The Impact of Computers on Attitudes Toward Learning in Sixth Grade Science Students

by

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GRADUATE COLLEGE
UNIVERSITY OF NEBRASKA

THE IMPACT OF COMPUTERS ON ATTITUDES TOWARD LEARNING IN SIXTH GRADE SCIENCE STUDENTS

JoAnn M. Stevens, Ed.D.

University of Nebraska, 1995

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The present study examined the impact of the use of computers in science instruction on student attitudes toward learning. Two hundred fourteen sixth graders served as the sample for this study. The subjects were randomly assigned by computer to one of two teams. One team used computers in the instruction of science and the other team did not use computers in the instruction of science. The independent variable was the use of computers in instruction versus not using computers in instruction. The dependent variables were: (a) attitudes toward computers (as measured by the Attitudes Toward Computers Survey), (b) attitudes toward learning processes (as measured by the Attitude Toward Learning Processes Survey), (c) knowledge of science (as measured by the Science Subtest of the Comprehensive Test of Basic Skills), and (d) attitude toward the use of computers and learning processes (as measured by structured interview questions). The Attitudes Toward Computers Survey and the Attitude Toward Learning Processes Survey were administered at baseline, mid-year, and at the end of the year. The Science Subtest of the Comprehensive Test of Basic Skills

was administered the end of the year, as were the structured interview questions.

Analyses of data revealed that students who were taught in class using computers experienced significantly ($p < .05$) more confidence toward computers, less anxiety toward computers, and a more positive attitude toward learning processes compared to students who were taught in class that did not use computers. Computer use did not significantly increase knowledge of subject content. In general, students who were taught in class using computers experienced a more positive attitude toward computers and learning processes than did students who were taught in class that did not use computers.

The study has implications related to the applicability of alternative instructional strategies, specifically computers, and the expansion of the use of computers throughout the curriculum.

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CHAPTER I

Introduction

Oliver Wendell Holmes once stated, "The great thing in this world is not so much where we are, but in what direction we are headed" (Taitt, 1993, p. 5). One important influence on the direction of education in recent years has been technology, particularly computer technology. Technologists and futurists have been predicting a technological revolution in education for many years (Samson, Niemiec, Weinstein, & Walberg, 1986). The Office of Technology Assessment predicted that by 1994 more than 4 million computers would be in schools (McGinnis, 1991). The Improving America's Schools Act of 1993 noted that educational technology can have a positive effect on students' achievement and motivation, and can create environments that increase interaction among students and between students and teachers (Department of Education, 1993). Lauda (1989) predicted that the remainder of this century would not be tranquil. He forecasted an increased need for adaptation to and stimulation of the way students think and manage their lives. If educators are to restore the competitive edge of our society and prepare people to face the requirements of a technological environment, learning for life in such a society cannot be incidental.

It must be consciously planned and implemented. It must be the direction schools are headed.

Research pertaining to technological forecasts has indicated that computer-assisted instruction (CAI) has been extolled as the innovation that would bring about fundamental changes in the teaching-learning process (Hawkridge, 1990; Samson, Niemiec, Weinstein, & Walberg, 1986; Riel, 1989; Cavanna, 1990; Trotter, 1990; Mojkowski, 1987; and Alvestad, 1993). With the expanding role computers play in society, school personnel should provide opportunities for students to use computers (Gressard & Loyd, 1986). In addition, because many students experience some computer anxiety and lack confidence when required to learn about or use computers, educators should strive to provide a positive computer experience for these students (Gressard & Loyd).

Student experience with computer assisted instruction may result in an improvement in achievement and development of positive attitudes toward learning (Hallworth & Brehner, 1980). Marzano (1992) stated that without positive attitudes and perceptions, students have little chance of learning proficiently, if at all. He identified two categories of attitudes and perceptions that affect learning: (a) attitudes and perceptions about the learning

climate, and (b) attitudes and perceptions about classroom tasks.

Technology could profoundly alter the structure and relationship within institutions and must be managed to achieve institutional goals. However, technology that electronically does no more than the old ditto sheets and "drill-and-kill" betrays the public's trust in the ability of education to maximize its resources. (Williams & Smith, 1994). Such poor technology also alienates students from the very tools that are essential to their future.

In relation to attitudes toward computers and computerized instruction, Lawton and Gerschner (1982) reported that children find computers have infinite patience, never forget to correct or praise, and help to individualize learning. Clement (1981) emphasized that personal attitudes toward computers in a learning environment can be critical to the success of any computer integration program.

The role that computers are playing in education has vastly increased in recent years, and the trend appears to be toward additional involvement (Vermette, Orr, & Hall, 1986). In a report for Project 2061, Johnson (1989) suggested that schooling should not only produce an awareness of the presence of technology and its impact on society but should also prepare youth to be active

participants in that technological world. Students should know how technology can be applied and how to apply it themselves. The new emphasis on K-12 science -- on inquiry-based, hands-on, project-based learning -- provides educators an opportunity to take advantage of the power of technology to transform students from passive, content-memorizers to lifelong, active, and scientifically literate learners (Bruder, 1993). Armed with these new technological tools, today's science teachers can move securely into the future, continually improving the efficiency of instruction while maintaining the hands-on excitement that has traditionally lured young scientists (Texley, 1989).

With the infusion of computers into the educational process, school officials must plan how to integrate the technology with curriculum. To determine how the students will benefit most from computers in the educational environment, instructional strategies will need to be assessed, along with attitudes toward the use of these strategies. As part of such an effort, the study presented here was designed to determine if the use of computers in middle level science education has an impact on attitudes toward computers and learning. Results will have implications for planning the future use of computers in classroom instructional activities. Due to the availability of a variety of instructional tools on the subject, science

was selected as the curricular area of study. As indicated by Sowell and Fuller (1990), computer use should allow science teachers to provide a greater variety of ways of learning science than are available without computers.

Purpose of the Study

The purpose of this study was to examine the impact of the use of computers in science instruction on student attitudes toward learning.

Research Questions

The research questions to be investigated in this study were:

1. Is there a difference in computer anxiety and computer confidence (as measured by the Computer Attitude Survey) over time (baseline, mid-term, and end of year) for students who were taught in class using computers compared to students who were taught in class that did not use computers?

2. Is there a difference in attitude toward learning processes (as measured by the Attitude Toward Learning Processes Survey) over time for students who were taught in class using computers compared to students who were taught in class that did not use computers?

3. Is there a difference in knowledge of science (as measured by the Science Subtest of the Comprehensive Test of Basic Skills) at the end of the sixth grade for students who

were taught in class using computers compared to students who were taught in class that did not use computers?

4. What is the attitude toward the use of computers and learning processes (as measured by structured interview questions) for students who were taught in class using computers compared to students who were taught in class that did not use computers?

Definition of Terms

The following definitions were assigned to terms and concepts used in this study:

1. Attitude. Personally held principles or beliefs that govern much of one's behavior (Marzano et al., 1988).

2. Attitude toward learning processes. Beliefs that govern one's behavior toward the interactions of the student, the teacher, instructional strategies, and the learning environment, as measured by scores on the Attitude Toward Learning Processes Survey.

3. Computer-Assisted Instruction (CAI): The use of the computer in instruction. It generally involves drill and practice, where the user practices a specific skill on the computer; tutoring, where the computer is used to teach a new concept; simulation, where the user or computer simulates a real life situation; or problem solving, where the student uses the computer as a tool to solve problems (Samson, Niemiec, Weinstein, & Walberg, 1986; and Shaw &

Okey, 1985). All types of CAI listed above were utilized for this study.

4. Computer attitude. Personally held principles or beliefs toward learning about and working with computers (Loyd & Gressard, 1984).

a. Computer anxiety. Anxiety toward or fear of computers or learning to use computers, as measured by scores on a subscale of the Attitude Toward Computers Survey (Loyd & Gressard, 1984).

b. Computer confidence. Confidence in the ability to learn about or use computers, as measured by scores on a subscale of the Attitude Toward Computers Survey (Loyd & Gressard, 1984).

5. Knowledge. The skills and processes acquired; understanding of component parts, and the recall ability grasped by the mind (Marzano, 1992). For the purpose of this study, knowledge of science was measured by the Science Subtest of the Comprehensive Test of Basic Skills, which is a standardized achievement test of knowledge of science.

6. Learning. An activity of the mind that involves the application of specific and controlled operations to new information, with the results that this information becomes a part of long-term memory (Keefe, Letteri, Ferrell, & Jenkins, 1988).

7. Learning processes. Interactions of the student, the teacher, instructional strategies, and the learning environment (Keefe, 1987).

Assumptions

1. The Attitude Toward Computers Survey is an appropriate instrument for assessing students' computer anxiety and computer confidence.

2. The Attitude Toward Learning Processes Survey is an appropriate instrument for assessing students' attitudes toward the different processes associated with learning.

3. The Science Subtest of the Comprehensive Test of Basic Skills is an appropriate instrument for assessing students' comprehensive knowledge of science.

Limitations

1. The population for this study was restricted to sixth grade students at a middle school, and the results can be generalized only to this population.

2. Only one measure of knowledge was used, as measured by the Science Subtest of the Comprehensive Test of Basic Skills.

Significance of the Study

A fundamental goal of a school is to provide opportunities for students to acquire and integrate knowledge and to apply knowledge in meaningful ways that allow them to explore personal interests and direct their

own learning (Marzano, 1992). Educational technology creates learning situations in which students can be engaged in activities they find interesting and exciting for their own reasons and which accomplish the educational goals of the curriculum (Riel, 1989). Riel indicated that revolution is too strong a term for the change that is accompanying computers into classrooms. But interactive technologies may provide the key to radical recontextualization of learning.

Interactive technology and computer literacy become of even greater importance and the number of schools providing instruction in computers increases each year, educators are forced to make important decisions about the proper roles of computers in the elementary and secondary school curriculums (Campbell, 1988). These decisions include the type and number of computers needed, the number of computers integrated into teachers' classrooms and computer labs, and ways in which the computers will be utilized once they have been installed. Assessments will be needed for training teachers and students on the use of computers and determining how comfortable they are in using computers in the classroom.

Many studies regarding computers have been conducted, but very few have considered large numbers of students or have examined the influence of computer assisted instruction over time on variables such as attitudes toward learning and

knowledge gained as a result of using computer assisted instruction (Ferrell, 1985). The study described here fills a void by examining the impact of the use of computers over time in computer assisted instruction, the impact of student attitudes toward computers and learning processes, and the impact of computer assisted instruction on knowledge of science.

The results of this study can help the school and district to assess the outcomes of computer use and to plan and provide technological experiences that will positively affect the educational process for students now and in the future.

CHAPTER II

Review of Literature

Attitudes Toward Computers

Hawkridge (1990) referred to the "pedagogic rationale" for using computers in the teaching-learning process. The pedagogic rationale is to enrich the existing curriculum and improve the way in which it is delivered by using computers as sophisticated educational tools. The use of computers can extend traditional ways of presenting information to children and offer new opportunities through varied instructional techniques, such as simulation. To justify using computers, policy-makers state that all children of secondary school age (and perhaps even those of primary school age) should be aware and unafraid of how computers work, because computers are pervading industrial societies and are likely to be important in all countries (Hawkridge). Since schools prepare children for life, they should prepare children to use computers.

Early studies of computers and academic motivation relied on self-reports of students' attitudes toward computers and found that most elementary through high school students considered computer activities to be highly motivating and interesting (Krendl & Lieberman, 1988). These authors indicated that computer use can raise student interest and improve attitudes toward particular academic

subjects, including writing, mathematics, and science. Because computer use can increase students' motivation to learn and their engagement in learning, some researchers have argued that computer use can also lead to greater academic achievement (Krendl & Lieberman).

Shaw and Okey (1985) compared the effects of alternative ways of using computer simulations on middle school students' achievement of concepts and attitudes toward computers and science instruction. The analyses revealed the groups receiving instructional treatments by computers performed significantly better than the comparison group on an achievement measure (Calfifornia Achievement Test). However, differences in instructional treatments produced no significant effects on attitudes toward computers and science instruction. In contrast, most studies comparing computer simulations with conventional classroom instruction have shown positive student attitudes toward computers and simulations. Shaw and Okey attributed their different findings to the short duration (two weeks) of their study.

Clement (1981) found that students liked computers because the machines (a) were self-paced, (b) did not embarrass students who made mistakes, (c) gave immediate feedback, and (d) left a general feeling that students learned better through the computer system. According to

Lawton and Gerschner (1982), other researchers noted that computers worked because they (a) were impartial to ethnicity, (b) were great motivators, (c) were excellent for drill and practice, and (d) used a teaching process that was structured to teach in small increments.

McGrath, Thurston, McLellen, Stone, and Tischhauser (1992) found that rural students in grades 4-8 who had access to computers liked computers and rated them higher than the students who did not have access to computers. Enoch (1985/86) in an exploratory investigation examined the general attitudes of middle school students toward computers. His results revealed that the overall attitude toward computers was moderately high. Since positive attitudes are correlated highly with achievement, the provision of student contact with computers should be worthwhile.

More than any other technological invention in recent years, the computer has carved a niche for itself in society (Turnipseed & Burns, 1991). Turnipseed and Burns (1991) found that computers have become familiar because of their affordability and their high visibility in exotic applications as well as in the day-to-day lives of nearly everyone in industrial nations. The computer has become entrenched, indispensable, and pervasive. Technological

advancement, speed, power, and knowledge are qualities revered in computers.

Computers and Attitudes Toward the Learning Processes

In the words of a leading computer scientist, "The way computing has permeated the fabric of purposeful intellectual and economic activity has no parallel" (Peled, 1987, p. 57). Information technologies have transformed the worlds of business, science, entertainment, the military, government, law, banking, travel, medicine, and agriculture (Office of Technology Assessment, 1989). The questions remain whether and how computers will make as deep a mark on classroom learning.

A study conducted by researchers from Vanderbilt University found that fifth graders who took part in technology-based science activities scored higher in a test of curiosity than students who received only traditional science instruction (Sivin-Kachala, 1993). Kulik, Bangert, and Williams (1983) applied meta-analysis to study the effects of CAI on students in Grades 6-12. These authors looked at the relationship of attitudes toward subject matter and instruction to final examination performance. Results showed increased achievement and more positive attitudes for students in the CAI classrooms. As reported by Ferrell (1985), for the most part, computers have been used in schools in a supplementary capacity, with the number

of computers in a school limited, and time-per-pupil as little as 7 to 10 minutes per day. Additionally, most of the studies which have attempted to document the effectiveness of CAI have been of short duration (8 weeks or less) and have not been well designed experimental-control studies.

During the 1980s, the amount of research on the role of classroom climate in the learning process increased tremendously (Brophy, 1982). Fisher (1983) reviewed the literature on CAI in relation to subject area, achievement range, and use in the curriculum. He concluded that, in terms of impact on achievement, CAI was most effective for science and foreign language instruction, with either high or low achievers, and used as a supplement to the regular curriculum. Fisher's review also indicated positive changes in student attitude, improved attendance, increased motivation, and lengthened attention span among CAI students. Similarly, Cordell (1991) reported that attitudes have been shown to correlate with learning outcomes. Positive attitudes are often associated with enhanced learning, while negative attitudes or high levels of anxiety are known to affect learning adversely. According to Black (1993), to help students get the most out of each day's lesson, teachers need to be flexible and allow students more than one way to learn. For example, the science teacher

might emphasize learning through projects, experiments, and the use of computers.

Marzano (1992), in studying past research and theory, reported that climate was conceptualized in terms of the learner and the quality and quantity of classroom resources available to the learner. More recently, psychologists have begun to view classroom climate as a function of the attitudes and perceptions of the learner, rather than as elements external to the learner. Marzano stated that students who have a sense of acceptance and a sense of comfort and order have a mental attitude conducive to learning.

Bloom (1978) said that students' self-concept, attitudes toward school, and attitudes toward learning are much influenced by their levels of achievement and success in school and classroom. Educators continually examine ways to ensure that every student learns well. In addition, researchers have found that the influence of teachers' attitudes, motivations, expectations, and viewpoints are key factors in student achievement. Beyond the intended course content, the teacher must consider motivational dynamics in the teaching and learning process when planning each classroom learning activity (Grossnickle & Thiel, 1988). These motivational dynamics include the use of computers in the teaching and learning process.

When computers are introduced into a classroom, many students respond enthusiastically and quickly master the skills necessary for successful use of computers. Clement (1981) reported that, in general, attitudes toward computer-based courses have been found to be positive among students in junior high schools. These positive attitudes make the interaction with computers a pleasant and rewarding learning experience.

The role of computers in our society has expanded dramatically in recent years, and familiarity with computers and the ability to use them effectively will be of crucial importance to success in many different fields (Loyd & Gressard, 1984). Computer experience is gaining wide recognition as a crucial component of the educational process, as our educational system seeks to prepare students for effective participation in society. Designers of school curricula no longer debate whether computers should be introduced into classrooms; the discussion now focuses on when they should be introduced and how they should be used in the educational environment.

Computers and Knowledge of Science

The Office of Technology Assessment (1989) stated that most historians of technology would agree with Noble Laureate Simon that the computer is no ordinary innovation. The most profound question facing American society today is

whether institutions can adapt to a world that has changed more dramatically in the last 30 years than in the preceding 30 decades (Office of Technology Assessment).

To prepare students for a society that can compete globally, educators must be able to apply strong science and math skills to emerging technologies (National Education Goals Panel, 1992). The National Education Goals Panel stated that competence in science and math must become basic in this country. More effort should be directed to developing curriculum standards that foster the abilities to think critically, apply knowledge effectively, and integrate the use of technology in a timely manner.

Using computers to stimulate student interest in continuing the study of science and technology is one desired outcome of science education (Beane, 1988). Attitudes and perceptions about science are powerful motivators working for or against student achievement in science (Kober, 1993). Kober stated that students who enjoy science are more apt to do well in science. The methods and resources used to teach science continue to influence student attitudes. Negative attitudes about science are learned, not inherited (Kober).

Mojowski (1987) stated that new technologies represent an improvement over previous tools, but are only a means to a larger end -- improved student learning. Technology has

the potential to enhance the way people think and learn and to change traditional patterns of access to knowledge (Mojowski). In Educating Americans for the 21st Century, a National Science Board report (1983), technology and an understanding of technological advances and applications were recognized as skills for students. While the initial infusion of computers into instruction might not have produced desired results, the relevance of technological education is still apparent (Greenberg, 1985).

In examining the impact of computers in classrooms, Ferrell (1985) indicated that much of the enthusiasm for using computers as a learning aid is based on reports by principals and teachers that computers produce achievement gains and that a child's enthusiasm for learning is increased when computers are used. Surveys conducted by the National Science Teachers Association and others have shown that the appropriate use of computers can result in desirable cognitive (e.g., improved knowledge) and affective (e.g., attitudes toward learning) learning outcomes for science students (McGinnis, 1991).

Reif and Morse (1992) reported that students learn differently today than in the past. In the 20th century most people were "paper" trained, but youngsters of today and the 21st century are "light" trained, i.e., comfortable with video- and computer-based material. In a study of CAI

in elementary school, children who used computers showed gains of 1 - 8 months of instruction over peers who received only traditional instruction (Office of Technology Assessment, 1989). Studies by Hedlund and Casolara (1986), Johnson and Johnson (1986), McGuire (1976), Sherwood and Hasselbring (1984), and Vockrell and Rivers (1984) also found that students achieved as well and usually better through computer simulations. The point is not that computer simulations are better than any particular instructional approach, but rather, that computer simulations are a viable means of instruction and may have an impact on content knowledge.

Evidence presented in numerous national reports on science learning has indicated that students in the United States are not achieving at acceptable levels of success (Educational Testing Service, 1988; National Assessment of Education Progress, 1978; Mullis & Jenkins, 1988). Fort (1993) stated that more than half the laws that Congress passes involve some aspect of science or technology, and the number continues to increase. The goal of these laws is science literacy, which can be defined as an understanding of the norms of science and a knowledge of major constructs, as well as an awareness of the impact of science and technology on society and the policy choices that must inevitably emerge (Fort). Since technology is the eyes,

ears, and muscle of science, an effective program should strengthen students' knowledge of technological processes and help them attain proficiency in use of these processes (Kober, 1993). Some schools are taking advantage of the promises that computers hold for science education. Though not conclusive, studies suggest that the use of computers can increase students' interest and improve achievement (Kober).

Summary

The Office of Technology Assessment (1989) stressed the need for studies evaluating different technological approaches. Research has evaluated some technological approaches more thoroughly than others. Effective assessments of newer applications of technology and use of computers are needed, as are longitudinal studies that follow groups of computer users over time.

A literature review by Krendl and Lieberman (1988), showed early studies indicated that computer use could raise student interest and attitudes toward computers and particular academic subjects, and lead to greater academic achievement. These studies provided a strong rationale for the infusion of computers in the teaching-learning process (Krendl & Lieberman, 1988). As reported by Ferrell (1985), computers have been used for the most part in a supplementary capacity in schools, with the number of

computers in a school limited, and time-per-pupil minimal. Recent studies suggest that the use of computers can increase students' interest and improve achievement (Kober, 1993).

The role of computers in our society has expanded dramatically, and has become increasingly evident that familiarity with computers and the ability to use them effectively will be of crucial importance to success in many different careers (Loyd & Gressard, 1984). Computer experience is gaining wide recognition as an important component of the educational process, as educational systems seek to prepare students for effective participation in society.

Technological changes are occurring rapidly. The infusion of technology and increased usage of computers have influenced curriculum. Educators hope -- and believe -- that by utilization of computers in teaching-learning situations each learner will achieve more optimally the goals of the curriculum (Ediger, 1988).

CHAPTER III

Methodology

Sample

The sample consisted of 214 sixth grade students at Adams Middle School in North Platte, Nebraska. The students were randomly assigned by computer to one of two teams prior to beginning the sixth grade. One team used computers in the instruction of science (n = 110); the other team did not use computers in the instruction of science (n = 104).

Design and Setting

The research approach to this study was a quasi-experimental design with repeated measures. At the beginning of the sixth grade, the subjects were randomly assigned by computer to two teams. One team had a teacher who used computers in science instruction. The other team had a teacher who did not use computers in science instruction.

The independent variable was use of computers in instruction versus no use of computers in instruction. The dependent variables were (a) attitudes toward computers (as measured by the Attitude Toward Computers Survey), (b) attitude toward learning processes (as measured by the Attitude Toward Learning Processes Survey), (c) knowledge of science (as measured by the Science Subtest of the CTBS),

and (d) attitude toward the use of computers and learning processes (as measured by structured interview questions).

Computers

Ninety-five Macintosh computers were added to the classrooms at Adams Middle School in the fall of 1993. At the time of this study, the computers were used for instruction by one of the two sixth grade science teachers. In addition, at the end of the school year, both sixth grade English teachers used the computer lab for writing activities for two different class sessions.

Computer Use

The team who used computers in the instruction of science used them for approximately 25 percent of the instructional time. Their class was conducted in the computer lab one day a week during the first semester and one or two days a week the second semester. The other team did not use computers in the instruction of science. The amount of classroom instruction was equal for both teams. The instruction time for one team included student use of computers, while the instruction time for the other team did not include student use of computers.

The team with computers used interactive science computer programs to complement and supplement the curriculum. Student interaction with the computers provided for student input and computer feedback, which kept students

continuously involved in the learning process. Science computer simulation programs were utilized for acquiring skills, problem solving, and obtaining concepts associated with the sixth grade science curriculum. Computer simulations provided students with experiences in observing, classifying, ordering, hypothesizing, and testing science concepts.

All sixth grade students were involved in a 9-week keyboarding class, where they were taught basic keyboarding skills. These 9-week classes were offered throughout the school year. The students participated in drill and practice activities, becoming familiar with the location and use of the keys. They did not interact with computer programs in this class.

Science Curriculum

There was one science teacher for each team. Both teachers used the same general science curriculum. The teachers used identical science notebooks, which contained the units and science process activities for the sixth grade curriculum. These notebooks were developed by teachers on the school's science curriculum review committee. Both classes used the same science textbook as a supplement to the science notebook. All students were required to keep their own science notebook and both classes followed the same guidelines for organizing the material in this

notebook. A thorough review of both teachers' lesson plans was conducted by two administrators who were responsible for evaluating these teachers. Additionally, the administrators made eight visits to each classroom when comparable content was being taught. Review of these data by the administrators indicated the classes were covering comparable science content.

Instructional Strategies

The two science teachers employed similar instructional strategies, except for supplemental materials which included the computer programs used by one teacher. The similarity was documented by classroom observations of each teacher each semester by three different administrators. In both groups, instructional planning focused on and followed the content of the sixth grade science curriculum. Instructional techniques, based on the students' ability levels, included explanations, discussions, small group work, problem-solving activities, and lab activities. Both teachers utilized available lab equipment, which included microscopes in studying cells; Lego kits in studying simple machines; diagrams, models, and maps in studying space; and plants in studying biomes.

Instruments

Attitude Toward Computers Survey

The Computer Attitude Survey (CAS), with subscales for computer anxiety and computer confidence, developed by Loyd and Gressard (1984), was utilized to measure computer anxiety and computer confidence (see Appendix A). The CAS is a Likert-type instrument consisting of 20 items which present positively and negatively worded statements of attitudes toward computers and the use of computers. The two types of attitudes represented are (a) anxiety toward or fear of computers or learning to use computers, and (b) confidence in the ability to use or learn about computers. Each subscale consists of 10 items which are distributed alternately throughout the instrument. The items are coded so that a higher score reflects a lower degree of anxiety and a higher degree of confidence. Each subscale score ranges from 10 to 40. The total score is the sum of the two subscale scores and ranges from 20 to 80. A higher score on either of the subscales or on the total scale indicates a more positive attitude toward learning about or using computers.

The reliability and factorial validity of the subscales were determined by internal consistency (alpha coefficient) and factor analysis. In a study conducted with junior high, high school, and college age students, Loyd and Gressard

(1984) reported coefficient alpha reliabilities for the computer anxiety and computer confidence subscales as .87 and .91 respectively. The CAS has been used with elementary, middle school, and high school students. According to Loyd and Gressard, the results of the factor analysis for this instrument showed a great correlation between subscales, indicating that the subscales shared substantial common variance. The reliability coefficient of the subscales indicated that each subscale was stable for use as a separate score. These authors suggested that the CAS is a convenient, reliable, and valid measure of computer attitudes.

Cronbach alpha reliability coefficients for this sample were .83 for the computer confidence subscale and .79 for the computer anxiety subscale. The Cronbach alpha reliability coefficient was .90 for the total Computer Attitude Survey.

Attitude Toward Learning Processes Survey

In this study, the Arlin-Hills Attitude Toward Learning Processes Survey, developed by Arlin and Hills (1974), was used to measure students' attitudes toward the interactions of the students, teachers, instructional strategies, and the learning environment. The Attitude Toward Learning Processes Survey is a Likert-type instrument consisting of 15 items which present positively and negatively worded

statements of attitudes toward interactions with students, teachers, instructional strategies, and the learning environment. The items are coded so that a higher score reflects a more positive attitude. Total scores range from 0 to 45. As a rule of thumb, scores of 30 or above are considered desirable by the authors.

In a study conducted with 14,000 pupils in Grades 1-12, Arlin and Hills (1974) reported an alpha reliability coefficient of .90 for the Attitude Toward Learning Processes Survey. This instrument, designed for anonymous assessment of group attitudes has been used with kindergarten through 12th grade students.

Cronbach alpha reliability coefficient for this sample was .86 for the Attitude Toward Learning Processes Survey.

Science Skills Subtest of the Comprehensive Test of Basic Skills (CTBS)

The CTBS consists of achievement tests, published by CTB/Macmillan/McGraw-Hill (1989), that may be used to assess the basic skills attained by students in kindergarten through 12th grade. The subject areas covered by the overall test are reading, spelling, language, mathematics, study skills, science, and social studies. Items are organized by content categories that reflect the educational objectives commonly found in state and district curriculum guides and in major textbooks, basal series, and

instructional programs (CTB/Macmillan/McGraw-Hill). The tests are organized in different levels of difficulty, according to the grade level of the students. The Level 16 test is given to sixth grade students. Reliability coefficients reported are the Kuder-Richardson 20 coefficients for the number-correct scoring. The coefficient for the science subtest is .84. In relation to content validity, the information regarding the development of the test indicates the blueprint was derived from an analysis of curriculum guides and recently published textbook series and instructional programs.

The goal of the science subtest is to sample a broad knowledge base, focusing on what is central and unifying in science understanding while avoiding what is esoteric or trivial. Another goal is to indicate how well inquiry skills have been acquired. The test is designed to measure core concepts regarded by the science teaching community as central to building scientific understanding.

The CTBS was the norm-referenced and criterion-referenced instrument chosen by the North Platte Public School district to measure student achievement. The CTBS instrument was chosen for its close alignment to the North Platte Public School district's curriculum.

Student Attitude Interview

Structured interview questions were asked of students on both teams to obtain qualitative data regarding their attitudes toward computers and learning processes (see Appendix B). A purposive sample of students from each team was randomly selected for the interviews. Redundancy of responses occurred after interviewing approximately 10 percent of the population. The sample consisted of an equal representation of boys and girls, low-ability and high-ability students, and students who had computers at home and had no computers at home. All students interviewed were asked the same four questions in an attempt to understand student feelings and to learn more about their attitudes toward computers and learning processes:

1. How did you feel about the learning activities in your science class? (e.g., teacher presentations, lab experiments, computer use, assignments)

2. How do you feel about the use of computers in instruction in school?

3. How do you feel about using computers in instruction in your classes this year?

4. How would you feel about using computers in your classes next year?

Pilot

The two surveys, Attitude Toward Computers Survey and the Attitude Toward Learning Processes Survey, were pilot tested with 20 seventh grade students to determine the degree of difficulty and comprehension. These students felt that these surveys were not too difficult for sixth grade students and they felt that the questions were easy to understand.

Procedures

1. Permission to conduct this study was granted by the superintendent of the North Platte Public Schools (see Appendix C).

2. Approval was granted by the University of Nebraska-Lincoln Institutional Review Board (see Appendix C).

3. In the Spring of 1993, as fifth graders, the subjects were randomly assigned by computer to two teams.

4. Written informed consent was obtained from parents, allowing the students to participate in this study (see Appendix C).

5. Written assent was obtained from sixth grade students participating in this study (see Appendix C).

6. The CTBS was administered to these students in the spring of 1993, as fifth graders.

7. The students entered Adams Middle School as sixth graders in the fall of 1993, at which time the results of

their CTBS Science Subtest scores were compared. There was virtually no difference in mean test scores for the students on the team who used computers in science instruction (55.5%) as compared to the students on the other team (55.1%).

8. The Attitude Toward Computers Survey and the Attitude Toward Learning Processes Survey were administered to all sixth grade students at the beginning of the 1993-94 school year. They were administered again at mid-year and at the end of the school year.

9. The CTBS Science Subtest was administered to all sixth grade students in the spring of 1994.

10. Selected students responded at the end of the year to structured interview questions concerning their attitudes toward the use of computers and learning processes. A sample of 10 percent from each team was judged to be adequate as redundancy of responses was noted.

Data Analysis

The following statistical procedures were applied to each of the research questions. Descriptive statistics (frequency, %, mean, SD) were collected on all demographic characteristics and each instrument to describe the sample. To determine if there were any differences on demographic variables by groups, t-tests were employed.

Research Question 1

Is there a difference in computer anxiety and computer confidence (as measured by the Computer Attitude Survey) over time for students who were taught in class using computers compared to students who were taught in class that did not use computers?

A repeated measures analysis of variance (repeated measures ANOVA) was used to analyze the responses to the Computer Attitude Survey.

Research Question 2

Is there a difference in attitude toward learning processes (as measured by the Attitude Toward Learning Processes Survey) over time for students who were taught in class using computers compared to students who were taught in class that did not use computers?

A repeated measures analysis of variance (repeated measures ANOVA) was used to analyze the responses to the Attitude Toward Learning Processes Survey.

Research Question 3

Is there a difference in knowledge of science (as measured by the Science Subtest of the Comprehensive Test of Basic Skills) at the end of the sixth grade for students who were taught in class using computers compared to students who were taught in class that did not use computers?

An independent t-test was used to analyze the responses to the Science Subtest of the Comprehensive Test of Basic Skills at the end of the sixth grade.

Research Question 4

What is the attitude toward the use of computers and learning processes (as measured by structured interview questions) for students who were taught in class using computers compared to students who were taught in class that did not use computers?

A content analysis of subject responses was used to analyze this question. Descriptive statistics (frequency, %) were used to depict the data.

CHAPTER IV

Results of Data Analysis

The purpose of this chapter is to present and discuss the results of this study. Emphasis is given to providing a descriptive profile of the subjects as well as presenting and analyzing data gathered in response to the research questions. Results of both quantitative and qualitative analyses are described.

Profile of the Subjects

Sample

The sample consisted of 214 sixth grade students at Adams Middle School in North Platte, Nebraska. There were 110 students randomly assigned to the team who used computers in the instruction of science and 104 students randomly assigned to the team who did not use computers in the instruction of science. Of the 110 students on the computer team, 47% were male and 53% were female. Of the 104 students on the non-computer team, 51% were male and 49% were female.

Forty-five percent of the students on the team who used computers in the instruction of science indicated that they had computers in their homes, as compared to 43% of the other team. Among those who had home computers, 92% of the computer team indicated that they used their computers at home, compared to 91% of the other team.

There was virtually no difference in knowledge of science for the two teams at baseline, as measured by the CTBS Science Subtest in the spring of their fifth grade year. The mean score for the team who used the computer in the instruction of science was 55.5%, and the mean score for the team who did not use the computer was 55.1%.

Research Question 1

Is there a difference in computer anxiety and computer confidence (as measured by the Computer Attitude Survey) over time for students who were taught in class using computers compared to students who were taught in class that did not use computers?

Using a repeated measures ANOVA, with group as the independent variable and **computer anxiety** as the dependent variable, there was a significant group by time interaction, F (2, 424) = 17.80, $p < .001$, on computer anxiety for students who were taught in class using computers compared to students who were taught in class that did not use computers. Simple main effect follow-up tests revealed a significant difference in computer anxiety between groups at the end of the year, $p < .001$. Students on the team who used computers in the instruction of science indicated significantly less computer anxiety at the end of the year than students on the team who did not use computers. There was not a significant difference between groups at baseline,

$p > .05$, or at mid-year, $p > .05$. See Table 1 for mean values, standard deviations, and results of the repeated measures ANOVA.

Table 1

Mean Values and Standard Deviations by Group for the Computer Anxiety Subscale and Results of Repeated Measures ANOVA

	Baseline	Mid-Year	End of Year
Group	Mean (SD)	Mean (SD)	Mean (SD)
No Computer	34.02 (5.28)	34.26 (4.84)	33.58 (5.27)
Computer	34.32 (4.38)	35.11 (4.24)	37.27 (3.04)

Repeated Measures ANOVA

Source	df	SS	MS	F	p
Group	1	418.158	418.158	9.89	.0019
Time	2	170.497	85.248	8.54	.0002
Time*Group	2	355.375	177.688	17.80	.0001
Error	424	4231.730	9.980		

Using a repeated measures ANOVA, with group as the independent variable and **computer confidence** as the dependent variable, there was a significant group by time interaction, F (2, 424) = 12.22, $p < .001$, on computer confidence between those students who were taught in class using computers compared to students who were taught in class that did not use computers. Simple main effect follow-up tests revealed a significant difference in computer confidence between groups at mid-year, $p < .05$, and at the end of the year, $p < .001$. There was not a significant difference between groups at baseline, $p > .05$. These results revealed that students on the team who used computers in the instruction of science indicated significantly greater computer confidence at mid-year and at the end of the year compared to students on the team who did not use computers. See Table 2 for mean values, standard deviations, and the results of the repeated measures ANOVA.

The results of the anxiety and confidence subscales revealed that students on the team who used computers in the instruction of science indicated a more positive attitude toward computers at the end of the year (as measured by levels of computer anxiety and computer confidence) compared to students on the team who did not use computers in the instruction of science.

Table 2

Mean Values and Standard Deviations by Group for the Computer Confidence Subscale and Results of Repeated Measures ANOVA

Group	Baseline Mean (SD)	Mid-Year Mean (SD)	End of Year Mean (SD)
No Computer	31.55 (5.42)	33.02 (5.24)	32.78 (5.71)
Computer	31.53 (5.41)	34.35 (4.45)	35.98 (3.04)

Repeated Measures ANOVA

Source	df	SS	MS	F	p
Group	1	362.188	362.188	7.17	.0001
Time	2	938.543	469.271	40.92	.0001
Time*Group	2	280.287	140.144	12.22	.0001
Error	424	4862.819	11.469		

Research Question 2

Is there a difference in attitude toward learning processes (as measured by the Attitude Toward Learning Processes Survey) over time for students who were taught in class using computers compared to students who were taught in class that did not use computers?

Using a repeated measures ANOVA, with group as the independent variable and **attitudes toward learning processes** as the dependent variable, there was a significant interaction, F (2, 424) = 32.76, $p < .001$, on attitudes toward learning processes between those students who were taught in class using computers compared to students who were taught in class that did not use computers. Simple main effect follow-up tests revealed a significant difference in attitudes toward learning processes at the end of the year, $p < .001$. There was not a significant difference between groups at baseline, $p > .05$, or at mid-year, $p > .05$. These results revealed that students on the team who used computers in the instruction of science indicated a significantly more positive attitude toward learning processes at the end of the year compared to students on the team who did not use computers. See Table 3 for mean values, standard deviations, and the results of the repeated measures ANOVA.

Table 3

Mean Values and Standard Deviations by Group for the Attitude Toward Learning Processes Survey and Results of Repeated Measures ANOVA

Group	Baseline Mean (SD)	Mid-Year Mean (SD)	End of Year Mean (SD)
No Computer	16.10 (6.84)	14.83 (7.45)	11.47 (6.83)
Computer	15.48 (6.34)	16.50 (6.75)	17.57 (7.29)

Repeated Measures ANOVA

Source	df	SS	MS	F	p
Group	1	913.598	913.598	8.64	.0036
Time	2	208.431	104.216	5.48	.0045
Time*Group	2	1246.412	623.206	32.76	.0001
Error	424	8065.049	19.021		

Research Question 3

Is there a difference in knowledge of science (as measured by the Science Subtest of the Comprehensive Test of Basic Skills) at the end of sixth grade for students who were taught in class using computers compared to students who were taught in class that did not use computers?

Using an independent t-test, with group as the independent variable and scores on the **Science Subtest of the Comprehensive Test of Basic Skills** as the dependent variable, there was not a significant difference between groups at the end of the year, t (199) = -1.07, $p > .05$. The mean score of the students on the team who used computers in the instruction of science was slightly higher (M = 54, SD = 23) than the mean score of students on the team that did not use computers (M = 50, SD = 29), but the difference was not significant.

Research Question 4

What is the attitude toward the use of computers and learning processes (as measured by structured interview questions) for students who were taught in class using computers compared to students who were taught in class that did not use computers?

A content analysis was used to analyze the subjects' responses to the structured interview questions. The student responses were coded and categorized by commonalities in content.

When the students were asked **how they felt about the learning activities in their science class**, students on the team who did not use computers indicated that it consisted mostly of paper work, taking notes, and listening to the teacher. They felt it was boring, with the exception of the unit related to tree content and working with microscopes, which they felt was fun. One student indicated that she wanted to use computers more by stating, "We only used the computer lab twice. I wish we could have used it more. The other team got to use the computer lab a lot." (Her team used the computer lab twice in English class at the end of the school year.)

Students on the team who used computers indicated that using computers in science was enjoyable. They also enjoyed working with the Legos, microscopes, and the Star Lab. They related specifics about what they learned when they used the computers. Comments included, "The computer programs gave us clues, then we had to find the answers - that was fun." "In the computer lab, we used 'Oh Deer' to find out about populations." "In the computer lab, we identified animals. We were able to understand the astronauts better. We were able to understand the life cycle of the fish." Table 4 lists the four most frequently repeated statements related to how the students felt about the learning activities in their science class.

Table 4

Frequency and Percentage of Common Responses by Group to Student Attitude Interview Question 1: How did you feel about the learning activities in your science class? (N = 10)

Common Responses of Students Not Using the Computer	Frequency	Percent
They were boring	9	90%
Mostly paper work & listened to teacher	6	60%
Want to use computer more; the other team used them a lot	4	40%
They were fun (microscopes, tree unit)	2	20%

Common Responses of Students Using the Computer	Frequency	Percent
They were fun, enjoyable	9	90%
Use of computers was fun	7	70%
Specifics about what they learned with computers	7	70%
Use of microscopes, Legos, Star Lab was fun	4	40%

Asked about **their feelings about the use of computers in instruction in school**, students on both teams felt that using computers was fun and that computers allowed them to do more things in class. Students on the team who did not use computers indicated that they wished they could have used the machines more in their classes.

Students on the team who used computers were very futuristic-oriented when expressing their feelings about the use of computers in instruction. Comments included, "It's important to use computers because you will be using them when you get into high school, and out of school, in jobs." "They prepare you for when you're older and have to use them." Table 5 depicts the three most frequently reported statements related to how the students felt about the use of computers in instruction in school.

Table 5

Frequency and Percentage of Common Responses by Group to Student Attitude Interview Question 2: How do you feel about the use of computers in instruction in school? (N = 10)

Common Responses of Students Not Using the Computer	Frequency	Percent
They are fun	8	80%
Wanted to use computers more	8	80%
They are helpful, you learn more	7	70%

Common Responses of Students Using the Computer	Frequency	Percent
They are fun	10	100%
Use of computers is important	6	60%
Indicated some future uses of computers	5	50%

When asked **how they felt about using computers in instruction in their classes that year**, students from both groups indicated that "keyboarding was boring." Students on the team who did not use computers indicated that they wanted to use computers more, by making statements such as, "We didn't get to use them much, but I liked them." "We only got to use them twice in English class and the other team used them all the time." "I wish we could have used the computer lab more."

Students on the team who used computers indicated that using the computer made class more fun and enjoyable. Comments from these students included, "The programs are fun, like we do in science." "I think it makes it more interesting when you use the computer." "I enjoyed using them in science, going to the computer lab." Table 6 depicts the three most frequently reported statements related to how the students felt about using computers in instruction in their classes that year.

Table 6

Frequency and Percentage of Common Responses by Group to Student Attitude Interview Question 3: How do you feel about using computers in instruction in your classes next year? (N = 10)

Common Responses of Students Not Using the Computer	Frequency	Percent
Want to use computers more	8	80%
Keyboarding is boring	5	50%
They are fun, enjoyable	3	30%

Common Responses of Students Using Computers	Frequency	Percent
They are fun, enjoyable	9	90%
Keyboarding is boring	6	60%
Using the computer makes things more interesting	5	50%

When the students were asked **how they would feel about using computers in their classes the next year**, students in both groups indicated that they wanted to use computers more, and both groups expressed positive feelings toward computers. Students on the team who did not use computers, indicated, "I'm looking forward to using them more." "I think they help us learn more." "I hope we get to use them in all of our classes - I like them."

Students on the team who used computers made comments regarding the importance of computers and how they could be utilized more in the classrooms. Comments from these students included, "We could use them in English class for our writing so we could use spell-check and correct our mistakes easier." "I wish we could use them more in our classes, like we did in science this year." "I enjoy working at your own speed, so I hope we use it more." "I like being able to do a lot of activities - one right after the other - like on the computer." Table 7 depicts the three most frequently reported statements related to how the students would feel about using computers in their classes the next year.

Table 7

Frequency and Percentage of Common Responses by Group to Student Attitude Question 4: How would you feel about using computers in your classes next year? (N= 10)

Common Responses of Students Not Using the Computer	Frequency	Percent
Want to use computers more	10	100%
Like them - they're fun	7	70%
Common Responses of Students Using the Computer	**Frequency**	**Percent**
Want to use computers more	10	100%
Like them - they're fun	10	100%
Responded with specifics on utilizing them more in class	7	70%

In analyzing student responses, students in both groups indicated that they enjoyed the learning process when there were hands-on activities, such as working with Legos, microscopes, and computers. The students on the team who did not use computers indicated that they wanted to use the computer more in their classes and felt somewhat "deprived" by not being able to use the computer as students on the other team.

Students on the team who used computers indicated positive feelings toward the use of computers and enjoyed using them in science class. Content analysis of all responses indicated that students on the computer-using team held more positive attitudes toward computers and learning processes than did students on the team who did not use computers in the instruction of science.

Summary

The two teams of sixth grade students were similar in demographic characteristics and in access to and use of home computers. Scores on the CTBS Scienc Subtest showed virtually no difference in knowledge of science between the two teams at the beginning of the study.

The analysis of data for Research Question 1 demonstrated that students on the team who used computers in the instruction of science held a more positive attitude toward computers, as measured by computer confidence and

computer anxiety, over time compared to students on the team who did not use computers. The findings demonstrated that students on the team who used computers in classroom instruction had significantly greater confidence and less anxiety toward computers over time than did the students on the team who did not use computers in the classroom. This indicates that the use of computers in instruction could have a positive impact on a student's level of confidence and anxiety toward computers.

The analysis of data for Research Question 2 demonstrated that students on the team who used computers in the instruction of science indicated a more positive attitude toward learning processes over time compared to students on the team who did not use computers. The findings demonstrated that students on the team who used computers in the classroom had significantly more positive attitudes toward the learning processes used in their classes over time than did the students on the team who did not use computers in the classroom. This indicates that the use of computers in instruction could have a positive impact on a student's attitude toward the learning processes used in the classroom.

The analysis of data for Research Question 3 demonstrated that students on the team who used computers in the instruction of science scored slightly higher on the

Science Subtest of the CTBS at the end of the year compared to students on the team who did not use computers. Results showed that the difference in the teams' knowledge levels was not significant difference. Thus, the use of computers in science instruction did not have an impact on a student's overall knowledge of science content.

The analysis of data for Research Question 4 demonstrated that students on the team who used computers in class had a tendency to have more positive attitude toward the use of computers and learning processes compared to students who did not use computers in class. The findings were supported by a content analysis of student responses to the structured interview questions.

CHAPTER V

Summary, Conclusions, and Recommendations

This chapter presents (a) a compilation of the processes and procedures utilized to conduct this study, (b) a summary of the findings of this study, (c) the conclusions drawn from the findings, (d) implications for schools, and (e) recommendations for future research.

Introduction

The 21st century is closing on us at an alarming pace. With it comes a wave of new technology that is altering the very face of the earth (Wright, 1994).

During the present century, advances in technology have altered the lifestyles and living patterns of most human beings (Gilberti, 1994). Despite these advances and changes, Gilberti stated that technology education is quite likely the least understood area of the school curriculum.

Continuing changes in our technological society have placed new demands on citizens. Wright (1994) stated that unless schools change their curriculum, tomorrow's citizens will understand little about the very basis of their way of life - technology. Referring to technology, Burke (1979) indicated that never have so many people understood so little about so much.

No longer is it adequate to educate students who know only the basics they have been able to memorize (Boysen,

1994). Educators are charged with the responsibility of helping students develop skills that make them creative problem solvers and effective decision makers. A study of technology contributes to an understanding of our technical means and empowers students to make rational decisions to meet life's challenges (Gilberti, 1994). Developing an effective technology education program in our schools requires collaboration, promotion, and exploration. Educators must understand that random experiences with computers and educational technology sprinkled across the future will do little to help students understand the scope and impact of technology on human life (Wright, 1994).

Educators must realize the increasingly important role that technology will play in the life of all human beings, and take the responsibility for providing technological opportunities for all students. Waetjen (1994) stated that educators are given the responsibility to provide young people with an education that prepares them for empowerment in a technological society. Educators must assess the technological needs of the students and the impact that technology has on learning. Technology removes many barriers to learning (Boysen, 1994). Educators should be searching, and researching, methods and strategies to remove barriers by using the new technological tools to create a more powerful learning experience for all students. This

search should begin in the classroom to determine the technological needs of the students and appropriate solutions to meet these needs.

Computers have become an important technological tool in the classroom. The role of computers in education has vastly increased in recent years, and the trend appears to be toward additional involvement (Vermette, Orr, & Hall, 1986). With the infusion of computers in the educational process, educators must plan how to integrate this technological tool into the curriculum. To determine how the students will benefit most from computers in the educational environment, instructional strategies must be assessed, along with attitudes associated with the use of these strategies. Such an assessment should begin in the classroom where students are actively involved in the learning process and different instructional strategies are being employed.

Purpose of the Study

The purpose of the study was to examine the impact of the use of computers in science instruction on student attitudes toward learning.

Design of the Study

The study used was a quasi-experimental design with repeated measures. To assist with quantitative analysis, the qualitative component of interview questions was also

employed. Two hundred fourteen sixth-grade students made up the sample. The students were randomly assigned by computer to two teams: 110 students on the team who used computers in the instruction of science and 104 students on the team who did not use computers in the instruction of science. Each team had a different teacher. The independent variables were use of computers in instruction versus not using computers in instruction. The dependent variables were (a) attitudes toward computers (as measured by the Attitudes Toward Computers Survey), (b) attitudes toward learning processes (as measured by the Attitude Toward Learning Processes Survey), (c) knowledge of science (as measured by the Science Subtest of the Comprehensive Test of Basic Skills), and (d) attitude toward the use of computers and learning processes (as measured by structured interview questions). The Attitudes Toward Computers Survey and the Attitude Toward Learning Processes Survey were administered at baseline, mid-year, and the end of the year. The Science Subtest of the CTBS was administered at the end of the year. The structured interview questions were asked at the end of the year.

Data Analysis

The responses to the research instruments were coded and verified. The Statistical Analysis System (SAS) was used to compute the statistics for presentation and

analyses. Descriptive statistics (mean, standard deviation, frequency, and percent) were computed on each item. Repeated measures ANOVAs and independent t-tests were employed to answer the research questions. In addition, to provide a qualitative component, a purposive sample of students was randomly selected from each team for interviews at the end of the year.

Summary of Findings and Discussion

Research Question 1

Is there a difference in computer anxiety and computer confidence (as measured by the Computer Attitude Survey) over time for students who were taught in class using computers compared to students who were taught in class that did not use computers?

The Computer Attitude Survey was utilized to measure students' attitude toward computers. Separate scores were collected for the subscales of computer anxiety and computer confidence.

There was a significant difference on computer anxiety over time between the students taught in class using computers in science instruction compared to students taught in class that did not use computers in science instruction. The students who used computers experienced significantly less anxiety toward computers at the end of the year compared to students who did not use computers in science

instruction. As students use computers more, they become more comfortable in using computers and therefore experience less computer anxiety. Conversely, students with limited computer usage are more likely to have increased anxiety. These findings concur with those of Loyd and Gressard (1984), who suggested that computer experience be provided as early as possible in school curricula so that students can increase their familiarity with computers and therefore lessen anxiety toward computers.

There was a significant difference on computer confidence over time between the students taught in class using computers in science instruction compared to students taught in class that did not use computers in science instruction. The findings demonstrated that those students taught in class using computers in science instruction had significantly greater confidence toward computers at the end of the year compared to students not using computers. The use of computers in the classroom and additional exposure to computers appeared to have a positive impact on the students' confidence toward computers. This finding is similar to those of earlier studies in which students exposed to computer simulations held more positive attitudes toward computers and simulations than did students who received conventional classroom instruction (Shaw & Okey, 1985).

The results indicated that students taught in class using computers in science instruction had a more positive attitude toward computers compared to students taught in class that did not use computers in science instruction. These findings are consistent with results obtained by McGrath, Thurston, McLellen, Stone, and Tischhauser (1992). They found that students who had access to computers liked computers a lot and rated them higher than the students who did not have access to computers. Results of a study by Enoch (1985/86) revealed that the overall attitudes of middle school students toward computers was moderately high.

Research Question 2

Is there a difference in attitude toward learning processes (as measured by the Attitude Toward Learning Processes Survey) over time for students who were taught in class using computers compared to students who were taught in class that did not use computers?

The Attitude Toward Learning Processes Survey was utilized to measure the students' attitudes toward the learning processes used in their classes. There was a significant difference on attitudes toward learning processes over time between the students taught in class using computers in science instruction compared to students taught in class that did not use computers in science instruction. The findings demonstrated that students using

computers indicated a more positive attitude toward the learning processes in their classes at the end of the year compared to students not using computers. Clement (1981) reported that, in general, student attitudes toward computer-based courses are positive among students in junior high. These positive attitudes make the interaction with computers a pleasant and rewarding learning experience. Results in the present study are consistent with those of Kulik, Bangert, and Williams (1983), who found more positive student attitudes toward subject matter and instruction in classrooms that used computers. Krendl and Lieberman (1988) found that most students considered computer activities to be highly motivating and interesting. Cordell (1991) reported that attitudes have been shown to correlate with learning outcomes. Positive attitudes are often associated positively with learning. Therefore, if the use of computers is associated with a positive attitude toward learning processes, computers should be utilized more in the classroom.

Research Question 3

Is there a difference in knowledge of science (as measured by the Science Subtest of the Comprehensive Test of Basic Skills) at the end of sixth grade for students who were taught in class using computers compared to students who were taught in class that did not use computers?

The Science Subtest of the Comprehensive Test of Basic Skills was utilized to measure overall knowledge of science. There was a difference in knowledge of science at the end of the year between students taught in class using computers compared to students taught in class that did not use computers, but it was not a significant difference. The findings indicate that the use of computers in science instruction did not have a significant impact on knowledge of science content. These findings do not concur with the studies by Kober (1993), which suggest that the use of computers can improve student achievement. Mojowski (1987) stated that technology has the potential to enhance the way people think and learn and to change traditional patterns of access to knowledge. New technologies represent an improvement over previous tools but are only a means to a larger end - improved student learning (Mojowski).

Research Question 4

What is the attitude toward the use of computers and learning processes (as measured by structured interview questions) for students who were taught in class using computers compared to students who were taught in class that did not use computers?

Structured interview questions were utilized to compare attitudes toward the use of computers and learning processes between students taught in class using computers in science

instruction and students taught in class that did not use computers in science instruction. A content analysis of responses demonstrated that students using computers experienced a more positive attitude toward the use of computers and learning processes than did students taught in class that did not use computers.

Students who used computers in class were futuristic-oriented toward the use of computers; related specifics about what they learned with computers and how they benefited from computers in instruction; were able to see the importance of computer use; enjoyed using computers to work at their own pace; and indicated that computers were enjoyable, and made the class more interesting.

Students taught in a class that did not use computers thought that their classes were boring; indicated that they used computers in English class only twice, but they were fun and enjoyable; and wanted to use computers more, as the other team had.

Early studies of computers and academic motivation relied on self-reports of students' attitudes toward computers and found that most students considered computer activities to be highly motivating and interesting (Krendl & Lieberman, 1988). Surveys by the National Science Teachers Association and others have shown that appropriate use of computers can result in desirable cognitive and affective

learning outcomes for students (McGinnis, 1991). The role of computers in society has expanded dramatically, and familiarity with computers and the ability to use them effectively will be of crucial importance to success in many different areas (Loyd & Gressard, 1984). In order to ensure that students are afforded every opportunity possible to experience success, educators must develop strategies to incorporate the use of computers in the curriculum and apply effective strategies toward their use in the learning process.

Conclusions

On the basis of the findings of this study, the following conclusions were drawn.

1. Sixth grade students who were taught in science class using computers experienced significantly less anxiety toward computers compared to students who were taught in science class that did not use computers.

2. Sixth grade students who were taught in science class using computers experienced significantly more confidence toward computers compared to students who were taught in science class that did not use computers.

3. Sixth grade students who were taught in science class using computers experienced a significantly more positive attitude toward learning processes compared to

students who were taught in science class that did not use computers.

4. Computer use did not significantly increase knowledge of subject (science) content.

5. In general, sixth grade students who were taught in science class using computers experienced a more positive attitude toward computers and learning processes compared to students who were taught in science class that did not use computers.

Implications for Schools

The results of this study have many implications for school districts when planning for the use of computers in the curriculum. This study indicated hands-on experiences with computers increased students' confidence toward computers, lessened anxiety toward computers, and resulted in a more positive attitude toward computers and the use of computers. The increased use of technology in society has placed greater demands on the schools to integrate more technology in the curriculum. This includes the use of computers in the instructional process. If hands-on experience with computers has a positive effect on students' attitudes, schools should strive to provide computer opportunities for students in every classroom and integrate the use of computers in each curricular area.

A second implication of this study relates to students' attitudes toward the learning processes used in the classroom. The results of this study demonstrated that hands-on experiences with computers have a positive effect on students' attitudes toward the learning processes used in the classroom. The use of computers as part of the learning processes could be considered in other classrooms which have content that lends itself to such teaching strategies.

Although the use of computers as part of the curriculum did not significantly affect academic achievement, the instructional strategy produced no negative or adverse effects. And, it should be noted, attitudes toward learning were improved. This finding indicates that the use of related computer programs could affect student learning outcomes (other than on only academic performance) in a particular curricular area. Further testing of knowledge is recommended due to the limitation of using only the Science Subtest of the CTBS as knowledge performance in this study.

The results of the student interviews indicated a strong linkage between computer use and positive attitudes toward the use of computers and the learning process. Students indicated several benefits of computer use and were able to express their feelings about the importance of knowledge and experience with computers for the future. The implication is that schools should expand the use of

computers. Computer technology is costly, but so is the price our students will pay if they are not prepared for the future employment marketplace. This preparation needs to begin in the early years of the education process. The additional use of computers could be especially important for students who do not have access to a computer at home.

Recommendations for Future Research

Based on the findings of this research study, the following recommendations for research are proposed:

1. This study should be extended to determine if using computers in the classroom has an effect on student attitudes toward computers and the learning processes throughout middle school (sixth, seventh, and eighth grades).

2. This study should be extended to determine if using computers in each curricular area has an effect on student learning and acquisition of knowledge.

3. Explore whether the use of computers in instructional strategies has an effect on teachers' attitudes toward teaching and their curricular area.

4. Explore whether the use of computers in the instructional process has an effect on parents' attitude toward the school.

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APPENDIX A

Computer Attitude Survey

COMPUTER ATTITUDE SURVEY

NAME: _____

GENDER: _____ Boy

_____ Girl

1. Do you have a computer at home?

_____ Yes

_____ No

If Yes, answer the following questions:

2. What type of computer is it?

_____ Macintosh

_____ Apple II

_____ Other

3. How long have you had it?

_____ less than 6 months

_____ 6 months - 1 year

_____ over 1 year

4. Do you use your computer at home?

_____ Yes

_____ No

If Yes, answer the following question:

5. How many hours per week do you use your computer at home?

_____ 1 hour or less

_____ 2-4 hours

_____ over 4 hours

COMPUTER ATTITUDE SCALE

By B. Loyd & C. Gressard

Below are a series of statements designed to permit you to indicate the extent to which you agree or disagree with the ideas expressed. For each statement, place a check mark (✓) in the category that most closely matches your feelings. Use the following code for your answer:

1 = Strongly Agree
2 = Slightly Agree
3 = Slightly Disagree
4 = Strongly Disagree

		1	2	3	4
1.	Computers do not scare me at all.	___	___	___	___
2.	I'm no good with computers.	___	___	___	___
3.	Working with a computer would make me very nervous.	___	___	___	___
4.	Generally, I would feel OK about trying a new task on the computer.	___	___	___	___
5.	I do not feel threatened when others talk about computers.	___	___	___	___
6.	I don't think I would do advanced computer work.	___	___	___	___
7.	I feel aggressive and hostile toward computers.	___	___	___	___
8.	I am sure I could do work with computers.	___	___	___	___
9.	It wouldn't bother me at all to take computer classes.	___	___	___	___
10.	I'm not the type to do well with computers.	___	___	___	___
11.	Computers make me feel uncomfortable.	___	___	___	___
12.	I am sure I could learn school-related computer activities.	___	___	___	___
13.	I would feel at ease in a computer class.	___	___	___	___
14.	I think using a computer would be very hard for me.	___	___	___	___
15.	I get a sinking feeling when I think of trying to use a computer.	___	___	___	___
16.	I could get good grades in computer classes.	___	___	___	___
17.	I would feel comfortable working with a computer.	___	___	___	___
18.	I do not think I could handle a computer class.	___	___	___	___
19.	Computers make me feel uneasy and confused.	___	___	___	___
20.	I have a lot of self-confidence when it comes to working with computers.	___	___	___	___

APPENDIX B

Student Attitude Interview Questions

Student Attitude Interview Questions

I.D. Number: _____

Team: _____ Gold _____ Blue

1. How did you feel about the learning activities in your science class? (i.e. teacher presentations, lab experiments, computer use, assignments)

2. How do you feel about the use of computers in instruction in school?

3. How do you feel about using computers in instruction in your classes this year?

4. How would you feel about using computers in your classes next year?

APPENDIX C

Permissions

University of Nebraska Lincoln

Department of Educational Administration
1204 Seaton Hall
P.O. Box 880638
Lincoln, NE 68588-0638
(402) 472-3726

INFORMED CONSENT FORM
IRB # 94-1-134 EP

Identification/Purpose of Project
This study is being conducted to examine the impact of the use of computers in instruction to enhance student learning in the sixth grade science curriculum.

Invitation To Allow Participation
Your son/daughter is invited to participate in this research study. The following information is provided in order to help you to make an informed decision whether or not to allow your son/daughter to participate. If you have any questions, please do not hesitate to ask. Your son/daughter is eligible to participate because he/she is a sixth grade student at Adams Middle School.

Procedures
Participation in this study will require approximately five minutes of your son's/daughter's time for each questionnaire. The students will answer questions to a Computer Attitude Survey, an Attitude Toward Learning Processes Survey, and a short science test. Baseline information will be used from the instrument administered at the beginning of the 1993-94 school year, with the surveys administered again at mid-year and at the end of the year. The science test will require one class period at the end of the year.

Risks and/or Discomforts
There are no risks or discomforts associated with this research.

Benefits
Students will be allowed an opportunity to give their input and opinions to the school regarding computers and learning processes. The information gained from this study may help us assess the present use of computers in the classroom and help us to provide beneficial computer experiences for students in the future.

Confidentiality
Any information obtained during this study which could identify your son/daughter will be kept strictly confidential.

Freedom to Withdraw or Ask Questions
Your son/daughter is free to decide not to participate in this study or to withdraw at any time without adversely affecting your relationship with the investigators or the University of Nebraska. Your decision will not result in any loss of benefits to which you are otherwise entitled. You may ask questions concerning the research before agreeing to allow your son/daughter to participate or during the school year. If you have any questions about your child's right as a research subject that have not been answered by the investigator, you may contact the University of Nebraska-Lincoln Institutional Review Board, telephone (402) 472-6965.

Consent to Receive Copy
You are voluntarily making a decision whether or not to allow your son/daughter to participate in this research study. Your signature certifies that you have decided to consent having read and understood the information presented. You will be given a copy of this consent form to keep.

Signature of Parent/Guardian	Son/Daughter	Date

JoAnn Stevens, Ed.S., Principal Investigator Off.: 308-535-7112
Ron Joekel, Ed.D., Secondary Investigator Off.: 402-472-3726

University of Nebraska Lincoln

Department of Educational Administration
1204 Seaton Hall
P.O. Box 880638
Lincoln, NE 68588-0638
(402) 472-3726

CHILD ASSENT FORM
IRB # 94-1-134 EP

A STUDY OF THE IMPACT OF THE USE OF COMPUTERS IN INSTRUCTION IN THE ENHANCEMENT OF LEARNING IN SIXTH GRADE SCIENCE

We would like you to invite you to take part in this study. We are asking you because you are a sixth grade student and the study is being conducted with the students in your class.

In this study, we would like to look at how the use of computers in science class affects your attitude toward computers, your attitude toward learning processes or the types of activities you do in class, and your knowledge of science. To do the study, we will ask you to answer questions concerning your attitude toward computers, your attitude toward learning processes, and questions about science.

There will be no risks or discomforts associated with this study. Your answers will be kept strictly confidential. The result of the science questions will not be used as part of your science grade. You will be given an opportunity to give us your opinions regarding computers and the learning processes that are used in class. The reason we are doing this study is to use your opinions to determine how you are benefiting from the use of computers in the classroom now, and how we can use computers to provide better learning experiences for you in the future.

Your parents will also be asked to give their permission for your answers to be used in this study. Please talk this over with your parents before you decide whether or not to allow us to use your answers.

You do not have to participate in the study or allow your answers to be used if you do not want to. If you decide to participate in the study, you can stop at any time.

If you have any questions at any time please ask one of the researchers.

IF YOU SIGN THIS FORM IT MEANS THAT YOU HAVE DECIDED TO PARTICIPATE AND HAVE READ EVERYTHING THAT IS ON THIS FORM. YOU AND YOUR PARENTS WILL BE GIVEN A COPY OF THIS FORM TO KEEP.

_____ _____
SIGNATURE OF SUBJECT DATE

_____ _____
SIGNATURE OF INVESTIGATOR DATE

INVESTIGATOR
JoAnn M. Stevens Office: 535-7112

"Our job is their learning
We're good at our job because futures depend on it."

North Platte Public Schools

Administrative Offices

1101 WEST FIRST STREET – P.O. BOX 1557 – NORTH PLATTE, NEBRASKA 69103-1557

PHONE (308) 535-7100 – FAX (308) 532-7255

DR. L. CHRIS RICHARDSON, *Superintendent*

DR. PAUL R. BROCHTRUP, *Associate Superintendent*

JACK L. PRICE, *Director of Personnel*

September 10, 1993

JoAnn M. Stevens, Principal
Adams Middle School
1200 South McDonald Road
North Platte, NE 69101

RE: Approval to Study Impact of Computer Instruction in 6th Grade at Adams Middle School

I have reviewed your proposal of September 7th to implement a comprehensive study of the impact of computer usage in instruction to enhance learning in 6th grade science. I believe this study will help our school district to assess our present program in this area and help us to ensure that technology will positively affect the educational process for our students now and in the future.

Based on your research plan which calls for voluntary response by all sixth grade students to a computer attitude survey, an attitude toward learning processes survey, and a comprehensive science exam, permission is granted to complete this study with Adams 6th graders.

If you have any questions please don't hesitate to call or stop in to see me.

L. Chris Richardson, Ph.D. Superintendent

University of Nebraska Lincoln

Research Compliance Services
Institutional Review Board
103 Whittier Bldg.
2255 'W' Street
P.O. Box 830849
Lincoln, NE 68583-0849
(402) 472-6965
FAX (402) 472-9323

March 8, 1994

Ms. JoAnn Stevens
Dr. Ron Joekel
Educational Administration
1204 Seaton Hall
Lincoln, Nebraska 68588-0638

IRB # 94-01-134 EP

TITLE OF PROPOSAL A Study of the Impact of the Use of Computers in Instruction in the Enhancement of Learning in Sixth Grade Science

Dear Ms. Stevens and Dr. Joekel:

This letter is to officially notify you of the approval of your project by the Institutional Review Board for the Protection of Human Subjects. It is the committee's opinion that you have provided adequate safeguards for the rights and welfare of the subjects in this study. Your proposal seems to be in compliance with DHHS Regulations for the Protection of Human Subjects (45 CFR 46).

We wish to remind you that the principal investigator or project director is responsible for keeping this Board informed of any changes involved with the procedures or methodology in this study. You should report any unanticipated problems involving risks to the subjects or others to the Board. It is also the responsibility of the principal investigator to provide the Board with an annual review and update of the research projects each year the project is in effect.

If I can provide you with additional information, please call me.

Sincerely,

R. Gene White, Director
for the IRB committee

xc: Dr. Priscilla Grew

University of Nebraska Lincoln

Research Compliance Services
Institutional Review Board
103 Whittier Bldg.
2255 'W' Street
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May 23, 1994

Ms. JoAnn Stevens
1412 West 1st Street
North Platte NE 69101

IRB # 94-01-134 EP

TITLE OF PROPOSAL: The Impact of Computers on Attitudes Toward Learning in Sixth Grade Science Students

Dear Ms. Stevens:

The Institutional Review Board for the Protection of Human Subjects has completed its review of the Request for Change in Protocol submitted to the IRB.

This letter constitutes official notification of the approval of the protocol change. You are therefore authorized to implement this change accordingly.

Sincerely,

R. Gene White, Director
for the IRB committee