitudes were: (a) ability to work at one's own pace, (b) lack of embarrassment when mistakes were made, and (c) a feeling of control over the learning situation.

White (1983) in a synthesis of research on electronic learning reported, as do many studies, that computers are effective teaching tools partly because they improve motivation and attention. Studies from the Electronic Learning Laboratory at Teachers College, Columbia University, show that attention, defined as time-on-task, is higher when computers are in use. Characteristics which appear to motivate and attract students to computers are the challenges provided by the software, fantasy involvement, and the game format of software. The difficulty level and pacing of CAI, as well as students' sense of control over the learning situation were also cited as important factors in keeping students alert and engaged in learning. Other points made by White were: (a) Students who are good at computers are generally good at math and science also, (b) the level of student interaction and socialization is greater when working with computers than it is in the classroom, (c) software which is rated as poor by teachers may be judged as fun and exciting by students, and (d) the game format in software is appealing to students and studies
indicate that educators should move to this mode of programming to keep student attention and motivation high.

Variables Related to Attitudes Toward Computers

This section will discuss variables which research has shown to relate to positive and negative attitudes toward computers and CAI. Variables that affect attitudes will be divided into two main categories: (a) variables related to the technical aspects of computers and CAI, and (b) individual difference variables that focus on personality characteristics and affect feelings of student knowledge and competence.

Technical Variables

Downtime.--One of the most pervasive problems with CAI today is equipment failure or downtime. This is the case especially in large programs which are seldom fully "debugged." Sedlack, Borman, and Cartwright (1972) identified system downtime as a variable which is clearly responsible for generating negative attitudes toward CAI. Smith (1973) examined attitudes and found students to have overwhelmingly enthusiastic and positive responses toward the medium; however, it was noted that interruptions in the program resulted in disappointment when the initial prevailing attitude was positive. Similar findings were reported by Jenkins and Dankert (1981) in their evaluation of the PLATO IV system. Students complained of frustration due to terminals shutting down in the middle of programs and not
allowing re-entry into the lesson at the point terminated. Despite this one major flaw in the system, the authors reported PLATO IV to generate overall favorable attitudes toward CAI. It appears that the positive aspects of CAI, in this case, overpowered temporary annoyances with the system and tended to override negative aspects.

**Instructional Feedback.**--The significance of instructional feedback or knowledge of results has long been recognized by behaviorists as a necessary condition in the learning process. Swenson and Anderson (1982) stated that the reinforcement of CAI is perhaps its greatest asset. The importance of feedback has also been stressed by other researchers as a contributor to favorable student attitudes toward CAI (Dence, 1980; Roblyer, 1985). Perez and White (1985) conducted a study to identify attributes of computers that students liked, as well as what they perceived they were learning. The researchers found that students like the computer because it can think faster than teachers and results can be seen immediately after a student decision is made. The lack of delay in receiving immediate results appeared to be one major attribute of computers that students rated as a major contributor to their liking of computers. Hess and Tenezakis (1973), in a study of Mexican-Americans, reported students to have a more favorable image of the computer than of the teacher. The computer was received as having more knowledge than the teacher and was regarded as fairer and more consistent in providing feed-
back about correctness or incorrectness of performance. The authors also found that students enjoyed the computer because it bases feedback comments strictly on performance and not on personal characteristics. The major elements of the favorable image were associated with expertise in processing information and giving objective feedback.

Gilman (1969) examined students' attitudes toward CAI as a function of type of feedback used to correct student errors. In this study five types of feedback were used which ranged from a continuous to a zero feedback mode. Results indicated no significant differences in attitudes between the continuous feedback group and the no feedback group. This finding was also reported by Lublin (1965) who found continuous reinforcement and no reinforcement groups to be the most unfavorable toward programmed instruction. The influence of feedback at this time appears to be an unsettled issue in the literature, but nonetheless, a contributing variable to students' likes and dislikes of CAI/computers.

Acceptance of Alternate Responses.--Another aspect of significance to the formation of students' attitudes related to the computer system is that of the computers' acceptance of alternate correct responses. Deficiencies in accepting responses that are literally incorrect, but conceptually correct or recognizing a correct response and all synonymous answers are perhaps the most important factors that limit student communication with the computer (Dennis, 1979). It
is also a source of identifiable frustration when the computer does not accept answers because of trivial student errors, such as misspellings or placing punctuation in the wrong place (Sedlack, Borman, Cartwright, 1972). While these limitations are due to courseware developers' decisions concerning acceptable discrepancies, they are, however, problems that appear to affect attitudes in a negative direction.

**Response Time.**--Response times are one of the most important elements influencing students' behavior, the amount of work they are able to accomplish, and their degrees of satisfaction with computer interaction. In examining this variable, Carbonell, Elkind, and Nickerson (1968) found that unpredictable response times are particularly disturbing and users seem to prefer a constant longer delay to a possibly shorter, but variable one. It was suggested that users become confused when there are distortions or lags in the time that it takes the computer to respond. Research by Sedlack, Borman, and Cartwright (1972) also provides evidence that irregular or slow response time is a contributing factor to negative attitudes toward computers. Students in this study were confused when the computer did not respond immediately and reported irritation with delayed responses from the computer. Lesgold (1983) also discusses response time and its role in causing frustration due to students' inability to control the timing loop built into most CAI materials. Because designers
anticipate 'n' seconds to complete each frame, it is a source of negative reaction when students rapidly complete the frame and must wait or respond too slowly and find the frame removed from the screen.

**Unreliable Materials.**—Holmes and Kidd (1981) explored students' reactions to computer software and reported that students will reject CAI materials if they are not perceived as practical, helpful, and easy to access. At a later date, Holmes (1982) further reported that negative reactions will be exhibited by students if the following conditions prevail: (a) learners have difficulty accessing the computer or CAI programs, (b) learners are delayed by insufficient machinery, (c) the computer or materials are unreliable, and (d) the equipment and materials do not allow for a wide measure of user control.

Research thus far indicates that when technical variables are optimally operating, attitudes are positive and the computer seems fair, likeable, clear, and enjoyable. However, when technical failures occur complaints about downtime, slow response time, and non-acceptance of alternate answers are likely to emerge. This suggests that students' likes and dislikes for computers/CAI are very pragmatic and predictable.

**Individual Difference Variables**

**Ability Level.**—Most of the researchers who address this issue suggest that CAI is relatively more effective for
low ability students than for average or high ability students (Crawford, 1970; Edwards, Norton, Taylor, Weiss, and Dusseldorp, 1975; Deignan, 1978). There is also evidence that CAI has been of special value in motivating and improving attitudes of students who had previously shown little interest in school or who were underachievers and potential dropouts (Cerutti et al., 1969). In a survey of the effectiveness of instructional media, Jamison, Suppes, and Wells (1974) reviewed findings that also support the view that CAI is more effective with students who are disadvantaged or below grade level. One explanation for these findings may be that lower ability students like CAI best because they are achieving consistent success after a history of failure. However, it must be kept in mind that the majority of studies that deal with ability level have employed the drill and practice mode of CAI. Conceivably the regular or high ability students are simply unchallenged and/or bored with the repetitiveness and structure of such programs. This explanation is supported by Clark (1982) who reports that high ability students seem to enjoy and learn more from permissive approaches that allow them to bring their own skills to bear on the learning task.

**Learning Styles.**—One of the foremost advantages of CAI is its ability to individualize the form, content, and pace of learning to match students' needs. Current theory suggests that when the individual learning styles of students are matched to the teachers' style of instruction,
learning occurs most effectively and efficiently. Because the drill and practice, and tutorial modes of CAI are the most frequently used in classrooms today, some researchers have begun to explore learning styles and CAI in an attempt to match the two. Hoffman and Waters (1982) in a study of student personality and success with CAI found CAI to be favored by those who have the ability to concentrate, pay attention to details, memorize facts, and stay with a single task until completion. Students who were most negative and dropped out of CAI courses were those who preferred group projects, competition, and opportunities for creative problem solving. These findings were similar to those of Pritchard (1982) who reported that the use of computers called for a learning style that included an aptitude for visual learning, physical passivity, and a preference for working alone. However, in an earlier study Duby and Giltrow (1978) explored factors that affect student learning and attrition from self-paced instruction, and found withdrawal from CAI courses to be a function of demographic and motivational characteristics, as opposed to the technical delivery mode. Burger (1985) also found no significant relationship between learning style and success with CAI. Students who had better grades were more favorable toward CAI, but learning style showed no clear relationship with either CAI preference or achievement. While the issue of learning styles is undecided at this time, the topic itself,
in some circles is moot. Given the current pressure to have a computer for each student, appropriateness of the media for every learner has not been seriously considered nor practiced. Computer time is now a requirement for all students regardless of whether it is in their best interest or not.

**Experience With CAI.**--Studies that report attitudinal measures with pre and post test techniques indicate that students are initially neutral to slightly positive toward CAI (Cerutti, Brubaker, and Littler, 1969; Smith, 1973). A study conducted by Mathis, Smith, and Hansen (1970) further shows that actual experience with CAI makes attitudes even more positive. This is a repeated finding in many studies related to attitudes and CAI (Enochs, 1984; Loyd and Gressard, 1984). However, other studies have provided evidence to the contrary. Saracho (1982) in a study of basic skills achievement and attitudes of elementary students found non-CAI users to have more favorable attitudes than those who participated in a CAI program. Further evidence of negativism toward CAI is provided by Pulos (1985) who conducted a four-year longitudinal study of children's perceptions of computers. Pulos found that students prefer to avoid computer usage during free time and viewed peers who like the machines as unusually bright or unpopular. The typical student perceived CAI to be "academic drudgery." These results were predicted
by Brophy (1970) when he stated:

It is commonly claimed that working with computers is exciting and inherently enjoyable. But once the novelty wears off, learning by computer becomes just another method, akin to learning with the aid of television, filmstrips, listening centers ... A few students can be expected to retain high enthusiasm indefinitely, but most will not. Once the novelty wears off, most people find it boring, repetitious and unrewarding. (p.8)

Literature related to students' experiences with CAI suggest that there is a need to look more carefully at the benefits and problems of regular usage and its effect on attitudes.
CHAPTER BIBLIOGRAPHY


CHAPTER III

PROCEDURES

Procedures used in this study involved a quantitative and qualitative exploration of the attitudes of sixth grade students toward computer usage. The purpose of this chapter is to describe the procedures employed.

Population

The data obtained for this study were collected from sixth grade students who were new enrollees in the district for the 1986-1987 school year. Bilingual students, special education students, and students who used computers for two or more classes in their former school did not participate in the study. Students eligible for the study were determined by manually reviewing the folders and class schedules of all new sixth grade students in the district. To determine whether students had used computers for two or more classes in their former school, they were asked to respond to question #3 on the Computer Attitude Scale (see appendix A). Those students who had used computers for two or more classes were eliminated from the study. Once the eligible population was determined, the students were divided into three ability groups: basic, regular, and honor. The students' schedule cards were used for classification purposes. A coding of "B" was assigned to those students
who attended two or more basic classes throughout the day, and an "H" was assigned to students who attended two or more honor classes. All other students were coded "R."

Initially, 52 honor students, 182 regular students, and 47 basic students were determined to be eligible for the study. Two hundred and eighty one students were administered the Computer Attitude Scale in September. By January the total population was reduced to 184. This represented a loss of 97 students from September to January: 8 basic students, 82 regular students, and 7 honor students. By May, 171 of the original 281 students remained intact. Therefore, this study was based on a total population of 171 students.

Instruments

Instruments used in this study were the Computer Attitude Scale (CAS) and an interview schedule. The CAS was the instrument used to evaluate students' attitudes toward CAI. The CAS was developed at the University of Virginia by Loyd and Gressard (1984). It is a Likert instrument which presents positively and negatively worded statements of attitudes toward computers. The CAS deals with students' opinions regarding anxiety, confidence in the ability to use or learn about computers, and enjoyment in working with computers.

Students evaluated each statement by placing a check mark in the column that indicated the extent to which they
agreed (ranging from strongly agree to strongly disagree) with a statement. Responses were scored on a four point scale with a 4 indicating the most favorable opinion and a 1 indicating the least favorable opinion. Scores could range from 30 to 120, but the lowest score received from this population was 48; the highest score obtained was 120. Item responses were coded so that a higher score corresponded to a lower degree of anxiety and a higher degree of confidence and liking. A higher total scale score indicated a more positive attitude toward learning about or using computers (Loyd and Gressard, 1984).

The coefficient alpha reliabilities of the CAS are .86, .91, .91, and .95 for the Computer Anxiety, Computer Liking, Computer Confidence subscales, and the Total Scale, respectively. Because the reliability coefficient of the three subscales share a large amount of common variance, it is reasonable to assume that the total scale score represents a general attitude toward computers and the use of computers that reflects liking, confidence, and freedom from anxiety (Loyd and Gressard, 1984). Therefore, only total scale scores were used in data analysis for this study. Loyd and Gressard (1984) in a validation study of the CAS substantiated usage of total scale scores by stating, "The total score based on the three subscales could be interpreted to represent a general attitude toward working with computers."
An interview schedule was designed for the purpose of interviewing students with strongly negative or positive attitudes toward computers. The interview questions were designed to make explicit, (a) positive factors influencing students' attitudes, (b) negative factors influencing attitudes, and (c) students' perceptions regarding the amount of time spent working with computers. The questions drafted for the study were piloted with three students prior to implementing the study. The questions were revised and arranged after the pilot study indicated that certain items were out of sequence, lacked clarity, and/or were incomplete. A final version of the interview guide was developed which incorporated revisions indicated by the pilot study. A copy of the final interview schedule appears in Appendix B.

The researcher employed the interview guide with all students to ensure that similar topics were addressed by those interviewed. To elicit the greatest clarity of information, the interview proceeded from guided to unstructured, exploratory questions to encourage students to verbalize ideas which may have been omitted from the guide. Exploratory or probing questions were also necessary to assist students in clarifying and expressing their own intent, especially when contradictory responses were given.
Procedures for Collecting Data

During the second week of September the Computer Attitude Scale was administered to the entire population of eligible sixth grade enrollees. Students were instructed to complete the top section which addressed questions related to age, sex, grade, and experience with computers in the previous school attended. After the top section had been completed, verbatim instructions were read to all students about how to complete the survey. Once the initial set of surveys was returned, all students who reported that they had spent two or more class periods working with computers in their former school were eliminated.

During the second week of January 1987, all eligible students were then administered the CAS for a second time. At the end of the second administration all surveys were scored by the researcher. Four basic, four regular, and four honor students who held the least favorable attitudes were then interviewed. The same number of students who held the most favorable attitudes were also interviewed. This resulted in a total of 24 interviews that were conducted by the end of February. During May the final set of surveys was administered to the remaining eligible population. The same procedure described above was employed for the purpose of selecting students to be interviewed. The final round of interviews was conducted during the second and third week of May 1987. This resulted in an additional set of 24 interviews. The total number of interviews conducted for the
study was 48.

All interviews were conducted in a private office where the students attended school. The students' interviews were audiotaped with a standard tape recorder that was in full view. Confidentiality of information was assured.

Procedures for Analysis of Data

Data obtained for the statistical analyses of this study were collected from 35 basic students, 91 regular students, and 45 honor students. A total of 171 responses were used for analysis purposes. All surveys were hand-scored by the researcher according to instructions provided by Loyd and Gressard (1984). A total scale score for each student was recorded at the end of each survey administration.

The Statistics Packages for the Social Sciences (SPSS) was used for statistical data analysis. Hypothesis I was tested by comparing the three groups' mean scores when categorized by ability level. Procedure ONEWAY with an appropriate multiple range test was used to determine if a statistical difference existed among any of the three groups. A multiple analysis of variance was utilized to compare group means in analyzing data for Hypothesis II, and the level of significance was reported.

Data analysis of the positive and negative factors influencing student attitudes was based upon information
obtained from student interviews. All information from the interviews was audiotaped and transcribed to written format prior to content analysis. The analysis occurred at two separate intervals. The first set of 24 interviews was analyzed after students had received four months of computer instruction. The second set of 24 interviews was analyzed after students had completed eight months of computer instruction. Student responses were analyzed according to guidelines outlined by Bogdan and Biklen (1982). In describing data analysis in qualitative research they state:

Data analysis is the process of systematically searching and arranging the interview transcripts ...that you accumulate to increase your own understanding of them and to enable you to present what you have discovered to others. Analysis involves working with data, arranging it, breaking it into manageable units, synthesizing it, searching for patterns, discovering what is to be learned, and deciding what you will tell others. (p. 145)

Initially, each transcript was studied holistically and read several times to form an overall impression. Once transcripts had been read and studied, ideas and the verbatim expression of those ideas were highlighted in the transcripts. After key words and repetitive phrases or
ideas had been highlighted, an initial list of categories was abstracted and coded. For example, the category of novelty was coded with a "1." Once categories had been listed and coded, each unit of data in the transcripts was coded to correspond with the appropriate category. For example, when a student said, "It's very fun and better than doing real work in the classroom," this response was coded to correspond with the category of nonrealistic. When a response contained more than one idea, it was divided and coded so that each unit of data contained only the expression of a singular idea. Units of data that fit under more than one category were coded and placed under all applicable categories.

Once the major categories and units of data had been coded, transcripts were cut into sections, and each response was placed in a folder that corresponded to a particular category. For example, one folder was labeled social aspects and all responses that dealt with students socializing with peers or adults were placed in that particular folder.

Trends were ascribed when 33 percent of the subjects' coded responses could be placed under a major category. Some responses did not form a predominant pattern; therefore, they were not used for data analysis. Once the data were categorized, a description of factors influencing attitude formation was created.
Summary

Subjects for this study were 171 sixth graders from ten middle schools in a North Central Texas school district. All subjects were new enrollees in the district who had not had extensive computer instruction in their former schools. Subjects were classified according to ability level and administered the Computer Attitude Scale at three intervals throughout the year. Forty-eight of the subjects were interviewed to examine the nature of their attitudes toward CAI and to identify positive and negative factors related to computer usage.

Analysis of variance procedures were used to test the two hypotheses. Hypothesis One measured significant differences in attitudes among the three ability groups while Hypothesis Two measured significant differences in attitudes over time. Appropriate multiple range tests were used to test significant differences. Qualitative procedures were utilized to analyze the interview transcripts.
CHAPTER BIBLIOGRAPHY


CHAPTER IV
ANALYSIS OF DATA

Major Quantitative Findings

The general purpose of this study was to examine attitudes of sixth grade students toward computers at various stages of usage over an eight month period of time. This chapter contains statistical and descriptive analyses of those attitudes. The first section of this chapter is an analysis of the two hypotheses stated in Chapter I. The second section is a detailed description of factors influencing students' attitudes toward computers. Section two is divided into two parts. The first part describes factors influencing attitudes after four months of computer experience while the second part describes factors influencing attitudes after eight months of usage.

Hypothesis One

The null hypothesis that there would be no significant differences among ability groups after eight months of usage was tested by comparing the three groups' mean scores after each administration of the Computer Attitude Scale (CAS). Table 1 displays results of a one-way analysis of variance of attitudinal scores when classified by ability level prior to students having computer experience (Score 1).
Table 1

ANOVA Summary Table for Ability Level and Zero Month's Experience

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>2427.83</td>
<td>2</td>
<td>1213.92</td>
<td>5.88*</td>
</tr>
<tr>
<td>Within Groups</td>
<td>34692.80</td>
<td>168</td>
<td>206.50</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>37120.63</td>
<td>170</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p > .01.

A multiple range test of the three groups indicated that there was a significant difference in the mean scores among the three groups beyond the .01 level (F=5.88).

Scheffe's procedure was used to isolate the found difference between groups. The mean score for basic students was 92.00, while the mean score for regular students was 101.71. The difference between these two group means was significant beyond the .01 level, suggesting that students in regular classes who have had limited computer experience were more positive in their initial attitudes toward computers than basic students with similar experience. No statistical significance was revealed between honor students and either of the other two groups. Table 2 presents a summary for ability levels and Score 1.
### Table 2

**Summary Table for Ability Level and Zero Month's Experience**

<table>
<thead>
<tr>
<th>Level</th>
<th>Mean</th>
<th>SD</th>
<th>SE</th>
<th>95% confidence interval for mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic</td>
<td>92.00</td>
<td>14.13</td>
<td>2.36</td>
<td>87.22 to 96.78</td>
</tr>
<tr>
<td>Regular</td>
<td>101.71</td>
<td>13.29</td>
<td>1.40</td>
<td>98.93 to 104.50</td>
</tr>
<tr>
<td>Honor</td>
<td>98.64</td>
<td>16.50</td>
<td>2.46</td>
<td>93.69 to 103.60</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>98.86</strong></td>
<td><strong>14.78</strong></td>
<td><strong>1.13</strong></td>
<td><strong>96.63 to 101.09</strong></td>
</tr>
</tbody>
</table>

A second analysis of variance was performed using scores from the CAS after students had had four months of computer experience (Score 2). Table 3 displays the results of a one-way analysis of variance of attitudinal scores when classified by ability level. A multiple range test of each group indicated that there was a significant difference among the three groups' responses beyond the .01 level (F=7.79).

### Table 3

**ANOVA Summary Table for Ability Level and 4 Months' Experience**

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>3555.72</td>
<td>2</td>
<td>1777.86</td>
<td>7.79*</td>
</tr>
<tr>
<td>Within Groups</td>
<td>38354.26</td>
<td>168</td>
<td>228.30</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>41909.98</td>
<td>170</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p > .01.*
Scheffe's procedure was used to isolate the found differences between groups. A significant difference was revealed between basic students and both of the other two groups. Basic students demonstrated significantly fewer positive responses than regular and honor students after four months of experience. Table 4 presents a summary for ability levels and Score 2.

Table 4

Summary Table for Ability Level and 4 Months' Experience

<table>
<thead>
<tr>
<th>Level</th>
<th>Mean</th>
<th>SD</th>
<th>SE</th>
<th>95% confidence interval for mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic</td>
<td>91.25</td>
<td>14.63</td>
<td>2.44</td>
<td>86.30 to 96.20</td>
</tr>
<tr>
<td>Regular</td>
<td>102.80</td>
<td>14.48</td>
<td>1.53</td>
<td>99.76 to 105.83</td>
</tr>
<tr>
<td>Honor</td>
<td>101.44</td>
<td>16.66</td>
<td>2.48</td>
<td>96.44 to 106.45</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100.01</td>
<td>15.70</td>
<td>1.20</td>
<td>97.64 to 102.38</td>
</tr>
</tbody>
</table>

A third analysis of variance was calculated using scores from the CAS after students had had eight months of computer experience (Score 3). Table 5 displays the results of a one-way analysis of variance of attitudinal scores when classified by ability level. A multiple range test of each group indicated that there were significant differences among the three groups' responses beyond the .01 level (F=5.60).
Table 5

ANOVA Summary Table for Ability Level and 8 Months’ Experience

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>3072.51</td>
<td>2</td>
<td>1536.25</td>
<td>5.60*</td>
</tr>
<tr>
<td>Within Groups</td>
<td>46021.82</td>
<td>168</td>
<td>273.94</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>49094.33</td>
<td>170</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p > .01.

Scheffe's procedure was used to test for differences between groups. As with Score 2, a significant difference was revealed between basic students and the other two ability levels. Again, basic students demonstrated significantly fewer positive responses than the other two groups after eight months of experience. The Cochran's C value was .4727 which indicated significance beyond the .01 level. Table 6 presents a summary for ability levels and Score 3.

Table 6

Summary Table for Ability Level and 8 Months' Experience

<table>
<thead>
<tr>
<th>Level</th>
<th>Mean</th>
<th>SD</th>
<th>SE</th>
<th>95% confidence interval for mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic</td>
<td>85.56</td>
<td>14.91</td>
<td>2.48</td>
<td>84.51 to 94.60</td>
</tr>
<tr>
<td>Regular</td>
<td>100.36</td>
<td>15.15</td>
<td>1.59</td>
<td>97.18 to 103.53</td>
</tr>
<tr>
<td>Honor</td>
<td>98.76</td>
<td>20.12</td>
<td>3.00</td>
<td>92.71 to 104.80</td>
</tr>
<tr>
<td>TOTAL</td>
<td>97.66</td>
<td>16.10</td>
<td>1.30</td>
<td>95.10 to 100.23</td>
</tr>
</tbody>
</table>
In summary, a one-way analysis of variance was used to analyze Hypothesis One. The results indicated that there were significant differences among mean group scores of the three groups after eight months of computer experience. The Scheffe procedure was employed as a post-hoc test to isolate found differences between group mean scores. A significant difference was revealed between basic students' scores and the scores of regular and honor students; however, this difference was also present prior to basic students' having any computer experience. Regular and honor students demonstrated higher positive responses than basic students' responses before and after eight months of computer experience. The null hypothesis was rejected due to the significance in scores after eight months of computer experience among the three ability groups.

Hypothesis Two

The null hypothesis that there would be no significant differences in students' attitudes toward computers after 0, 4, and 8 months of experience was tested with a multiple analysis of variance (MANOVA). Table 7 displays the results of the MANOVA using a repeated measures design.

Table 7
MANOVA Summary Table for Computer Experience Time

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within Cells</td>
<td>97561.52</td>
<td>170</td>
<td>573.89</td>
<td>.25</td>
</tr>
<tr>
<td>Constant</td>
<td>5012085.48</td>
<td>15012085.48</td>
<td>8733.51</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>5109647.00</td>
<td>170</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The F value (F=8733.51) was significant at the .01 level. Variation was indicated between the administration of the Computer Attitude Scale at 4 months and the administration at 8 months (Wilks Lambda = .03). Therefore, the null hypothesis was rejected. Table 8 presents a summary of attitudes for the total group after 0, 4, and 8-months of experience.

Table 8
Descriptive Statistics of Attitudes in Incremental Time Blocks

<table>
<thead>
<tr>
<th>STATISTIC</th>
<th>0 MOS.</th>
<th>4 MOS.</th>
<th>8 MOS.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>98.86</td>
<td>100.01</td>
<td>97.66</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>14.78</td>
<td>15.70</td>
<td>16.99</td>
</tr>
<tr>
<td>Standard Error Mean</td>
<td>1.13</td>
<td>1.20</td>
<td>1.30</td>
</tr>
<tr>
<td>Variance</td>
<td>218.36</td>
<td>246.53</td>
<td>288.79</td>
</tr>
<tr>
<td>Minimum Score</td>
<td>62.00</td>
<td>48.00</td>
<td>48.00</td>
</tr>
<tr>
<td>Maximum Score</td>
<td>120.00</td>
<td>120.00</td>
<td>120.00</td>
</tr>
<tr>
<td>Range</td>
<td>58.00</td>
<td>72.00</td>
<td>72.00</td>
</tr>
</tbody>
</table>

Major Qualitative Findings
A second goal of this study was to describe students' attitudes toward computers and to identify factors affecting those attitudes. Initially, it was proposed to identify negative and positive factors and to report them as discreet
findings. However, there was a pervasive ambivalence in the majority of transcripts, so positive and negative responses were woven to create an understanding of how diverse factors combine to affect attitude formation. This section is divided into two parts for the purpose of describing attitude formation after four and eight months of computer experience.

**Attitudes After Four Months**

This section describes positive and negative factors that affected attitude formation after four months of computer experience. A total of twenty-four students were interviewed to obtain the data. Eight students from each ability group were interviewed. Student quotes in this section are based upon their experience with the WICAT computer system which was described in Chapter 1 (p. 8).

"You Don't Have to Write Down Stuff"

The majority of students in the first sampling evinced a positive attitude toward the computer programs in their curriculum. The most frequently used words in response to the question, "What words would you use to describe working with computers?" were "fun" followed by "easy" and "interesting." The most positive respondents included "exciting," "unique," "educational" and "neat" (as in fun) in their descriptions. Curiously, "typing" and "keyboard" also occurred frequently as descriptive words, both positive and negative. Further reading into the transcripts provided insights about the relationship between these very
literal descriptions and the expected emotional ones. With few exceptions, the students sampled preferred the typing aspect of computers to the pencil and paper format to which they are accustomed. Student attitudes appeared to be affected in a positive direction by the strong novelty aspect of typing answers, as opposed to writing answers with a pen. Even those students who were critical of the computer programs reported positive responses toward typing on the keyboard. Thus, it appears that the novelty of using keyboarding skills is fun, interesting, and exciting, and is one factor that leads to positive reactions toward computers. Below are some representative samples of responses students made in response to the question, "What do you like best about working computers?"

You don't have to write down stuff. You just punch one key and the question is answered without having to write with a pen.

I especially like the typing part and not having to write so much.

It's a change from being in the classroom and having to write everything.

Not having to write. It's fun to type on them.

It's more fun to write on the screen than on paper.

"I Love the Games"

The novelty of typing tied in closely with a number of
other factors evoking a positive response. Students in the sample also made an association with video recreational games and the school's computer curriculum. Frequently, students alluded to an expectation that the computer programs should conform to the recreational computer generated games to which most of them had been exposed. In addition to the "fun" aspect of typing, many students responded with those aspects which engaged right brain activity; such as, imagination, creativity, manual, and visual activity. Frequently mentioned words were "games," "drawing," and "typing," words which often appear on television. Hence words which describe recreation appear again and again in the transcripts.

It's exciting to draw the pictures.

It's fun to play the games and see if you can beat the computer.

I love the games and competition. We definitely need more games. Games to work all of those thousands of math problems would make it more interesting.

I like drawing the pictures and typing a story about them because I get to use my imagination.

Typing stories about your drawing is the funnest of all.

"You Don't Have to Stay in the Classroom"

There was also a clear trend of student favorableness
toward going to the computer lab, as opposed to remaining in the classroom. Students made a definite distinction between the two work environments. For many, the lab was a respite from "work." In reply to the question, "How do you feel when it is time to go to the lab?" students responded:

It's very fun and better than doing real school work.

The computer is better than real work. It's like having a day out of work.

It's not bad because the work is easy most of the time and the teacher won't give you homework on lab days.

It's like a field day and you get to have fun and you don't have to stay in the classroom and do your real school work.

It depends. If there is work to do in the real classroom, then I'd rather go to the computers.

These responses point toward a perception of the computer lab as a place associated with unreality. It was strongly implied that conventional class work is real and reality is not "fun," "interesting," or "exciting." Even students with a definite negative attitude toward computers felt strangely positive about going to the lab. Their responses often reflected a resignation to the inescapable trip to the computer lab. Statements included:
I hate computers, but I'd rather go to the lab than stay in the classroom.

I don't like them (computers). They're aggravating, but I'd rather go to the lab. The classroom is boring.

I guess I'd rather go there than stay with the teacher in the classroom.

Once I get there I'm glad I'm there, but I usually don't want to go.

It must be concluded then that the hours of unreal time are generally anticipated with indifference, if not enthusiasm, by students of all attitudinal persuasions. Across transcripts, the computer lab was consistently perceived as a brief reprieve from the regular classroom.

"Working Alone is Best"

The human interaction factor was another category to emerge from the surveys. When asked about a preference for working alone or with a partner, the opinions expressed were congruous. Positive, academically oriented students reported that they work in isolation and prefer to keep it that way because "a partner just slows you down" or "if I don't know the answer, a partner probably wouldn't know it either." Even students who were disenchanted with the computer learning process showed a strong preference for working alone, although their reasons for enjoying the solitude were quite different from those who held a positive stance. Reasons given for enjoying the solitude were:
I'll work on them if I have to, but I want to do it alone because I don't like other people laughing when I make a mistake.

I work alone and that's what I like about it. You work individually and nobody bugs you to hurry up.

Working alone is best because the computer doesn't care if you work or not. It's not going to send you to the office for not working.

I can concentrate better when I work by myself and I don't feel pressure from people working faster than me.

Although students were divided on their rationale for preferring isolation, there was almost complete agreement among all students that learning alone is best. Learning with a partner or in teams held no appeal to the students surveyed.

"The Computer Fouls Up, and the Teacher Helps"

Another feature of the computer which affected the attitudes of students, in a negative direction, was the total objectivity of the computer. This category emerged when students were asked if the computer ever did anything to frustrate them or make them impatient. The conflict between human and machine recurred throughout many of the interviews. This was best illustrated by a criticism common to the majority of respondents.
The computer fouls up and marks your answers wrong when they're right and then you have to review all the work again even when you didn't miss it in the first place. My teacher could just look at the right answer marked wrong and check it and tell me to go on. The computer won't do that.

When you escape (hit the escape key) from the lesson you have to start all over again from the beginning. Sometimes my hands hit the wrong key and it ruins my whole day's work and I have to start over again.

You can erase all your work if you hit the wrong key by accident. When you do this the computer makes you do the same problems over again, even though you know how to work them and by mistake just happen to hit the delete key.

When you push the wrong key by mistake and push the return key the computer marks it wrong even though you knew it was wrong and you accidentally hit the wrong key. If you had a pencil and paper you could erase it and do it over, but on the computer you have to do the whole set of problems over again.

Sometimes you get things right and the teacher says you are right, but the computer says you are wrong.

When asked if there was anything frustrating about the
lab experience, the majority of students pointed to the fact that if a wrong key is pushed, even by accident, the whole sequence of learning must be repeated from the beginning. In other words, the consensus of students was that computers are absolutely inflexible and have no tolerance for human error. The machines lack the human quality of mercy or forgiveness and this reality was extremely frustrating to students. So while the students praise the lack of pencil-and-paper drudgery they simultaneously bemoan the fact that mistakes on the computer cannot be easily corrected. Once the enter or delete key is pushed, there is no compromising with the computer. Thus, students are faced with two unacceptable alternatives. The incorrect answer may be left as is and counted wrong even though the student knows the correct answer or the delete key may be pressed and the whole sequence is rerun from the beginning. Students reported a particular frustration when such an event occurred near the end of the program. Students also reported negativism when the computer scored a correct response as wrong and they had no means of appeal through a rational argument with the machine.

All respondents who reported the above complaint simultaneously reported a preference for working with a teacher rather than a computer if given a forced choice between the two. They disliked the fact that the computer does not possess the human ability to admit its own mistakes
and a teacher does. Many students shared the conviction that their real teacher was vastly superior to the implacable machines because:

She knows more than a computer and can explain better. She also expects you to learn and knows special ways to make you learn better.

I like the teacher because she can make it more interesting. You have to read directions off the computers and if you don't understand it you can ask the teacher, but you can't ask the computer to be more clear.

Teachers are nicer and they can help out in a nice way. They understand you better even if you're not saying it in the exact words that the computer makes you say it in.

A teacher is better. A computer doesn't have a personality. A teacher has time to sit down and talk to you.

The teacher thinks better and can discuss and describe things more better than a computer.

Thus, students perceive the teacher as a necessary addition in the lab to offset the remoteness of the computer programmer who cannot be accessed for clarification or negotiation purposes. The physical presence of a teacher was a major element of the students' favorable image of working in the computer lab. Students were firmly convinced
that a computer would never replace teachers because of the personal, human characteristics that teachers possess. Teachers were consistently perceived as indispensable in the computer lab to counteract feelings of depersonalization.

"It Goes Down a Lot"

Another problem encountered by even the most cooperative, positive student was hardware failure. This was a pervasive problem reported by numerous students and was a definite source of temporary discontent. Common reactions to downtime were:

Sometimes it doesn't work and I just have to sit there. We don't get anything else to do so it's boring to sit and wait for someone to fix it.

It goofs up and goes down a lot.

It will break sometimes and you can't go back to the classroom.

Sometimes it won't work and we have to sit and be quiet for an hour with nothing else to do. We don't even talk because the teacher says it bothers the lady trying to run it.

The variable of downtime was clearly responsible for bringing out student complaints about the system, but this temporary annoyance did not appear to affect the overall attitudes of students. When asked to give an overall impression of enjoyment in working with the
computer, typical responses were "Yes, they're fun most of the time," "Yea, they're interesting; I like them," or "Sure, I do. There are only a few times when I really get mad." However, downtime was cited as one factor that most students could spontaneously recall as a problem with computers.

"The Work is So Easy"

Another paradox in the interviews was that a quality which evoked widespread criticism also evoked a positive attitudinal response from the same student. This was the perception that the programs are easy. The opinion voiced by students, both positive and negative, was that the curriculum was repetitious and lacked academic rigor.

I'd like to have harder problems. The ones we have now are too easy.

The work on the computer is easier than work in the English book. I usually don't want to leave the lab because the work is easier.

It's probably a bit too easy. Addition and subtraction are really easy. We've had it since first grade.

We do the same math problems and English stories over and over even though we already know how to do them.

Everything in English is easy to do, but that's O.K. because it's fun to write.
The work is so easy that it makes you feel guilty for spending an hour and not really learning anything new.

The issue of easiness was a frequently leveled criticism, repetition being the chief complaint. When asked about program changes, students reported that they encountered the same content over and over, even though it was easily mastered the first time. However, this was not a particularly negative factor from the students' perspective. It appears that the success associated with the easiness served to increase student positiveness toward computers.

"Three Times a Week is Plenty"

A final pattern that was identified in the transcripts was a satisfaction with the amount of time spent in the computer lab. With a few exceptions, all students felt that they spent the right amount of time in the lab each week. In response to the question, "What is your opinion of the amount of time spent working in the lab?" students reported the following:

Three times a week is plenty.

Once a week for each course is good.

I think it's the right amount. At times it seems a little long, but it's mostly fine.

It's not too long or short.

It's O.K. I get just about all the practice I need going three times a week for an hour.
We go enough time as it is.

Thus, students were satisfied with the amount of time spent working with computers. They also felt that the amount of time should not be extended in future years. The comments below substantiate this point:

I think the time is just right. If we did anymore, it would start to get real boring.

I think we use them enough now. More time next year would be too much and it would only get us out of more work.

Definitely not anymore time. We go the perfect amount this year. Too much longer would burn us out.

Keep the time the same. It would be a real drag if we went more than once a week for our subjects.

While the majority of students did not want to spend more than three hours per week in the lab, it was of interest that none of them wanted to spend less time either. So from the students' perspective, three hours per week is an appropriate amount of time to spend with computers. An expansion of this time was viewed by students as a variable that could impact their attitudes in a negative direction.

In conclusion, after four months of experience one sees in the responses to this questionnaire attitudes that were not clearly articulated into positive and negative camps. Rather, there was a continual fluctuation that was partly
mechanical and partly social. On the one hand there was the excitement of the new and exotic. Simultaneously, there was the not-so-faint echo of the preceding generation's instinctive distrust and dislike of computers. However, when asked, "Overall, do you enjoy working with computers?" nineteen of the twenty-four responded with "Yes."

**Attitudes After Eight Months**

Attitudes expressed in this later sampling of students were similar to the earlier group, except for the spread. At the extreme end of the positive attitude spectrum were four enthusiastic students whose counterparts at the opposite end were equal in number. Contrary to the earlier sampling, there was no ambivalence in the transcripts of the four extremely positive students and the four extremely negative students. These eight students were totally for or against computer usage with no contradictory or indefinite responses. For example, when a student with a positive attitude was asked about frustrating aspects of the computer, the response was, "Nothing. I really enjoy all of it, especially the story writing." The remaining students fell in the middle with a tendency toward negative reactions, and very specific complaints about the computer system. Their responses were more refined and definite than the earlier sample.

"My Eyes Begin to see Yellow Dots"

The single most common objection that ran consistently
through the entire range of students was the factor of eye strain, which resulted from constant focus on the screen for the entire period. Students with essentially positive responses to the computer looked upon this as a necessary discomfort much the same as one comes to view the uncomfortable desks and chairs in almost any classroom. This idea was communicated with statements like:

My eyes get tired of looking at those long stories, but I have to look anyway or I can't answer the questions at the end.

I'm usually ready to leave the lab after the hour because my eyes go buggy and I feel dizzy. After a while that computer can really hurt your eyes and stop your learning because you can't see straight.

I'd rather read stories from the book because it tires my eyes to follow the words on the screen.

I always have to wear my glasses to the computers or I know I'll never be able to see for an hour to finish the work. It's really hard on my eyes to look at the screen all the time.

My eyes begin to see yellow dots after a while and it makes it hard to concentrate on your work.
The computer has these lines on it that bother my eyes. The brightness on the screen always shines in your face.

Those students with unfavorable attitudes toward the computers seemed to focus on this aspect of eye strain more keenly than the rest. These same students put more emphasis on the physical discomfort of the lab than the educational merits or lack in the program. For example, one student said, "You can't move around in the lab and sitting for an hour in front of that screen gets to the old eye nerves." This forced inactivity was a common theme in the transcripts on students with negative thoughts about the lab. Thus, the physical factor of eye strain was one trend in the data that appeared to influence attitudes negatively, except for the most fanatical students.

*It's Too Long at One Time*

Another consistent factor in the sampling was the time element. To those few students at the extreme end of the positive scale the time was "just perfect." However, the remaining students felt that the time spent working with computers was "O.K.," "all right," or "enough." Many felt that the lab time was adequate, but felt it should be broken into smaller segments. For example, students said:

It's too long at one time. We should go more days with shorter minutes. We would probably be able to learn more because we wouldn't get as tired.
We spend an o.k. amount of time, but it should be broken up so you don't spend too much time at once. After a while the work gets real boring because it seems like it will never end.

An hour is too long. Maybe you could change it for us next year. How do they expect us to learn when our eyes are glued to the screen for a whole hour?

If we went five times a week it might be better because sometimes an hour seems like forever. If we just stayed ten minutes a day our eyes wouldn't hurt either.

The time is good, but maybe we should go more often and not stay as long.

Thus, students in this later sampling viewed the time element similarly to students in the first sampling and agreed that an hour per week was appropriate for each class. However, after eight months of usage students were beginning to experience mental and optical fatigue and were formulating alternatives to the one hour arrangement. This visual and mental fatigue made subjective time seem to drag out due to long periods of scanning the monitor.

"Math is Too Easy. Games Are the Best Part"

There was also a clear trend in the interviews
regarding the repetitious nature of the math program. The
general feeling among students was that the problems are too
easy and although the material has been mastered, it is
encountered again and again. In this second sampling,
another aspect of the stultified program was mentioned. In
the math program, more complex math problems must be solved
on paper and the answer transferred to the screen. A
comment that typified annoyance with this process was, "I
don't like having to use scratch paper. We should be able
to work the problems on the computer and not use paper and
pencil." Others reported that this was a meaningless
duplication of effort.

Balancing this widely held discontent with the math
program was the equally widespread approval of the math
games. Common responses included, "In math we need more
games to add interest because the same problems get old
after awhile," and "We repeat the same problems all the
time. It would help to have some more games to break the
boredom." Also on the positive side was the fact that
students who apparently had some difficulty with math
problems felt that the slow, methodical presentation of the
program allowed them to absorb the material better. Some
felt that a machine devoid of the capacity to become
irritated was an easier way to go over problems which were
difficult to absorb. So while the math program was faulted
for its ease and repetitive content, it was praised for its
games and instructional pace.
"The Writing is My Favorite Part"

Just as the math program won accolades for its games, the English program received high regard for the creative writing section. Associated with this favorable reaction were expressions of enjoyment regarding the use of imagination, fantasy and using one's "own ideas." As one student commented, "It's fun to use Wordsworth and put your fantasy on the screen." Students especially enjoyed the word processing capabilities in the English program. The ability to revise, edit, rearrange sentences, and change spellings held strong appeal. In reading and math, answers are simply right or wrong and the consequence of being right or wrong is the dubious privilege of repeating a sequence. In contrast, the English program allows students to easily correct their errors and move forward with no associations of punishment for punching an incorrect key. Thus, the inflexible image of computers in the other two subject areas is not deplored in the English program. Simultaneously, students are not restricted to entering their writings according to a structured format; the entire screen is available for the free expression of ideas. Of the three program offerings, English was the one most favored by students.

"The Reading Stories Are Too Long"

The long reading selections in the reading program unanimously collected criticism from the second group as
well as the first. The excessive length as well as the "dry" content as one student phrased it was repeatedly mentioned by students. When asked about possible changes in the reading program, students responded:

The reading stories are too long and kill my eyes. They should be shorter.

The stories aren't too interesting stories.

My eyes get tired of reading those long stories.

We could read the stories in our book and then just answer the questions on the computer.

Students spoke of the time (five minutes or more) required for the computer to print the selection. Then there was the problem of eye strain because the characters are contrasted too brightly on the screen. When the above mechanical problems were coupled with tedious dull content, mental rejection occurred. Of interest was the fact that no other content in the reading program was criticized. The only factor that clearly stood out in the students' minds was the long, uninteresting reading passages.

Contrary to the first set of interviews, students in this later sampling expressed definite concerns related to the academic value or content of the educational programs. This trend was absent in earlier interviews when most students agreed that changes in content were not needed.
However, after eight months students were beginning to focus on problems in the subject areas and the necessity of change.

"It Would be Better to Have a Partner"

Unlike the previous sampling, many of the students in this second group felt it was better to work with a partner. In response to the question, "Would you prefer to work alone or with a partner?" students replied:

I would rather have a partner because we could get a lot more done because we could race to see who could get done first. We could compete to get more done.

A partner because you share your ideas.

It would be better to have a partner so you wouldn't always have to go through the HELP cycle. Your partner could give you the help instead of the computer.

It would make it more interesting to have a partner. Sometimes the teacher doesn't have time for you so a partner could fill in.

With a partner you could share your skills and work as a team to get the right answer.

The above opinions were in total reverse from the ones reported after four months of usage when working alone was
viewed as the optimal arrangement. Apparently, factors such as repetition, physical inactivity, and visual fatigue were beginning to weigh heavily and students were ready for more socialization to offset the monotony. There appeared to be a relationship between computer dissatisfaction and strong socialization needs.

"The Novelty is Gone"

Another difference in the attitudes expressed by this group and the first was the unreality factor which figured so prominently in the initial set of interviews. While a couple of students still regarded the lab as a place to lie low and coast for an hour, mention of the "real" classroom was conspicuously absent. Only one student compared the lab to "free time in elementary school," but this was more a criticism of the lack of challenge than any qualitative difference in formats. Nine months had apparently given the novel, unreal aspects time to wear off.

In conclusion, interviews in May were more critical of the computer programs than those conducted in February. Students were much more exacting in describing their satisfactions and dissatisfactions, and their rationale for liking or disliking computers was more practical than emotional. For example, students addressed such issues as physical discomfort, low quality courseware, and efficient uses of time. It appeared that extended experience with computers sharpened critical thinking about the strengths
and weaknesses of computers. Despite the increase in reported negative factors students still viewed computers as an integral facet of education today and even the most negative students conceded that computers are here to stay, like it or not.
CHAPTER BIBLIOGRAPHY


CHAPTER V

SUMMARY, FINDINGS, CONCLUSIONS AND DISCUSSION, AND RECOMMENDATIONS

Summary

The rapid growth and publicized success of computer-assisted instruction have raised questions about long-term effects of this new technology on attitudes of students toward computers. Current research related to attitudes is primarily confined to short-term studies which simply report attitudes as positive or negative. In addition, variables associated with these perceptions have not been a focal point of inquiry in the majority of studies. The purpose of this study was to measure effects of time on student attitudes toward computers. A second purpose was to examine key variables believed to be associated with positive and negative attitudes toward computers. This study was an attempt to extend knowledge in these two areas.

The review of related literature pertaining to students' attitudes was discussed in two sections. Section I contains summaries on the effectiveness of CAI which was gleaned from meta-analyses, syntheses, and reviews of research on the CAI movement. Findings from these studies overwhelmingly support the view that a curriculum supplemented by CAI is more effective in raising achievement
scores and favorably influencing attitudes toward subject matter than traditional classroom methods alone. Furthermore, it has been determined that CAI has its strongest effect with elementary and disadvantaged students, as opposed to secondary students or typical populations. Factors related to positive reactions toward computers have been those associated with motivation; e.g., immediate feedback, self-paced instruction, and positive reinforcement. While current literature consistently reports that students have positive attitudes toward computers, the majority of studies have been short-term in scope.

Section II contains research related to variables which generate positive and negative responses toward CAI. This section was divided into two categories: 1) system variables which relate to the mechanical aspects of computers, and 2) individual variables that focus on personality characteristics and affect student feelings regarding knowledge or competence. It has been determined that students are apt to be positive in their initial experiences with computers, but become less enthusiastic when technical variables begin to interfere with computer interactions; e.g., downtime, delays in receiving feedback, and deficiencies in accepting alternate correct responses. Individual difference variables associated with attitude formation toward CAI have included ability level, learning
style, and length of experience. Reportedly, the longer students work with computers the more positive their attitudes become.

The subjects for this study were 171 sixth graders from middle schools who were new enrollees in the district studied. The entire population was classified by ability level and administered the Computer Attitude Scale at three intervals to measure computer attitudes. An interview schedule was designed to investigate students' perceptions related to time, and key variables influencing attitudes. Forty-eight students were selected for interviews based upon scores from the Computer Attitude Scale.

Findings

Hypothesis one -- The first hypothesis stated, "There will be no significant differences in mean scores obtained from the Computer Attitude Scale among low, average, and high ability students after eight months of computer experience."

The results indicated that there was a significant difference among mean scores of the three groups after eight months of experience. Regular and honor students demonstrated higher positive responses than basic students after eight months. Therefore, the null hypothesis was rejected.

Hypothesis two -- The second hypothesis stated, "There will be no significant differences in mean scores obtained
from the Computer Attitude Scale among students with no experience, four-months' experience, and eight months of computer experience."

The results indicated that there was a significant difference in mean scores among students with no experience, four months', and eight months' experience. The source of variation was between the four month and eight month scores. Student attitude scores decreased over time. Therefore, the null hypothesis was rejected.

Research Question -- The research question to be answered in this study was stated, "What are some specific variables that influence the attitudes of sixth graders toward computer-assisted instruction?"

Findings from this study suggest that there were a variety of factors influencing attitudes, in a positive direction, during the initial four months of computer experience. In general, students held positive attitudes toward computers. Major factors shown to have engendered positive attitudes were typing, games, easy content, and isolation from peers. Most students enjoyed going to the lab, as opposed to remaining in the "real" classroom, and felt that three hours per week were ample. There was also a clear preference for having a teacher present during computer time for clarification or negotiation purposes. Negative factors were primarily associated with downtime and computer inflexibility. Overall, results from interviews
conducted after four months of usage tended to indicate that attitudes toward CAI remained decidedly favorable throughout the first half of the school year.

Findings from the interviews conducted after eight months of experience shared some similarity with earlier findings; for example, enjoyment of typing, going to the lab, games, and having a teacher accessible. The only new, positive variables to emerge from the second round of interviews were those associated with creative writing and word processing. The remaining variables which were identified after four months of usage were reversed. After eight months, the easy content encountered earlier turned into repetitious drill and was criticized for lacking challenge and variety. The time element continued to be viewed as ample, but complaints related to one hour sessions became common. As the tedium of drill and one hour segments became routine, students began to report a preference for more socialization through working with a partner, as opposed to working alone. Thus, as reality set in, interest began to wane and students seriously reconsidered and revised their initial stances. In reference to negative factors, students began to register complaints about eye-strain, physical discomforts, low quality courseware, downtime, and program inaccuracies. As these mechanical and software problems increased or became more customary, there was a corresponding decrease in enthusiasm and positive
comments related to working with computers. Mechanical problems and inferior software were clearly responsible for influencing student attitudes, in a negative direction, after eight months of usage.

Conclusions and Discussion

Based upon current research, one would assume that attitudinal differences exist among various ability levels of students. A commonly held belief is that lower ability students are relatively more positive in their attitudes toward CAI than average or high ability students. Reasons often cited to substantiate this belief are primarily those associated with motivational factors; e.g., immediate feedback, high success, self-paced instruction, and an infinitely patient environment. However, findings from this study did not accord with this commonly accepted belief about lower ability students and CAI. One conclusion from this study was that lower ability students begin CAI with significantly less positive attitudes toward CAI than regular or high ability students, and these less positive attitudes persist throughout the year.

A practical question that emerges from this conclusion is, "Why do lower ability students feel less positive toward CAI than students in other ability groups?" One explanation may be that lower ability students view their participation in the CAI program as remedial, and therefore, more of the same. The drill and practice that lower ability students
encounter with mimeographed worksheets or workbooks in their regular classroom may be perceived as qualitatively no different from drill and practice with computers. Perhaps, the only real change that these students see is in the delivery system for instruction. While one cannot argue with the extreme importance of drill and practice for mastering basic skills thoroughly, possibly the programs could be offered in a more interesting or challenging format to enhance the motivational value often ascribed to computers. While certain parameters for drill and practice must be established, careful consideration should be given to providing a diversity of programs geared toward the mastery of basic skills without departing from the necessity of drill and practice. Through such a change, lower ability students may not perceive CAI as remedial, but rather a refreshing alternative to previous learning activities which have traditionally been repetitious and unsuccessful.

A second explanation for lower attitude scores among lower ability students may be a total reliance on the visual modality for learning with CAI. Instructions which might appear reasonably easy to follow or reading passages that appear similar to those in textbooks could assume a different characteristic when placed on a screen in front of a student with limited reading skills. This is especially true when lower ability students are required to work independently without the support of a more capable peer or
the auditory input and guided practice normally provided by a teacher. The reading requirement and simultaneous restriction of social interactions may be overwhelming, and therefore, discouraging to lower ability students. Thus, it seems that a cooperative learning environment may be conducive to improving the attitudes of lower ability students toward CAI. Support for the idea of working cooperatively or with a partner was generated from student interviews.

A third explanation for the scores of lower ability students may be that the scores reflect a general attitudinal problem toward school as a whole, and computer programs in particular. The decline in self-reported attitudes could be indicative of global negativism toward anything that happens in school, especially computer technology or any other comparable program that focuses on academic achievement. The possibility that lower ability students, as they grow older, tend to report less favorable attitudes toward a wide variety of instructional stimuli may explain the less positive attitudes found in the present study. Therefore, the decline may be accounted for by an initial negativism toward school which is escalated as lower ability students progress through school and are forced to comply with academic requirements.

A final explanation for the findings from Hypothesis I may be that students in the average and high groups felt
more positive toward CAI because of the small investment of effort required for them to achieve success. In other words, average and high students may have been becalmed by accurately and quickly completing questions without having to engage higher level thinking skills. Also, because the risk of failure is minimal, and there is no system of accountability, average and high ability students may feel comforted, and therefore, more positive toward computer usage. Furthermore, the existing program's lack of accountability and challenge may be reinforcing the unreality perceived by students and adding to their positive reactions toward computers.

Current research related to Hypothesis II reports that interest and attitudes toward CAI are maintained over a period of time that far exceeds the novelty and accommodation to the equipment itself. However, over a full school term, this study did not support those findings. While the data showed students to be initially positive in their attitudes, it also indicated a decline in attitudes after eight months of usage. Therefore, it was concluded that long-term computer usage significantly weakened students' attitudes toward computers. From this conclusion, it is suggested that novelty was primarily responsible for the positive attitudes obtained after four months of usage, rather than anything intrinsically motivating about working with computers. Perhaps, after eight months of usage
students began to get irritated by computer failure and repetitious programs which were not as evident during the early stages of usage. While students begin with initial enthusiasm, it is conceivable that they become discouraged by problems of mechanical failure and low-quality software. Consequently, their attitudes decrease and resistance to CAI increases. This explanation is in accord with the information obtained during the student interviews, and is a highly probable cause for a decline in attitudes.

Based upon interview analyses, another culprit for the decline in attitudes was eyestrain. This brings up questions of cause and effect. Is the computer presenting a negative stimulus which inhibits enthusiasm and cultivates a generalized negativity toward working with computers? Would these same students respond more favorably if conditions were more comfortable? Teachers have long recognized the direct relationship between eye fatigue and mental fatigue. This was addressed decades ago in the changing of blackboards with white chalk to greenboards with yellow chalk. Perhaps a similar modification of the computer screen will need to be made in order for an hour of uninterrupted time to be effective. Another, more economically feasible solution, would be a change in scheduled time. Support for several segments of computer time, as opposed to one hour sessions, was originated in this study. Students were in agreement that the amount of time spent working with comput-
ers was adequate; however, they questioned the wisdom of one hour sessions.

In summary, the transferability of these findings is limited by several factors; therefore, caution should be taken before generalizing the findings to all CAI programs. First, the findings from this study are suggestive of reality only with the WICAT system. The same findings may not occur on other computer systems that utilize different software. Secondly, the findings may be limited by the use of self-reported attitudes which were obtained through the student interview guide. Therefore, the findings may not extend to the ability to predict about other groups. However, the qualitative and quantitative information can serve as a basis for change or provide some general understanding about how students view computers. Some basic information was provided in this study that may be useful in policy planning regarding the implementation or maintenance of CAI programs.

Recommendations for Practice

Based upon results of this study, several recommendations are offered for facilitating positive views of CAI. Resistance to CAI can be overcome with certain modifications of the program currently in use.

1. Administrators should ensure that teachers are accessible during computer time. Teacher involvement in the instructional program appears to be a critical
element in determining receptivity to the program.

2. Downtime must be minimized, but when it is unavoidable either backup tapes or alternate instructional activities must be available to reduce dead space in the curriculum.

3. Due to the extreme popularity of typing, proper keyboarding skills should be taught during the first semester of usage. This would encourage proper typing techniques and circumvent the hunt-and-peck method currently being used by students.

4. Software should be previewed by teachers and errors corrected by programmers prior to student usage.

5. An increase in instructional games and simulation experiences should be developed for certain learning activities that are dull and repetitious in nature.

6. When students are subjected to intensive use of CAI for the duration of a school year, human factors need to be carefully monitored. Physical and visual variations during computer time are warranted when scheduling of one hour sessions cannot be avoided.

7. The capabilities of the computer must be exploited more thoroughly and imaginatively. More diverse and challenging programs are needed to avoid the tacit, and sometimes explicit, association between CAI and electronic workbooks. This change should also be coupled with an accountability system.
8. Computer time should be allocated equally among ability levels. The educational assumptions behind scheduling lower ability students into computer labs more frequently than higher ability students needs careful examination.

Recommendation for Further Study

The following recommendations are based upon findings from this study.

1. A different study should be conducted on other computer systems to determine if the findings from this study are specific to WICAT only.

2. This study should be replicated with elementary and high school students to determine if the findings from this study vary with grade level.

3. A study to explore dispersion among the scores of honor students should be conducted to determine more precisely the effect of CAI on this particular ability group.

4. A longitudinal study to follow the students surveyed in this study should be conducted.
APPENDIX A

COMPUTER ATTITUDE SCALE
SURVEY OF ATTITUDES TOWARD THE LEARNING ABOUT AND WORKING WITH COMPUTERS

The purpose of this survey is to gather information concerning people's attitudes toward the learning about and working with computers. It should take about five minutes to complete this survey. All responses are kept confidential. Please return the survey to your instructor when you are finished.

Please check the blank which applies to you.

Age: ( ) 9 ( ) 10 ( ) 11
( ) 12 ( ) 13 ( ) 14
( ) 15 ( ) 16 ( ) 17 or over

Grade:___________

Sex: ( ) Male ( ) Female

Did you work with computers in the school you attended last year?
( ) Yes ( ) No

If you answered "yes" to the above question, in how many classes per day did you work with computers?
( ) one class per day ( ) two classes per day ( ) three classes per day
( ) more than three classes per day

COMPUTER ATTITUDE SCALE

These are a series of statements. There are no correct answers for these statements. They have been set up in a way which permits you to indicate the extent to which you agree or disagree with the ideas expressed. Place a check mark in the parentheses under the label which is closest to your agreement or disagreement with the statements.

<table>
<thead>
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<td>. I would like working with computers.</td>
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<tr>
<td>. Working on a computer would make me very nervous.</td>
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<tr>
<td>. Generally I would feel OK about trying a new problem on the computer.</td>
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<tr>
<td>. The challenge of solving problems with computers does not appeal to me.</td>
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<tr>
<td>. I do not feel threatened when others talk about computers.</td>
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<tr>
<td>. I don't think I would do advanced computer work.</td>
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<tr>
<td>. I think working with computers would be enjoyable and stimulating.</td>
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<tr>
<td>. I feel aggressive and hostile towards computers.</td>
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</tr>
<tr>
<td>Strongly Agree</td>
<td>Slightly Agree</td>
<td>Slightly Disagree</td>
<td>Strongly Disagree</td>
</tr>
<tr>
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<tr>
<td>I am sure I could do work in computers.</td>
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<tr>
<td>Figuring out computer problems does not appeal to me.</td>
<td>( )</td>
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<tr>
<td>It wouldn't bother me at all to take computer courses.</td>
<td>( )</td>
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<tr>
<td>I'm not the type to do well with computers.</td>
<td>( )</td>
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<tr>
<td>When there is a problem with a computer run that I couldn't immediately solve, I would stick with it until I have the answer.</td>
<td>( )</td>
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<tr>
<td>Computers make me feel uncomfortable.</td>
<td>( )</td>
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<tr>
<td>I am sure I could learn a computer language.</td>
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<tr>
<td>I don't understand how some people can spend so much time working with computers and seem to enjoy it.</td>
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<tr>
<td>I would feel at ease in a computer class.</td>
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<tr>
<td>I think using a computer would be very hard for me.</td>
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<tr>
<td>Once I start trying to work on the computer, I would find it hard to stop.</td>
<td>( )</td>
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<tr>
<td>I get a sinking feeling when I think of trying to use a computer.</td>
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<tr>
<td>I could get good grades in computer courses.</td>
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<tr>
<td>I will do as little work on computers as possible.</td>
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<tr>
<td>I would feel comfortable working on a computer.</td>
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<tr>
<td>I do not think I could handle a computer course.</td>
<td>( )</td>
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<tr>
<td>If a problem is left unsolved in a computer class, I would continue to think about it afterward.</td>
<td>( )</td>
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</tr>
<tr>
<td>Computers make me feel uneasy and confused.</td>
<td>( )</td>
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</tr>
<tr>
<td>I have a lot of self confidence when it comes to working with computers.</td>
<td>( )</td>
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</tr>
<tr>
<td>I do not enjoy talking with others about computers.</td>
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</tbody>
</table>

**Your name:**

**School's name:**
APPENDIX B

STUDENT INTERVIEW SCHEDULE
INTERVIEW SCHEDULE

1. What words would you use to describe working with computers?

2. What would you say you like best about working with computers?

3. What would you say you like least about working with computers?

4. Overall, do you enjoy working with computers?

5. Does the computer ever do anything that frustrates you or makes you impatient?

6. Do you work alone in the lab or with a partner? Which way would you prefer to work and why?

7. Would you prefer to learn from a teacher or a computer?

8. Describe how you feel each day when the teacher tells you that it is time to go to the lab?

9. Describe how you feel when it is time to leave the lab and return to regular classes?

10. What is your opinion of the amount of time spent working in the lab?

11. Would you like to work with computers next year if you remain in the district? Would you like to use computers more, less, or the same amount of time?

12. What changes would you like to see in the reading program?
   What changes would you like to see in the math program?
   What changes would you like to see in the English program?

13. As a result of working with computers, do you think you will be interested in working with computers in the future?

14. Are there any other comments that you would like to make about computers?
BIBLIOGRAPHY

Books


Journal Articles


**Papers Presented**


Unpublished Materials
