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THE TEACHERS' VOICE: A QUALITATIVE STUDY OF TEACHERS' VIEWS OF THE IMPACT OF COMPUTERS ON TEACHING AND LEARNING

A Dissertation

Presented for the

Doctor of Education Degree

The University of Tennessee, Knoxville

Basma Damiri-Khader

May 1998

Dedicated to the Honor of My Mother,
Mrs. Nadia Khader,
and to the Memory of My Father,
Mr. Rachid Khader

Acknowledgements

A long journey begins with a little step. To those who lent a hand along the way, my gratitude. Throughout the course of this research, many people have assisted me with their help, knowledge, and encouragement. I am most grateful to all of them, for without them, this task would have been impossible.

First of all, many thanks go to my Chairman, Dr. Thomas Turner and to my committee members, Dr. Dale Doak, Dr. Anne McIntyre, and Dr. Charles Hargis. Their contribution extended well beyond building this study to building mental and emotional foundations within me. I wish to thank my advisor, Lawrence Coleman for guiding me through the doctoral program. Your help has been greatly appreciated. Many thanks and hats off to my participants (teachers) who helped collect my data and tried their best to improve their teaching practice and their students' learning.

Many thanks and appreciation to my good friend, Dr. Julie Little for providing love, encouragement and support when they were most needed. Also, I am thankful to my friends Dr. Suzanne Newbold, Dr. Victor Barr, Liz Whitson and Gale Brewer for the assistance they provided throughout this process.

I am grateful for the unlimited love, encouragement, and support of my mother, Mrs. Nadia Khader. Thank you for teaching me the value of education. Your love and devotion can never be adequately acknowledged. I thank my brothers, Nafith Khader, Dr. Fakhri Khader, Dr. Zohair Khader, Dr. Khaled Khader and immanent Dr. Kamal Khader. Also, I wish to thank my sisters, Shaharazad Khader, Mahasen Khader, Summer Khader and Omymah Khader. Thank you all for your contributions to my molding as a child and for the inspiration you gave me to look beyond apparent limits.

Forever, I will be thankful to my husband, Ramadan, for encouraging me to believe that my dream could be made possible. Your love and support have given me the strength to endure to the end. Without you, this task would have been impossible. My greatest and deepest thanks is reserved to my children, Yazan Damiri, Anas Damiri, and Malek Damiri. Your smiles lightened my way when the path was dim to reach my goal. Thank you all for watching me work on my dissertation more than you wanted to.

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CHAPTER I

INTRODUCTION

With the 21st Century less than half a decade away, educators are seeking ways to improve the teaching and learning process in order to effectively address current needs and future challenges (Snelbecker, 1982; Cuban, 1986). One suggestion that has been supported by a large number of educators is to enhance teachers' effectiveness and students' learning through effective and appropriate use of educational technology.

Since 1920, educators have seen a number of educational technologies introduced to the classroom. In an effort to make instruction both productive and enriching, film, radio, and television are examples of educational technologies applied by educators with high expectations (Cuban, 1986). The computer is the most important among the latest technologies that have been introduced to the classroom. Much has been written about the potential benefits of computer use in the classroom. For example, computers have the capacity to individualize learning for pace and subject coverage, expose students to unlimited amounts of information, relieve the tedium of repetitive activities,

encourage critical thinking and problem solving, provide immediate feedback, provide motivation, and allows the learner to use visual and graphic symbols in an interactive exchange of information (Beasley, 1984; Mehan, 1985). In addition, Atkins (1993) asserted that:

> the greatest potential for computer applications is in the area of retrieval, manipulation, and exchange of information. Full utilization of these capabilities means an escape from "2 x 4 learning" - that is, learning bounded by the two covers of the book and four walls of classrooms. (p. 75).

Therefore, the majority of research on school computing has concentrated on how to get more computers into schools and how to help teachers become more interested and competent in using computers in the classroom (Bosco, 1986; Tucker, 1983). As a result, the proportion of schools reporting the use of at least one computer expanded dramatically, according to the U.S. Congress Office of Technology Assessment (OTA). By 1995, schools placed an estimated 5.8 million computers, roughly one for every 9 students (Loveless, 1996).

The use of computers in schools has been viewed by parents, teachers, and administrators as an essential part of improving education (Rothenberg, 1994; Knupfer, 1993). Therefore, it was the interest of this study to look closely at the actual functions of computers in the classroom and to determine how the availability of computers in the classroom

has impacted or influenced the teaching and learning process.

Background

Computers have been used for educational applications since the early 1960s. However, the major focus for the first three decades of educational computing was computer programming and computer-assisted instruction (CAI). With the emergence of the personal computer and various types of educational technologies in the 1980s, the role of computers in the classroom shifted from providing curriculum materials in the form of drills and practice, tutorials, games and simulation to a teaching and learning tool. Since that time teachers and students have been using word processing and experimenting with new educational software that encouraged critical thinking, problem solving, and exploration (Kearsley, Hunter & Furlong, 1992).

The presence of computers in the classroom is not just another piece of equipment that has been added to the classroom. This presence necessitates change. Many educators have argued that computers in the classroom will transform the way teachers teach, the way students learn, and the way teachers and students interact. Also, a number of educators have felt that the computer revolution is going

to improve teachers' productivity and creativity (OTA, 1988;, Olson, 1988; Fulton, 1993; McDaniel & McIrney, 1991; Kulik & Kulik, 1985). In addition a number of educators have argued that when computers are used appropriately in instruction, they promote improvement in students' academic achievement, motivation, and attitude toward learning (OTA, 1988; Becker, 1987; Olson, 1988).

Although the majority of researchers have agreed that the use of computers in education has a positive affect on the teaching and learning process, the teacher has been ignored in this evaluation process. The teacher is the major determinant of the extent and the nature of the impact which computers may have in education. How comfortable the teacher felt about the use of computers in the classroom and how clearly she/he understood and accepted the nature of this innovation could generally determine its impact (Knupfer, 1993; Cuban, 1986; Nuccio, 1990). Watson and Tinsley (1995) stated that

> It is the one teacher who decides where, when, how and which tools to exploit and to be used by the students...Thus it is far less the products than the uses made of them which need to be evaluated. The question to ask is not "what does the computer do?" but rather "what does the teacher do" (p. 19).

Statement of the Problem

Much of what has been said and written about the impact of computers in the teaching/learning process in the classroom has been essentially based on supposition. Many educators have relied on their past experience to make judgements and predictions for the future (Langley, 1996). Further, research on actual teachers' use of computers in instruction is limited. The majority of research has been directed at determining the effectiveness of computers as instructional devices, not at ways which teachers use computers. For example, some researchers have compared the effectiveness of new instructional methods with those of traditional methods on the basis of students' outcomes.

According to Mehan (1985) it has been people's experience with computers, not the inherent features, that has made the difference.

> A microcomputer in the classroom is a social practice and not a technology. The crucial ingredient is people's experience with the machine, not its "inherent" features. It is what people do with the machine, not the machine itself that makes the difference (p. 19).

Machines and computers may be used for a variety of purposes and in a variety of ways. By the same token, they may be used in a very limited way or not at all, as Knupfer (1993) put it. The impact of computers in education is for the most part controlled by the teacher.

> Therefore the extent and the nature of the impact of computers in schools will depend on individual teachers. It is the teacher who lives with the innovation, and it is ultimately the teacher who will accept or reject, implement successfully, or fail to implement technology in the classroom (p. 171).

Further, it has been suggested that research emphases for the future must be to understand how teachers use computers in their practice and how the presence of computers impacts teachers, students, and the social organization of classroom (Olson, 1988). Also, Neuman (1989) called for more descriptive studies to focus on how computers actually function in the classroom.

Purpose of the Study

The purpose of the current study was to determine how a selected group of teachers who were part of the 21st Century Classroom program in Knoxville, Tennessee actually used computers and how continued computer use affected the teaching/learning process.

Importance of the Study

This qualitative study attempted to determine the actual functions of computers in the classroom and how these functions affect the teaching/learning process.

Understanding the effect of the use of computers on teaching/learning from teachers' perceptions may produce meaningful change in education. Durost (1994) argued that technological planning should start from the end point of instruction - deciding what educators do with computers and then mapping backwards, planning on appropriate software and ancillary equipment for the classroom.

By talking directly with teachers, the researcher hoped to bring their views to bear on the policy makers' decisions. These decisions in turn will affect teachers as they continue to integrate new technologies into their practice. Also, the data that emerge from interviewing these teachers offer insights for administrators and policymakers on how teachers currently use computers and how the continued use of computers can affect the teaching/learning process. As McMeen (1986) stated,

> computer issues in an institution should incorporate teachers' views because teachers often represent the best clinical expertise available in terms of their knowledge about the practice of teaching (p. 105).

Limitations and Delimitations

This study was delimited to a number of teachers who were part of the 21st Century Classroom program in Knoxville, Tennessee. The 21st Century program has been a

state-wide program in the State of Tennessee, aimed at upgrading the use of technology in schools. This study was also delimited to the teachers who met the selection criteria and who were willing to participate in this study. These teachers were chosen from six different schools that represented different areas in Knoxville, Tennessee. Because of the constant changes of technology, this study was limited to the time that it was conducted. As with any qualitative research, data analysis and conclusions will be limited to the interpretations of research data by the researcher.

Assumptions

1. It was assumed that the 21st Century Classroom teachers have positive attitudes towards technology and use it on a regular basis.
2. It was assumed that the impact of the use of computers in the classroom depend on the individual teacher.
3. It was assumed that participants (teachers) were frank and honest in responding to the interview questions.
4. It was assumed that continued use of computers would have an impact on the teaching/learning process in the classroom.

Research Question

The question that provided a framework for this study had two major and dependent parts which were:

How did a selected group of teachers who were part of the 21st Century Classroom program in Knoxville, Tennessee actually used computers; and, how continued use of computers affected the teaching/learning process?

Definitions of Terms

The following terms were operationally defined for use in the present study:

computer programming:	communicating in a language that the computer and the human can both understand (Papert, 1980)
Drill and practice:	refers to the use of computers to drill facts and basic skills.
Computer Assisted: Instruction (CAI)	generally denotes tutor-made computer activities (Beasely, 1985; p. 216)

simulation:	the ability of the computer to create real-life situations by means of simulations.
Educational technology:	the practical use of various kinds of equipment and devices which can aid school learning (Snelbecker, 1982; p. 43).
Telecommunications:	This term refers to communication between computers via telephone connection (Beasely, 1985; p. 217)
Listserve group:	A group of people who share a common interest and communicate via the Internet.

Organization of the Study

This study has been presented in five chapters. Chapter one included the introduction, background, statement of the problem and the purpose of the study, as well as the definition of terms, assumptions, delimitation, methodology and importance of the study. Chapter two was a review of the literature relevant to the use of computers in the teaching/learning process. The methodology of the study has

been described in Chapter three where the details of research design, participants selection, data collection and data analysis procedure were fully discussed. Chapter four was devoted to the presentation and analysis of the data, including findings and discussion of the research question of the study. Chapter five included a summary of the study, conclusions drawn from the findings, implications of the study and recommendations for further research.

CHAPTER II

REVIEW OF THE LITERATURE

Introduction

The purpose of the current study was to determine how a selected group of teachers who were part of the 21st Century Classroom program in Knoxville, Tennessee actually used computers and how continued computer use affected the teaching/learning process in the classroom. This chapter reviewed related literature in an effort to provide an overview of recent findings and trends in research related to the computer and its impact on the teaching/learning process. In addition, this chapter attempted to provide substantial data useful in developing this study.

A survey of literature was carried out through searches of Library Literature, Education Index, Dissertation Abstract International, Education Resources Information Center (ERIC) databases, and the Internet, using the search engines Alta Vista and Yahoo. The researcher used the online catalog and the interlibrary loan at the Hodges Library at the University of Tennessee. Once a review was located, its bibliography was examined to serve as a cross-

reference with the computer search and to identify additional resources.

In reviewing the literature the researcher found four dominant areas of inquiry related to the field of the study. These areas were: 1) computers in education, 2) impact of computer use on teaching, 3) impact of computer use on learning, and 4) teacher perceptions of the impact of computer use on the teaching/learning process.

Computers in Education

"Computer technology has been an integral part of our daily lives, and one field that has quickly accepted the services of the computer is education" (Meinster, 1990; p. 1). Over the past 10 years, the number of computers in schools has steadily increased. The proportion of schools reporting the use of at least one computer expanded dramatically in the 1980s and 1990s. According to the U.S. Congress Office of Technology Assessment (OTA), the percentage of schools with one or more computers grew from 18 percent in 1987 to 95 percent in 1995. By 1995, schools placed an estimated 5.8 million computers, roughly one for every nine students (Lovelles, 1996). The long range plan for computer technology in the 1990s according to OTA has been to provide five working computer stations in each

classroom and to network within schools and from schools to the wide area network (Radlick, 1995).

The steady increase of the number of computers in schools is of economic as well as educational interest. A main concern shared by many educators, parents and governments is that schools need to prepare students to live and work in the technologically oriented world of the 21st century and schools cannot do so by using the old teaching approaches that have changed little over the past years and do not address current needs and future challenges (OTA, 1988; Waugh, 1982; Wood & Smellie, 1990; Hannafin & Savenge, 1993). In addition, O'Shea & Self (1983) mentioned that governments have felt it is important to encourage the use of computers in education for these three reasons.

1. Children need to be aware of the nature and uses of computers in order to be able to cope with present and future technological society.

2. Computers can help with certain administrative chores, such as the maintenance of students' records and schedule of classes.

3. Computers can help to improve the learning process (p. 1).

In addition, the use of computer technology in schools has been viewed by parents, teachers, administrators, and policy makers as an essential part of improving and enhancing the quality of education. Dwyer, Ringsaff, & Sandholtz (1991) stated:

> We have found that computing, placed in the hands of well supported teachers and students, can be agents for catalyzing educational excitement and growth of a kind that is simply without precedent. We believe that there has simply been no other tool like it in the history of education (p. 71).

Several researchers have commented that no other technological change has had quite the potential as computer technology. In the history of education, there has not been a concept or technique that has the capability to impact curriculum, administrators, students, teachers, and parents as does the computer (Rothenberg 1994; O'Shea & Self 1983). Although the computer is a machine in the usual sense of the word, it is qualitatively different form all machines that educators previously encountered (Beasley, 1984). As Papert (1980) stated, it is the "proteus" of machines. "It is an incomplete machine which may be completed in an enormous variety of ways to produce an enormous variety of machines" (Beasley, 1984; p. 1).

Impact of Computer Use on Teaching

In dealing with the implementation of computer technology in schools, educators have been constantly confronted with the need for individual change in attitudes and beliefs as well as classroom based changes in teaching strategies, curriculum, specific teaching duties, daily

routines, and classroom management (Fullan, 1991; Dwyer, Ringsaff & Sandholtz, 1991; Knupfer, 1993; Niemiec, 1987). Many educators have suggested that as more and more computers are placed in the classroom, more teachers will change the way they teach (Perelman, 1990; Nuccio, 1991; Hager, 1981; Olson & Eaton, 1986; Caruso & Shade, 1994; Dupagne & Krendal, 1992). One of the changes in the teaching practice that many educators mentioned was the teacher's role. According to Knupfer (1993), computers will shift the role of teachers from information provider to a learning partner in the education process. He stated,

> Teachers are not only directing their students to realize different outcomes as a result of using computers, but they are also engaging in different roles as students experience different processes of learning. The teacher's role is no longer focused on providing information, nor is it to be straightforward facilitator as was believed in the early stages of educational computing. Instead, the teacher's role is emerging as a learning partner and collaborator in the educational process (p. 166).

Knupfer added that the use of computers in the classroom has not only changed the teacher's role, but also made a significant alteration of teachers' relationships with students. He argued that teachers in the future will have to establish a collaborative relationship with students that can make room for thinking that is creative and on a higher order than in the past. Knupfer further added that in order to accomplish this change, teachers will need to

cross traditional barriers that have weakened the benefits that are possible with technology in the classroom. They must be willing to put forth continual effort in order to succeed in the implementation process. Nuccio (1990) added that teachers will need to become more learner oriented and less teacher centered to make effective use of these technological advances.

Educators such as Miller and Olson (1994), Caruso and Shade (1994), and Morgan (1993) have suggested that the use of computers has changed classroom management styles. It allows teachers to develop new ways of managing their classes. Many teachers have moved towards small group activities. Others have focused on improving their skills in managing cooperative learning groups. Such practices have meant that teachers have given fewer lectures and spend more time working with small groups and individual students.

Another noted change in the teaching practice has been that the use of computers have allowed teachers to discover more ways to meet the different needs of students with different levels of abilities. This has been because computers place no ceiling on learning material, so that high ability students can reach advanced levels of proficiency and knowledge. Computers could be used to assist teachers in accelerating students through subject matter where verbal or mathematical abilities are

demonstrated (Beasley, 1985; Dover, 1983; Mann, 1993). Moreover, Hancock (1983) asserted that

> the computer, even more than a teacher, can respond promptly and allow for speed variations. The able children can push ahead, only limited by their imaginations, while slower children gain confidence from working at their own pace and receiving a response to their efforts regularly and privately (p. 173).

There have been other changes in the teaching practice that could result from computer implementation in education. Olson & Eaton (1986) have posited that teachers will spend more voluntary time and effort to prepare for in-class activities in order to be successful in the implementation process. In return, they receive satisfaction from offering their students a variety of experiences that the teachers value and students enjoy (Olson, 1984; p. 41).

As teacher's ideas about teaching change, they develop alternative ways to evaluate their students' academic performance. Recent assessment strategies will cause teachers to focus more on quality and content of student's verbal and written communication skills than on paper and pencil exercises (Langley, 1996; McDaniel & McInrney, 1991; Anderson, 1988). All these changes in the teaching practice could allow many teachers to be much more productive, creative, and successful in their classrooms (Kearsley, Hunter & Furlong, 1992).

An overwhelming amount of evidence was pointed to the idea that computer implementation in the classroom will transform the teaching practice in the classroom. It is important to realize that the teacher's existing attitudes, working habits, and skills have a great influence on their acceptance, style of implementation, and outcomes regarding educational computing (Knupfer, 1993; Guban, 1986). Knupfer (1993) added that

> the teacher's role must be central to any change; because the teacher lives and works in a classroom with its own built-in imperatives and social culture, the teacher's real working conditions must be taken into account. Finally, reformers must realize that the teacher will judge the acceptability of any change by its conformity to current needs and objectives and not according to some agenda that is foreign to the teacher's experience (p. 173).

Impact of Computer Use on Learning

Evaluation research has always been the first kind of research to be conducted when a new instructional medium is used (Thompson, Simonson & Hargrave, 1992). Since computers are the latest instructional medium in education, many researchers have experimented to discover their effectiveness on students' learning. The results were similar to that of other forms of media. This indicates that students can learn from computers (Becker, 1987; OTA, 1988; Sivan-Kachala & Bialo, 1994; Kulik & Kulik, 1987).

One of the major figures who has begun to view the computer as a means to improve student's learning and the nature of education has been Seymour Papert. He was one of the major developers in MIT's logo project involved with providing a computer language program which could be easily mastered by young children. According to Papert, computers can be used to provide a discovery learning environment to put students through their paces, to present material of an appropriate level of difficulty, and to teach children how they think. Papert stated

> In most contemporary educational situations where children come into contact with computers, the computer is used to put children through their paces, to provide exercises of an appropriate level of difficulty, to provide feedback, and to dispense information. In the logo environment the relationship is reversed: The child is in control: The child programs the computer. And in teaching the computer how to think, children embark on an exploration about how they themselves think. Thinking about thinking turns the child into an epistemologist, an experience not even shared by most adults (Papert, 1980; p. 3).

Other researchers provided ample evidence that students can benefit in a variety of ways when computers are used as an instructional tool. It has been suggested that when computers are used appropriately in instruction, they can promote improvement in students' learning, motivation, attendance, and self-esteem (Jernstedt, 1982; Fulton, 1993; Olson, 1988; Kulik et al., 1985; Aston & Fakhro, 1992; Sivin-Kachala & Bialo, 1994; Snelbecker, 1982; Nuccio, 1990; McDaniel & McInrney, 1991).

A nationwide study conducted by the Office of Technology Assessment (OTA) revealed that the appropriate use of computers new technologies within effectively organized schools can make a remarkable difference in academic performance, motivation, and dedication to learning (OTA, 1988). Moreover, research by Krendl & Lieberman (1988) and Griswald (1986) have found an increase in not only scholastic accomplishment, but also in students' perceptions of how much they have learned in relation to their effort when using computers.

The relationship between academic achievement and self-esteem also has been cited in the literature. Reil (1985) has mentioned that computer use can raise student interest toward certain academic subjects because computer use can increase students' motivation to learn which might lead to greater academic achievement.

Other researchers have made a connection between motivation and academic achievement as a result of computer implementation. The standard hypothesis is that "If student attitudes improved as a result of technology applications, then students' academic motivation would also improve, resulting in enhanced learning outcomes" (Krendl & Clark, 1994; p. 89). Other researchers discussed the motivational characteristics of the computer and asserted that most

students considered computer activities to be highly motivating because they are interactive which means that "it enables the user to enter into some sort of dialogue with the material and information presented" (Atkins, 1993; p. 333). Therefore, the computer allows the user to be presented with still or moving images, graphic, and data. The user can respond via an input device such as a computer keyboard, a mouse or potentially, speech (Atkins, 1993). Educators who are searching for optimal ways to attract students and increase their motivation are developing software features designed especially to attract and hold students' attention. For example, instructional software can motivate learners by providing rewards for successful academic performance. Such as accumulation of points for each correct answer (Krendl & Lieberman, 1988; Caravella, 1983).

Computer settings have generally been found to promote significant social and verbal interaction among students as well as cognitive performance over that of students working independently at the computer (Johnson, Johnson & Stanne, 1985; Devillar, 1989; Hess et al., 1986; Ford et al., 1982).

In order to investigate the relationship between computer availability and classroom organization, Dweyer, Ringsaff, and Sandholtz (1991) observed four elementary school teachers as they introduced and used computers in

their classrooms. Dweyer, Ringsaff, and Sandholtz' study showed that when students work at the computer they call upon other students for help and comment on each other's work. The verbal interaction that occurs is an important mechanism of understanding. In trying to explain material to each other, the students seem to restructure their own understanding. The verbal interaction is also important because it leads students to hear different point of view. This experience of students assisting each other is "different from their experience in other parts of the school day. They often corrected each other's mistakes, modeled possible answers to problems, and demonstrated ways to complete assigned tasks" (p. 12).

Another consequence of peer interaction is that it provides social resources which facilitate learning. In the process of entering text onto the computer, a student who is typing is often concerned with issues such as spelling and the other students concentrate on different issues such as the construction of the essay and coherence among sentences. In a cooperative learning environment, the students, who have mastered the material most quicky benefit from explaining it to the slower learning students, and the slower learning students benefit from the help they receive. In other cases, the cooperative group may compete with

individuals at similar levels of ability. In this case, the group can succeed only if faster learners help the slower ones so the slow members feel that they make important contributions, even if they do not contribute as much as the brightest members of the group (Vockell & Edward, 1990).

Other researchers have found that computers can motivate students to engage in problem solving tasks. The development of problem-solving abilities and creative thinking skills in education received widespread attention in professional journals and popular periodical literature in the last decade. General research indicates that creativity can be taught and can be trained (Baudrot, 1989; Edwards, 1983; Eiser, 1996; Doolittle, 1995; Wolf, 1995; Digranes, 1987; Torrance, 1970, 1973). Computers have been the recent innovation through which educators have attempted to teach and train creative ability. Practor (1991) has mentioned that computers "is an ideal way to break the chains of students expectations and release any hidden potential" (p. 7). Since the fundamental focus in the problem solving process is expressing one's thoughts and idea. This process requires that students make their thinking "visible" to others as well as to themselves. In doing so, students learn to explain their representations with good choices. Mann (1993) has mentioned that computers

have changed the way in which ideas are expressed. He stated

> Technology has changed the way information is managed, presented, stored, retrieved, taught and learned. It has also changed the way that ideas are expressed in spoken or written language. Now ideas commonly represented in the form of images, graphic and videos. These ideas are the most valuable commodities of our present and future information age (p. 75).

Although the area of focusing on creativity and computer software is very limited, many researchers have agreed that the use of computers with children can improve problem solving ability. Within the area of computer-assisted instruction, many software packages have been created to develop creative problem solving skills; however, there have been very few research studies to back these claims of the computer software publishers or educational advocates of software. One of the reasons for this lack of research has been because of the number of disagreements about the definitions of creativity, about how to tell whether something is creative, and about the inability of researchers to foster creative solutions in a controlled laboratory setting (Medin, 1992).

Despite these positive results of computers' ability to enhance learning, deepen understanding, facilitate interaction, enhance problem-solving ability and provide stronger motivation for studying specific content area.

Rothenberg (1993), Clark (1983, 1985), Krendl & Lieberman (1988), Sivin-Kachala & Bialo (1994) stated that superior learning outcomes attributed to computer applications may be due to novelty of using computers rather than to the instructional potential of computers on the delivery system. This means that people tend to like new and different activities when they are first introduced but that their attention span and enjoyment-level will diminish over time. This idea has been neglected in research on technology and learning because of the preference for short-term, small-scale experimental applications of technology (Clark, 1983; Krendl & Lieberman, 1988). However, there is uncertainty about whether these outcomes will endure after the attraction of novelty wears off as computer use continues. The research necessary to resolve this issue has not yet appeared. However, many factors will influence the long-term impact of computer in education, but certainly computers have the potential to make a lasting impact if it is found that their awareness and use are beneficial to students' academic achievement (Waugh, 1982).

Teacher Perceptions of the Impact of Computers on the Teaching/Learning Process

Research on actual teachers' use of computers in instruction is limited. Many of the research efforts have been directed at determining the effectiveness of computers as instructional devices, not at the ways in which teachers use computers. For example, some researchers compare the effectiveness of new instructional methods with those of conventional instruction on the basis of student outcomes. Others compare different software design or the use of technology under different environmental conditions.

As mentioned in chapter one, the effectiveness of the use of computers depends on the teacher who uses it and how they incorporate computers into their teaching. Aworuwa (1994) stated

> Teachers are the key to any technology implementation, initiatives in education. Teachers can make or mar an innovation. The best conceived innovation may fail if teachers do not see its utility. Teachers may change the nature of an innovation to suit their purposes (p. 22).

Few researchers have realized the importance of the teacher's role in implementing computer technologies in education, and pointed to the need to extend the inquiry to include teachers' points of view (Cuban, 1986; Knupfer, 1993). The research in this area has varied in methodology.

Generally speaking, most researchers have used surveys (self-administered questionnaires) or personal interviews to collect their data. In some cases, the researchers have combined interviews with naturalistic inquiry, such as classroom observations. They often have used case studies by interviewing a few participants in great depth. Respondents usually have been asked to report personal data, such as age and teaching experience.

The studies reviewed in this section were selected because of their focus on teachers' points of view of the actual use and impact of computers in the classroom. One of the earliest people to study the effect of media in education was Larry Cuban. He studied the introduction of film and radio in the classroom after 1920, generally using secondary sources and primary ones where appropriate. He constructed the actual teacher usage of these media until the introduction of instructional television in the mid-1950s. Then he investigated classroom television. In examining these technologies, he asked questions that probed why teachers have used radio, film, and television as they have. In answering these questions, he offers a view from the classroom rather than from the school administrators or policy makers. He consciously has made an effort to correct an imbalance in most writing about classroom reform, which

ignores the teacher's perspective. In Cuban's study, he discovered that audio-visual materials in general, such as film and radio, have generally been used by teachers in the past as a break in the classroom routine for both teachers and students, or as a rest for the teacher. In 1986, Cuban studied the use of computers in the classroom and concluded that the number of computers in schools is growing rapidly. However, as with other innovations, such figures seldom bear a strong relationship to the frequency of teachers' or students' use. Guban added that individual students who use computers (and not all do) spend, on average, a little more than one hour a week (or 4 percent of all instructional time with computers. The explanation That Cuban has constructed argued that teachers do not use computers as often as policy makers wish because these tools do not meet teachers' test of efficiency. Teachers need a tool that is simple, versatile, reliable, and durable.

Another study that reached conclusions similar to Cuban's study was Becker's (1983). Early surveys were conducted in roughly twenty countries by the International Association for the Evaluation of Educational Achievement (IEA). Data were gathered from a probability sample of principals, schools-level computer coordinator (or most knowledgeable computer-using teachers) and both computer-using and non-using teachers. The 1983 "school uses of

microcomputer survey" showed that because most schools had so few computers compared to the number of student they served, computer use was severely limited. Students only got to sample educational games for language development or math computation and to do drills in mathematics, language, or social studies. In doing so, according to Becker, students were learning more about the nature of computers (computer literacy) than actually mastering curricular content and skills.

Becker's second national survey of instructional uses of school computers distributed in 1985 revealed that teachers rarely used computers regularly to provide students with instruction or practice in traditional school subjects. Instead, they used them mainly as enrichment to provide variety in the classroom daily practice and daily curriculum. This use has been typical of secondary schools, which has taught students about computers themselves primarily for general purpose "computer literacy."

Becker's third report (1991) on the survey on the impact of the use of computers in schools concluded that the last part of the decade saw an increase in total use of computers in both elementary and secondary schools. There has been an increased effort to use computers as productive tools for expressing ideas and recording and analyzing

information. Becker also found that the number of teachers using computers doubled from 1985 to 1989, giving reason for optimism. This survey also measured teachers' perceptions and beliefs about the effect of computers on students. Teachers who used computers believed that this use offered students several benefits: motivation, cooperation and independence, development of higher order thinking skills, and mastery of basic skills. The majority of teachers reported that their teaching styles had not changed significantly with their use of computers. Becker concluded that "the steady growth in the number of computers in schools is finally beginning to have an effect on most students' school lives" (p. 392). However, Becker added that progress of computer implementation has been slower than its proponents would wish as a tool for intellectual improvement. In practice, the use of computers in schools is usually for transmitting subject matter-specific factual knowledge and drill and practice basic skills.

Another study that tried to answer the question, "Do computers change education?" was conducted by Riel (1989). Riel tried to understand the changes that take place when a computer is added to the educational environment in classrooms. A single computer was placed into each of four classrooms, and the changes that took place in teaching and

learning as this new technology was incorporated into the educational practices over the school year were examined. The teachers were interviewed weekly over the course of the year, classrooms were observed, and notes were taken in each classroom three days a week. Riel found that no significant change was found in the way teachers arranged the space and used time in their classroom. In classrooms where learning centers had been used extensively in the previous year, when there were no computers in the classroom, the computer became one of the learning centers that students rotated through over the course of each day.

The teachers who used whole group methods continued to teach their classes in this manner. Teachers used the computers to demonstrate concepts to the whole class. The results of this study suggested that micro-computers continue to be inserted into existing classroom arrangements without leading to wholesale changes in classroom organization. However, the availability of microcomputers added a new dimension of participation to the classroom. Teachers found that they could increase the time students spent working on the computer by having students work in pairs rather than individually.

In 1991, Tennessee Education Association conducted a survey study with 449 Tennessee educators reported in a

title "Bits, Bytes, and Barriers: Tennessee Teachers' Use of Technology." Among the questions that were the concern of this study was "What effect has educational technology had on teachers and students?" Respondents most frequently indicated a positive effect on students' motivation and subject interest. Sixty-six percent of teachers perceived a positive effect of technology on their students' social behavior and on students' academic performance. Forty-seven percent of teachers reported that students were motivated to work with technology. The second most frequent response, twenty-three percent, was individualization. Respondents reported that using educational technology allows greater individualization.

A number of case studies addressed the impact of computers on the teaching learning process. Naimi (1990) conducted a qualitative multi-site case study that examined computer use in four elementary schools. This study found that computer use influenced some changes in teaching style. Teaching with computers enabled some teachers to vary grouping patterns and students' learning experiences from independent work and individualized instruction to cooperative work in pairs and small groups. Some teachers reported that demonstrating with the computer to their classes encouraged more active and creative student

participation. Also, this case study found that using computers in instruction positively affected students' motivation to learn, social interactions and cooperation, time on task and performance. In addition, this study found that teachers use computers primarily to teach basic skills (drill and practice), computer literacy, part of whole class demonstration and writing.

Fair (1992) conducted another case study to describe the nature of teacher change resulting from the implementation of computer technology into the curriculum of the individual elementary classroom setting. Study results indicated that the four teachers that Fair studied made changes in teaching strategies, curriculum and classroom management. Some teaching strategy changes included using the computer as a learning station, using a large group presentation on introducing software, developing strategies to teach keyboarding, and increasing the number of group activities students were completing at the computer. Teachers also made changes to curriculum. They moved from using drill and practice software to using application software with students, using a variety of types of writing and computer software with students and adding keyboarding instruction. Classroom management included adding more computer schedules and dealing with a more complex classroom environment (e.g. noise level and student behavior).

All four of these teacher also indicated that using the computer had been a positive experience for them. Teachers viewed the use of the computer as a motivating tool for students, found that teachers often used the computer as a reward for positive behavior and completion of work.

Hass (1992) conducted a case study to investigate how computers impact the practice of teaching. The case study was conducted with one teacher who was an active user of computers in her classroom. Data were collected through a series of structured interviews with a second grade teacher. The findings in this study corroborates that successful computer using teachers incorporate computers in the same ways they use other technology - as a tool to help them achieve their existing goals. One teacher was trying to implement the use of computers in a way that suits her style, her beliefs, and her circumstances.

Similar findings were found in the study that Conery (1992) conducted to describe and interpret the beliefs and teaching practice of three computer-using elementary school teachers. Qualitative inquiry approach was used. Conery found that teachers were still teaching what they had always taught. They were simply using new tools to meet existing objectives. They did not alter their teaching styles to accommodate the introduction of computer technology and did

not explore new opportunities for classroom instruction that computer use might appear to invite.

Sivin-Kachala & Bialo (1994) summarized the educational technology research conducted from 1990 through 1994. It was based on 133 research reviews and reports on original research projects from published and unpublished sources. The report concluded that educational technology has demonstrated a significant positive effect on students' academic achievement for all major subject areas, for both regular education and special needs students. Another finding is that the use of computers in the classroom has a positive effect on students' attitudes toward learning, self-esteem, and motivation. Also, this report found that introducing technology into the learning environment encourages cooperative learning and increases teacher/student interaction. This report concluded that the most important determinant of students' attitudes when using computers is the teacher.

Kulik and Kulik (1987) conducted a meta-analysis that covered a total of 199 comparative studies on the effectiveness of computer-based education. Overall results were:

1. Most of the studies reported that computer-based instruction has positive effects on students. Students generally learned more in class when they received help from computers. The average effect of computers in all

199 studies used in our meta-analysis was to raise examination scores by 0.31 standard deviations, or from 50th to the 61st percentile.

2. Students also learned their lessons with less instructional time. The average reduction in instructional time in 28 investigations of this point was 32%.

3. Students also liked their classes more when they received computer help. The average effect of computer-based instruction in 17 studies was to raise attitude-toward-instruction scores by 0.28 standard deviations.

4. Students developed more positive attitudes toward computers when they received help from them in school. The average effect in 17 studies on attitude toward computers was 0.33.

5. Computers did not, however, have positive effects in every area in which they were studies. The average effect of computer-based instruction in 29 studies of attitude toward subject matter was near zero (p. 224).

Summary

Computers and computing have rapidly achieved importance in our society, economy, and culture. Instructional computing has challenged the traditional instruction and possibly changes it. Many educators have agreed that the use of computers in the classroom will change the way teachers teach, the way students learn, and the way teachers and students interact. These changes have been viewed by educators as a revolution which has improved education. One of the changes that has been mentioned is

the change in the teacher's role. Many researchers have mentioned that the use of computers will shift the role of teachers from information provider to a facilitator and a learning partner.

Relationships with students is another area of change that educators have mentioned. It has been suggested that the use of computers will change classroom management style. It will allow teachers to develop new ways of managing their classes. Many teachers will move towards small group activities. Others have focused on improving their skills in managing cooperative learning groups.

Many educators have mentioned that the use of computers will allow teachers to meet students' different needs, different abilities, and different learning styles. In addition, when computers are used, teachers are required to spend more voluntary time and effort to prepare for in-class activities. As teachers' ideas about teaching change, they develop alternative ways to evaluate their students' academic achievement.

Other researchers have provided ample evidence that students can benefit in a variety of ways when computers were used as an instructional tool. It has been suggested that when computers are used appropriately, they can promote improvement in students' learning, motivation, attendance,

self-esteem, and social and verbal interaction among students as well as cognitive performance. Other researchers have found that computers can motivate students to engage in problem-solving tasks.

An overwhelming amount of evidence pointed to the idea that the use of computers in the classroom will improve teaching and learning. It is important to realize that teachers' existing attitudes, working habits, and skills have a great influence on the impact of the use of computers on the teaching and learning process.

Chapter Summary

This chapter began with an introduction that explained the sources and procedures used in conducting the literature reviewed. This was followed by four areas of inquiry related to the field of the study. The first review was on the area of computers in education which discussed the importance of the use of computers in education. The second area was the impact of computers on teaching which dealt with the implementation of computers in schools and how they affected the teaching practice. The third area discussed the impact of the use of computers on students' learning which included students' academic achievement, motivation,

problem solving, and relationship with each other. The last area was teachers' perception of the impact of the use of computers on the teaching/learning process which reviewed the literature involved. Research focused directly on teachers' point of view of the actual use and impact of computers in the classroom. This was followed by a summary and a chapter summary.

CHAPTER III

RESEARCH DESIGN AND METHODOLOGY

Introduction

The purpose of the current study was to determine how a selected group of teachers who were part of the 21st Century Classroom program in Knoxville, Tennessee actually used computers and how continued computer use affected the teaching/learning process.

The purpose of Chapter III was to describe the procedure followed in developing and accomplishing this study. The design of the study discussed in this chapter was organized under four areas: Development of the Study, Participants Selection, Data Collection, and Data Analysis.

Development of the Study

Research on actual use and impact of computers in the classroom has been limited. As Underwood et al. (1996) stated, the early 1980s were dominated by the perception that the use of computers as instructional tools in the classroom "must be doing good and little or no evaluations

took place" (p. 6). Later, many of the research efforts were directed at determining the effectiveness of computers as an instructional device, not at the way in which teachers actually used computers.

Recent researchers indicated that descriptions and explanations of what computers actually accomplish would be accurate only if the computer use were viewed from the perspective of teachers. Meinster (1990) argued that the initiative to implement computers on a broader scale was the responsibility of administrators and policy makers. However, teachers' acceptance of the computers should not be overlooked.

Qualitative researchers have been interested in trying to understand the meaning that people place on their experience and discover what they are experiencing, how they interpret these experiences, and how they themselves structure the social world in which they live (Demarrias, 1996). Therefore, the researcher believed that the qualitative approach would give the researcher a way to explore the meanings that teachers attach to the use of computers in their daily work and discover the perception of these teachers of the impact of this use. Further descriptive quantitative research simply could not produce this level of deep understanding. As Neuman (1989) asserted,

> the naturalistic approach will move computer-based education beyond findings that simply state the method as being effective to a deeper understanding of the factors underlying that effectiveness as they are operationalized in classroom settings (p. 40).

Although some existing quantitative studies address issues related to computer use in the classroom, these numerical studies emphasized statistical relationships among variables or the frequency of specific behavior (for example, number of computers in the classrooms, weekly hours of computer use, teachers' attitudes towards computer use, etc.) These studies were valuable for providing a certain type of information regarding classroom computing, but they cannot tell the whole story, nor are they intended to provide insight and understanding into the beliefs and motives of classroom teachers.

Another reason for choosing a naturalistic inquiry approach for this study was the nature of the research question. That question was, "How did a group of teachers who were part of the 21st Century Classroom program in Knoxville, Tennessee used computers and how the continued use of computers affected the teaching/learning process in the classroom." According to Demarrias (1996) qualitative research questions always have to be open-ended, designed to better understand human perceptions, experience, and history and thus, rely on in-depth data derived from methods that require longer periods of time spent with participants. For

all these reasons stated, the naturalistic inquiry approach appeared to be the most helpful approach in providing a deeper understanding of the factors underlying the effectiveness of computer use in the classroom. It was believed that such an approach would help the researcher "to look for patterns and themes that suggest plausible connections between phenomena" (Guba and Lincoln, 1982, p. 242).

Participants Selection

Participants of this qualitative study were teachers who were part of the 21st Century Classroom project in Knoxville, Tennessee. The 21st Century Classroom project was a State-wide project in the State of Tennessee, aimed at upgrading the use of technology in the State of Tennessee Schools. In 1993, the Tennessee Department of Education implemented programs that promote the effective integration of instructional technologies across all curricula. One of the goals of this reform initiative was to inspire and support creative new approaches to learning. The State Department of Education made grant funding available to local school systems that successfully propose formal descriptions for innovative projects integrating educational

technology in the classroom. The funding awarded a minimum expenditure totaling $20,000 per classroom. It was required that at least 10% of each 21st Century Classroom allotment must be utilized to acquire educational software. The minimum equipment included a fully-equipped teacher work station with CD-ROM drive, large screen presentation device and laser-disc player. At least two networked student workstations had to be included. Identified teachers for such classroom were required to attend 30 hours of department supplied training (Tennessee State Department of Education, 1993).

There were many reasons that made teachers who were part of the 21st Century program worth studying. The teachers in this study were valuable subjects for the following reasons. They had:

1. Worked in a technologically rich environment.
2. Immediate access to computers when needed.
3. Attended at least 30 hours of department supplied training.
4. Chosen to get and use computers in their classrooms which indicated that these teachers feel that the presence of computers in the classroom was desirable and it would impact the teaching/learning process in their classroom.

In Knox County Schools, in the 1996-97 school year, there were sixty-four teachers involved in the 21st Century Classroom project at the middle school level. A list of these teachers and schools was provided to the researcher by the computer technology office in Knoxville, Tennessee. All teachers that the researcher contacted agreed to participate in this study; however, one teacher wanted to decline at the time of the interview because she had to staple a big pile of papers before the end of the day. The research promised to staple those papers right after the interview and the teacher agreed. The researcher also had to reschedule two interviews because teachers were sick at that time. The researcher knew that only after she went to their schools.

A stratified random sampling technique was used to select participants for this study. Stratification was schools, grade levels, and area taught. These criteria were chosen in order to have a sample that would represent all schools, levels and subjects. Fourteen teachers were selected from six different schools in different areas in Knoxville, Tennessee. Two teachers were chosen from school #1, two teachers from school #2, three teachers from school #3, three teachers from school #4, three teachers from school #5, and one teacher were chosen from school #6. The fourteen teachers who were selected to participate in this study also met the following criteria:

- Currently had technology available in their classrooms and used it as part of their teaching.
- Taught at least for two years before having technology.
- Taught at least for one year with technology.
- Willing to participate in this study.
- Taught at the middle school level.

The researcher chose to study middle school teachers because there seemed to be less research in this area and because the middle school was her particular area of interest. Of the available studies on teachers' use of computers, most were conducted on elementary and high school teachers (Aworuwa, 1994, Naimi, 1990, Fair, 1992, Hass, 1992). Since the use of computers in the middle schools differ from the use of computers in the elementary and high schools due to students' age, curriculum, etc., research on the use of computers in the middle schools is overdue.

Data Collection

In order to achieve the purpose of this study, fourteen middle school teachers who were part of the 21st Century Classroom project were interviewed. These teachers were selected from six different schools located in different areas of Knoxville City. All of the participants selected using the stratified procedure agreed to be interviewed.

Each participant signed a consent statement prior to the collection of the interview data. A convenient time and

location to conduct the interviews was determined during informal phone conversation. All of the interviews were conducted in the teachers' own classrooms. Each interview took approximately 60-75 minutes.

Data Analysis

The goal of this data analysis procedure was to identify recurring themes that emerged in the interviews. According to Bogdan and Biklen (1992), Data Analysis

> is the process of systematically searching and arranging the interview transcripts...to increase your understanding of them and to enable you to present what you have discovered to others. Analysis involves working in data, organizing it, searching for patterns, discovering what is important and what is to be learned, and deciding what you will tell others (p. 145).

Analyses procedures were used on a set of tasks described by Lincoln and Guba (1985). This procedure was selected for two reasons. First of all, Lincoln and Guba's tasks seem clear and easy for the researcher to follow. Second, the researcher felt that if these steps were followed no vital information will be missed or left out.

The remainder of this chapter explained the tasks and how the researcher carried them out. Lincoln and Guba suggested four tasks for analyzing data. These tasks were: unitizing, categorizing, filling in patterns and member check.

Unitizing was the process of discovering meaningful units. After reading the transcripts of the 14 interviews several times. The researcher was able to discover a number of units. According to Lincoln and Guba a unit is:

> the smallest piece of information about something that can stand by itself, and it must be interpretable in the absence of any additional information other than the broad understanding of the context in which the inquiry is carried out (p. 345).

Such a unit may be a simple factual sentence or it may be as much as a paragraph. Having located the units, the researcher entered them onto a separate index card. Each index card was coded. These codes were included with designations for particular sources. For example, the designations 13-9B indicated interview respondent number 13, p. 9, paragraph B of the interview transcript.

The categorizing process identifies relationships among the units. According to Lincoln and Guba, "the essential tasks of categorizing were to bring together into provisional categories those cards that apparently relate to the same content" (p. 347). Given the pile of cards that resulted from the unitizing process, the researcher selected the first card from the pile, read it, noted its contents, and placed it on one side. This first card represented the first entry in the first yet-to-be-named category. The researcher continued reading each card and decided whether

it was "looked-alike" or "felt-alike" with cards that were placed in some provisional category, or whether it represented a new category and proceeded accordingly.

Cards that were recognized as possibly irrelevant to the developing set of categories, were placed into what Lincoln and Guba called a "miscellaneous pile." They were not discarded at this point but were retained for later review.

Next, the researcher reviewed each card in each category. The cards that were judged clearly irrelevant at this point were discarded.

In the Filling in Pattern process, the set of categories was examined for possible relationships among categories. This enabled the researcher to identify recurring themes and verify their existence by once more reviewing the data.

Member Check involves verifying the interpretations of the data by cross check with the original interviews. To help the reader to trust the findings of this qualitative study, the findings and interpretations were tested against the sources form which the data were collected. As Lincoln and Guba asserted

> the conclusion of the categorization process...provides a useful opportunity to apply a major trustworthiness technique: the member check. If the issue is whether the analyst (or team) has successfully produced a

> construction of the respondents, constructions - the best way to determine that is to take the reconstruction back to the respondents for their examination and reaction (p. 351).

When the interviews were transcribed, participants were given copies of their data and asked to confirm or deny the data collected by reviewing transcripts. The researcher called each participant to discuss accuracy of this information. Each agreed that the interviews accurately described their situations regarding the impact of computers in the teaching/learning process.

To establish credibility, the naturalistic equivalent to reliability, interview transcripts were reviewed by a 21st Century Classroom teacher who did not otherwise participate in the study. The researcher gave copies of data and asked the teacher to come up with her own categories. The teacher came up with almost the same categories as the researcher. The only categories she did not agree upon was the use of computers for developing problem solving abilities and for students' evaluation since not too many teachers used them that way. The researchers used these two categories that the teacher did not agree on and mentioned how many teachers used computers that way. She also did not come up with the category "teacher's level of satisfaction," but she agreed that this should be a category. This teacher was also a graduate student who was

knowledgeable in research methodologies used in the study. In addition, the teacher was familiar with the teaching practice and the use of computers in the classrooms. This review was intended to affirm existence of these categories identified by the researcher and to assure an acceptable level of consistency.

Chapter Summary

This chapter has described the procedures which were employed in collecting data for this study. A brief description of the participant selection process was presented. This was followed by description of the procedure of data collection and data analysis. A total of fourteen teachers who were part of the 21st Century Classroom program in Knoxville, Tennessee were selected to take part in this study. These teachers were interviewed, each interview lasted approximately 60-75 minutes. Interviews were videotaped, transcribed, and analyzed. The complete results of data analysis and discussion are presented in Chapter Four. Chapter Five then presents a summary, conclusions, implications, and recommendations for further research.

CHAPTER IV

FINDINGS

Introduction

The purpose of this study was to determine how a selected group of teachers who were part of the 21st Century classroom program in Knoxville, Tennessee used computers and how the continued use of computers affected teaching/ learning process. The major research question guiding this study was: How a selected group of teachers who were part of the 21st Century Classroom program in Knoxville, Tennessee actually used computers and how the continued use of computers affected the teaching/learning process. In this chapter, the researcher presented the analysis of data addressing the research question and its subsidiaries. It was the intent of the researcher to contribute to an understanding of the kind of effects associated with computer use for teaching and learning as seen through the eyes of teachers.

The result of this study and the subsequent themes emerging from the data were summarized and discussed in this chapter. The analysis of the data was presented in six

sections: 1) participants' profile, 2) nature of computer use, 3) Impact of computer use on teaching, 4) Impact of computer use on learning, 5) Teachers' computer choices and 6) Teachers' level of satisfaction.

Participants' Profile

Fourteen teachers from six different schools in Knoxville, Tennessee were interviewed. All the participants were full-time teachers. These teachers represented a broad spectrum of background and personal views. They taught different subjects, different grade levels, at different schools. The one thing they had in common was that they were experienced teachers who taught for many years and still look for ways and means to improve and enhance their teaching practice. Therefore, they decided to use computers and related technologies. Table #1 lists comparative information about the participants.

In this section, the teachers who participated in the study were introduced including a description of who they were and a brief history of their teaching and computing experience. These teachers were:

Teacher #1

He was a teacher for twenty-five years at the sixth grade level in the area of reading and language arts. His highest degree was a master's in elementary education. At the time of the study, his class consisted of 35 students. 97% of his students were in extended resources. His involvement with computers started ten years ago. He had 6 computers, one of these computers was connected to the Internet.

Teacher #2

She was a teacher for thirteen years at the seventh grade level in the area of science. At the time of the study her highest degree was a master's of science education. She used computers in her classroom for thirteen years, and had thirty-five students in the classroom. She had ten computers, one of these computers was connected to the Internet.

Teacher #3

She was a teacher for thirteen years at the sixth grade level in the areas of reading and language arts. Her highest degree was a bachelor's in education at the time of the study. She had 32 students and used computers for two years. She had 5 computers in her classroom. None of her computers were connected to the Internet.

Table #1

Participants' Description

Teacher No.	Sex	No. of Students	No. of Years Teaching Experience	No. of Years Using Computers	Grade Level	Teaching area	Educational Level	No. of computers	Connectivity to the Internet
1	M	35	25	10	6	Language Arts	Masters	6	Yes
2	F	35	13	13	7	Science	Masters	10	Yes
3	F	32	13	2	6	Language Arts	Bachelors	5	No
4	F	17	7	3	6	All Subjects	Bachelors+	6	Yes
5	F	16	10	3	6	Social Studies, Science	Bachelors	4	Yes
6	F	25	25	3	7	Mathematics	Bachelors	5	No
7	F	30	27	2	7	Social Studies	Bachelors	5	Yes
8	F	30	19	2	7	Science	Bachelors	6	No
9	M	23	7	7	6	Mathematics	Bachelors	5	Yes
10	M	30	25	3	8	Science	Masters+	6	Yes
11	F	35	20	3	7	Language Arts	Bachelors	5	Yes
12	F	19	10	12	6, 7, 8	Talented and Gifted Students	Bachelors	10	Yes
13	F	35	7	2	6	Physical Education	Bachelors	3	Yes
14	F	15	15	13	6, 7, 8	Talented and Gifted Students	Bachelors	7	Yes

Teacher #4

She was a teacher for seven years in the areas of reading, math, language arts, spelling, science and social studies for special education students. Her highest degree was Bachelor's in elementary education and was working on getting a master's degree in educational technology. At the time of conducting this study, she had 17 students with a wide variety of handicapping conditions. Some of her students were: mentally retarded, learning disabled, functionally delayed, and severely emotionally disturbed. She used computers for 3 years and had 6 computers, one of which was connected to the Internet.

Teacher #5

She was a teacher for 10 years at the sixth grade level in the areas of social studies and science. At the time of conducting this study, she had 16 students who were resource or special education. She used computers in her classroom for 3 years. Her classroom consisted of four computers, one of which was connected to the Internet.

Teacher #6

She was a teacher for twenty-five years. She taught seventh grade math for students who were on the eighth grade level, "compacted math students". She taught two classes who were on grade level and one below grade level class of seventh graders who were working out of the 6th grade

curriculum. She had a Bachelor's degree in elementary education. She used computers in her classroom for three years, and had a total of five computers, none of which was connected to the Internet.

Teacher #7

She was a teacher for twenty-seven years. She had a Bachelor's degree in science and taught seventh grade social studies. Her smallest class was thirty students. Some of her students were in the gifted and talented program. Others were part of the special education program. She had five computers, and one of these computers was connected to the Internet.

Teacher #8

She was a teacher for nineteen years at the seventh grade level in the area of science. At the time of the study she had a Bachelor's degree in education. She had thirty students in her class, and had a total of six computers that were not connected to the Internet.

Teacher #9

He was a teacher for seven years at the sixth grade level in the area of mathematics. He had a Bachelor's degree in elementary education. He had 23 students in his classroom, some of whom were special education students and some of whom were talented and gifted. They were not

grouped but they were mixed in together. He used computers in his teaching for seven years, had six computers, one of which was connected to the Internet.

Teacher #10

He was a teacher for twenty-five years in the area of physical science for the eighth grade level. He had a Master's degree in education in "curriculum and leadership". He had a Bachelor's degree in liberal arts and zoology and had about eighty quarter hours of post Master's in Education. His students were pretty much about average students academically. He had used computers for three years, and had six computers, one of which was connected to the Internet.

Teacher #11

She was a teacher for twenty years. She taught seventh grade language arts. She had a double major degree in English and elementary education. She had on the average of thirty-five students in her classroom. These students were heterogenous students except for one group which was on the high school level. She had 5 computers, one of which was connected to the Internet.

Teacher #12

She was a teacher for ten years. She was the teacher of all the gifted and talented students in the school. She had a Bachelor's degree in law and was certified to teach

gifted and talented students. She taught for ten years, had ten computers, one of which was connected to the Internet and had an average of 19 students in any given time in her classroom.

Teacher #13

She was a teacher for seven years in the area of physical education for sixth, seventh and eighth grade levels. She had a master's degree in physical education. She had on the average of thirty-five students at any given time, and a total of three computers that were not connected to the Internet.

Teacher #14

She was a teacher for fifteen years. She was a teacher of all gifted and talented students in the school. Her highest degree was a bachelor's degree in elementary education. She had on the average of fifteen gifted students in any given time, and a total of seven computers, one of which was connected to the Internet.

Nature of Computer Use

It was part of this study's interest to determine how teachers used computers in their classroom. Data Analysis revealed many common patterns among teachers in the way they used computers in their classroom. These patterns were:

Enhancement and Expanding Curriculum

As teachers went through the curriculum, they anticipated chapters or subject matter they would be teaching at the current year, discovered the areas in the curriculum that were not clear, and areas that needed to be expanded, then found software that could enhance or supplement the missing information in the particular chapter or chapters. Teacher #9 selected his software according to the areas that needed to be expanded in the curriculum.

> If there's something that's needed to be scored, but it's not necessarily scored very well in the book's supplemental materials, I can pull software into the curriculum and use it that way. If there is something needs to be expanded, I have different CD's that allow me to give them more - a lot of information about it. There are certain people that we've talked about just kind of mentioned briefly in the chapter but then I say "well we can go in and read a whole lot more back on the computer (Teacher #9).

Teachers who had at least one computer connected to the Internet could use software that was related to their topics and could search the Internet for most current information.

> When I was able to buy the software, I try to anticipate the chapters and subject matter that I'd be teaching and then purchase the software. Now, since I have a computer that is connected to the Internet, I go on it and find current information, like with the comet, it was real nice to be able to download star map of where they could look at the comet (Teacher #10).

Development of Classroom Presentations

Twelve teachers in this study mentioned that they used computers to develop classroom presentations by using a

number of presentations and multimedia programs which they taught themselves how to use. Teachers encouraged their students to develop and present their reports using the same means which teachers use.

> I do a lot of presentations by using a multimedia program called Powerpoint. Often show them on the big screen TV which makes a world of difference in the way I present things and in the way I see things. Students have been developing some of their reports using the computer and translating them into Powerpoint. So it's been an interesting thing for them. (Teacher #5).

Sometimes students did a better job than teachers in presenting their projects. Teacher #7 admitted that her students did a better job than she in translating their presentations into a multimedia program.

> My students have the advantages to be able to use computers for their reports and their presentations. They have been using "Hyperstudio" multimedia program. They're 100% better than I am. I click on the wrong thing and I get discouraged. Them, they just forge right ahead. So they have done presentations last year, the best ones came at the end of the year with the civil war chapter when they put pictures and text and music together in Hyperstudio to present to other kids in the class (Teacher #7).

Although twelve teachers mentioned that they used computers for presentations, teachers `#3 and #1 mentioned that they did not use computers for presentations. Teacher #3 did not use computers for presentations because she did not have the device that connected her computer to the big screen TV. She was promised by the administrators in her county to get the device that helps her use computers for presentation, but she did not get it yet.

> As far as instruction I don't have the device that allows me to see my computer screen as the students would see the screen over the TV. I'm waiting on that to come and I'm anxious and I really want that to be here, and it's been a long time. Now I do not know what to do - - I need the county to get on the ball and give what they said they were going to give me. I'm supposed to have the card that enables me to see the computer monitor on a big screen TV. Those things will help me so much - - I need that (Teacher #3).

Teacher #1 also did not use computers for presentations because his classroom was not big enough to hold a big screen TV with all other equipment that he had. Since the printing on most of the software was too small, it was hard for the whole class to see, especially when they sit far away from the monitor.

> See, I don't have room, I could have bought a big screen TV. Yeah, but I mean shoot, I don't have room. See, the computer doesn't really introduce concepts, now maybe the day will come where a program will, and you could get big enough screens where they could read it. Now, when they're putting these programs together they should know especially by now that they need to use the largest type, they use little bitty type and if you're far away from the monitor you can't see it.

Drill and Practice

All teachers mentioned that they used computers to drill and practice basic skills that were not part of the curriculum, especially for below grade average students.

> For my little below grade level class I've got a lot of software that helps pick up the background that is not part of the curriculum. If they still cannot find factors of the numbers, for example, if they still don't know that the factors of 6 are 2 times 3, I've

> got software in a form of game where they can go play fraction munchers or they can go play another game where they use their multiplication tables to solve a little game, and it reviews on that (Teacher #6).

Teachers used computers to drill and practice skills that were required in order for students to get good scores on certain achievement tests, for example, Tennessee Comprehensive Achievement Test (T-Cap).

> The kids use them for drill and practice every day we've got math programs and language arts programs to help them on T-Cap tests they take in the spring (Teacher #3).

Teacher #4, who taught special education mentioned that drill and practice has been a major use of computers in her classroom. She used computers to teach her students basic skills in reading and spelling.

> Drill and practice basic skills is a major use for computers in my classroom. My kids do their spelling on the computers. In fact, the LRE kids do their words in alphabetical order, but instead of writing sentences, they have to either draw a picture or find stamps to represent that word in their spelling lists. We use a lot of interactive CD ROMs that make the kids want to learn how to read and they'll set there and read it to you before they play it.

Research Development

All teachers in this study mentioned that they used computers mostly to access information, expand the curriculum and to help students complete their assignments or projects. Teachers who had computers that were connected to the Internet used the Internet to access new information.

> I guess I just use it mostly right now for research when I've got some major project going, so we access information from the Internet...I usually give the children an assignment that they have to go and use computers and find information. In science class, we did some reports on bionics and they were working in cooperative groups. One child in the group had the animal...one had the plants, one had the climate...one had the map and as they did their research, they had to do that from the computer (Teacher #5).

Teachers who had computers that were not connected to the Internet could use the electronic encyclopedia and other software to access information they needed for research.

> Students have been able to use computers for projects. For learning center we always use the encyclopedia. I can always find something on it. So that makes it nice. One thing I can do with Grolier encyclopedia I can save files and I can put those files on other computers then let students look at that computer and show that on another one (Teacher #9).

Record Keeping

Most teachers in this study mentioned that they were glad that they did not have to use the old grading book because using a grade book program was easier and faster.

> Probably more now on the plus side things like my grade book. I don't keep an old timey grade book any longer. I use my grade program. I have letters to parents on file and if I need to generate a new one I can without any effort. So you see to get to the end of the 6 weeks and your grades are averaged and you just have to print out a hard copy of it. That's much easier than sitting down and averaging grades (Teacher #7).

Development of Problem Solving Abilities

Only teachers who taught gifted and talented students mentioned that they used computers to enhance student's problem solving skills.

> I use like...my big program is Odyssey of the Mind because that program is a creative a problem solving program and I use a lot of educational programs and that helps students to solve problems, right and quick.

Summary

It was part of this study's interest to determine how teachers used computers in their classroom. Data analysis revealed many common patterns among teachers. These patterns were enhancing and expanding curriculum. As teachers went through the curriculum, they anticipated chapters they would be teaching at the current year. Then they found software that could enhance or supplement the missing information in the particular chapter. Teachers also used computers to develop classroom presentations by using a number of presentation and multimedia programs to present their ideas in a different and more interesting way. Drill and practice basic skills was another use for computers, especially for below grade average students. Teachers also used different programs, electronic

encyclopedias, and the Internet to access information to develop research, expand curriculum, and help students to complete their assignments or projects. Computers helped teachers to keep their students' records, for example, grade books, letters to parents and field trip notes. Only teachers who taught gifted and talented students mentioned that they used computers to enhance students' problem solving skills.

Impact of Computer Use on Teaching

Teachers in this study perceived a variety of impacts of computer use on their own teaching. These impacts that teachers reported were:

Enhancement and Diversification of Instructional Strategies

Many teachers in this study believed that the use of computers in their classroom enhanced and diversified their instructional strategies by making it possible to use different means and ways to get the point across.

> If these computers were taken away today, I think I would be lost because I've found so many better ways to teach things. So many more effective means to get the point across that I need to have. So, once you get it, it's like an extension of yourself. It gives me another way to teach. It changes my presentation to a more visual type presentation. I do maps. I can do

> charts. I can do graphs. I can do pictures of people, and it's not always let's pass this book around and look at Thomas Jefferson...It gives me another avenue to use. It makes me excited and it helps me to pass my excitement to my students. (Teacher #11).

The variation of ways and means in teaching made teaching and learning more interesting. It made it easier for teachers to grasp students' attention.

> I'm a pretty good teacher but I can be boring, even as hard as I try, because I'm still going to be doing things in a way I'm comfortable with. And there are just so many ways I can stand in front of the class, and you know. So it just gives me another whole bag of tricks that I can use to grab their attention, to change gears. I can do a little lecture and then I can go to the Powerpoint (presentation program). I can use my CD player. I can use my tape player. I can come over here and use some sound effects. It is like if they're bored in my classroom they've got a problem. There's no reason that a student would be bored in this classroom ever (Teacher #11).

Teacher #7 mentioned that she used to vary her teaching methods by using the overhead projector but she believed that it did not have the same effect on students because she could do much more by using multimedia programs to present her lesson.

> With Powerpoint, I can put on the screen at least an outline for things that I want them to get or see. I can put it all up at once or I can do that by going over and touching the mouse one click at a time. I have used the same technique with just the overhead, but they prefer to see it on the larger screen because it will move. It will come from the side. It will drop down from the top. And it's in color. In many different colors. I can always use colored pens on the overhead but it just does not have the same effect (Teacher #7).

Compatibility with Teaching Style

Many teachers mentioned that the use of computers helped them to meet their teaching style, especially teachers who did not enjoy lecturing all the time and liked to do more hands on activities.

> I never was a big lecturer. I didn't like to lecture a lot. It helps I guess my weaknesses was lecturing and I did not enjoy doing it. I never used the book a whole lot, so probably, since we don't have much lab equipment in this school, it allows me to do more hands on activities (Teacher #10).

> I was not a lecturer for a whole period of time anyway. I think it helped me with my lectures and I guess rather than doing activities mainly with pencil and paper now we're using something different with less lecturing. Also, I'm the kind of person who needs to change. I'm not the person that likes to do the same thing every day or even every year. So this was a nice change at the time it gave me another way to teach (Teacher #7).

Reenergizing Teachers

Using computers in the classroom gave teachers, especially those who taught for a long time, new horizons to look for. It gave them the change that they needed after spending many years doing the same thing every day. The presence of computers in the classroom gave them a different atmosphere, different environment, and different way to teach and learn. Many teachers in this study were considering changing careers before computers came along.

> I was considering in the back of my mind whether or not I wanted to try a new career. I've taught for twenty some years and before this came along, in fact, about the same time it came along, I was thinking, "Well, maybe I'll quit teaching and do something different." I just felt like there weren't any new horizons, you know, except for students. There are just so many ways you can do things that I was just feeling like I might want to change. And this came along, and I thought, "Well, I'll give this a try." And now it's reenergized my teaching and there's no thought in my mind now that I want to change (Teacher #4).

For other teachers, technology kept them not only from changing careers but also it kept them from changing schools. Since computers were not assigned to them, they were assigned to whomever was teaching that classroom. So if they change schools, they could not take computers with them.

> I'm one of those people who tends to stay at a school five, six, or seven years. I don't think I could ever stay at a school for twenty years. This came right at the right time. It has given me a change so that it's just a different atmosphere, different environment and different things to learn. So I've really enjoyed that. It's refreshed my teaching. I think so, to me that's the most beneficial thing that's occurred for me...sometimes I miss high school and think, well, I'd like to go back and teach high school again, but what keeps me here is that the technology is not assigned to me. I'm in charge of it here and it will stay here (Teacher #10).

Creation of time for teachers to be facilitators

Many teachers in this study mentioned that the use of computers in the classroom gave them a chance to be facilitators for some time instead of being an information

provider for all the time. So teachers could step aside and not be on the stage all the time.

> In some cases it allows the teacher to step aside and be more of a facilitator and less of an instructor, or to use a trite phrase "a guide on the side instead of the sage on the stage." But there is still going to be a need for that "sage on the stage" from time to time. But I think technology does allow the teacher on a frequent basis to become the guide on the side." I mean it's making me more of a facilitator of learning rather than just a regurgitator of information. I really think so (Teacher #11).

Students level of expertise sometimes determined the role of the teacher. When students had a good level of expertise in using computers, teachers had a better chance to be facilitators.

> When I go to the computer I'm more of a facilitator than an instructor. When I'm up here in the class, and they're not using the computer, I'm the instructor. At the beginning of the year I'm more of an instructor because they are looking to me for everything. Now with their level of expertise, I'm more of a facilitator. They look to me to say, now which program do you want us to run, and they'll run it (Teacher #1).

Although thirteen teachers in this study mentioned that the use of computers in the classroom gave them a chance to be a facilitator for some time, teacher #13 has mentioned that it did not affect her role as a teacher.

> No, it does not change my role as a teacher and it really does not change my philosophy of teaching. The only thing it does is it puts something exciting for the kids in my hands, something different. A new way to present my ideas. It doesn't necessarily mean I'm changing my teaching methods. It's just a different way to present my ideas. It is just a tool. The teacher is the important part of it (Teacher #13).

Requirement of more time and effort

All teachers in this study mentioned that they spent more time and effort in order to use computers as a teaching tool.

Teachers spent more time and effort in different areas. These areas were: Availability of computers, familiarity with computers, making choices, computer integration, and computer maintenance and protection

Availability of Computers

Some of these teachers spent a lot of time and effort just to bring computers into their classroom.

Teacher #1 collected grocery store receipts to raise money and buy computers.

> I saw it as a wave of the future. I kind of saw that by what I'd read in professional magazines, but I did not have any money. So, we started collecting Kroger and Food City (grocery stores) coupons and got the kids to collect them and we got up to probably about seven computers, and we got the administration to take a conference room and turn it into a little lab and we got it all wired and then they moved us before we could get it together, but we probably collected about twenty thousand dollars worth of equipment, so we had a start on it (Teacher #1).

Teacher #12 spent time, effort and money when she used her first paycheck to buy her first computer.

> I started using computers when I got my first paycheck, even it was not enough to buy one computer and a printer and it cost $2,200, and I thought oh boy, what a bargain, because this was when computers were very

> expensive. This was in 1985. Teaching is a losing business here. Yeah, it cost a lost of money to be a teacher. So, I got into computers and I love it.

Teacher #6 brought her own computer from home and shared it with her students.

> I had two computers that are Apple IIE compatible. One was a gift to me to use it as long as I wanted and one was from home that I brought in for the kids to use. I have some old programs that some of the kids know how to use and enjoy working on those computers as well.

When the 21st Century Classroom program came out these teachers were lucky enough to get a number of computers into their classroom, but still some teachers had the responsibility to bring those computers from the central office to their classrooms, which could be time and effort consuming. Teacher #7 had to make arrangements with another teacher to help her bring her equipment to the classroom.

> At the last day of my training I was able to pick up 3 of my computers that afternoon but my car was so small I knew I couldn't get them in my car so I called one of our technology teachers here and said if I came by school and teach your last period class would you go down to ... building and bring back my computers in your truck. So he did, and I was ready to start almost the next day (Teacher #7).

It was teacher's responsibilities to set computers up and wire them. However, teachers sometimes got help from family members, colleagues or students.

> Students helped me to set these computers up. If I had to do that by myself, I would still probably be working with it. It took just 30 minutes one day for us to throw the cable across the ceiling tiles and one student plugged in what needed to be plugged in and so we were set. Some of the boys took 2 or 3 steps up the

> ladder and moved the ceiling tile. It was a good experience for all of us (Teacher #7).
>
> A lot of effort and time goes into setting all this up. Countless, countless hours. If you're truly a contract person saying I work 8:00 - 3:45, you might as well forget that. I'm here by 7:30 in the morning most times and I'm usually here until 7:00 or 8:00 at night and I'm not through then (Teacher #6).

Familiarity with Computers

In addition to spending time and effort in bringing computers to their classrooms, other teachers spent time and effort trying to learn how to use computers. Most teachers in this study mentioned that they began using, and continued to use computers because of their own initiatives. They were not trained to teach with computers, and never had a workshop or in-service training to help them on how to teach with computers.

> Well, we go to 21st Century training, when we get the 21st Century classroom and what they do is they basically show you how to turn it on, show you that there are holes in the back that match up with cords. I mean it's really, it is very basic thing. And a lot of it I already know how to do, but there were a few tricks that you pick up (Teacher #13).

Even when there were training sessions for teachers to learn about computers, administrators did not choose the right time or place for teachers to be able to attend, and the topics were not of teachers' best interest.

> There are some training programs available at...which is at the other end of the earth from here, but usually it starts long before I'm ready to leave school and it

> may not be at convenient times, it is always at night, and it's not always on what I need at all and often you're working on other machines that is different from yours with problems that are not quite like yours. I want to access it from my computer and look for glitches that always appear on my screen which is not always what's in training. Mine doesn't do this, if mine would do this I wouldn't need to be here (Teacher #6).

Since a week of training that teachers were required to take was not enough for them to learn everything they needed to know, teachers had to find other alternatives. Many of them had attempted to learn by doing with the help from other colleagues.

> Basically, I've learned it by doing. Also, we have a computer technology person on staff who has been on call when I've come to a problem that I couldn't solve myself. And it has helped a lot. And there's another fellow that has a 21st Century Classroom, and he spends all his time doing it. And so he's shared a lot of things , but I've shared with him, too (Teacher #11).

> Training a lot of times is not enough. Since I decided to try to experiment on my own most of the time. I learned how to use Hyperstudio for Windows by myself. I had somebody to show me how to use Powerpoint. It took me about 15 minutes to learn how to use it. You have to be willing to go out and experiment and try to troubleshoot it myself before I call one of the guys downtown (Teacher #4).

Other teachers learned how to use computers by subscribing to listserve groups which are a group of people who communicate and share their common interest via the Internet.

> I get some ideas from some people and I subscribe to an ed-tech listserve, so I get quite a bit of mail. I've done a lot of this on my own and my best friend is the

> technology coordinator, so she helps me a lot when I need help (Teacher #4).

Teacher #3 took classes and paid from her own pocket to learn how to use computers.

> That is why I'm taking a class on how to use computers in the classroom. I thought I'm not learning enough...I pay $100 from my own pocket and that's not right. But I'm learning it, so I can help my students and teach other teachers some new things. Sometimes it is frustrating when you have all these computers and not know how to use them.

Making Choices

When teachers completed the one week of training, administrators gave them the authority to spend $20,000 worth of hardware and software. For the inexperienced teacher, this could be a hard decision to make. These teachers went through a lot of software and hardware in order to choose what they wanted, or what they thought they wanted.

> I went for training for a week, and I really was just so ignorant. All I knew was how much I did not know, because there is just so much to learn, and I even gave myself the name of the "Techno-idiot." Because I'm the kind of person, I wouldn't even attempt to program a VCR to tape something at home. And so, I'm thrown into $20,000 worth of equipment. I needed to make a $20,000 worth of purchases at school prices, which is a lot more than you could get on the open market. And I had to decide how I wanted to teach using this equipment, and it was a new life totally. And I felt so inadequate and made a lot of choices knowing nothing, because at the end of that week period, they tried to show us things and tell us things but I had no experience and at the end of that time period, I had to

> order all software and all the hardware that I wanted or I thought I wanted (Teacher #11).

For the inexperienced teacher it was easy to make mistakes and purchase software and hardware that they would never use. Teacher #10 mentioned that if he had the time to preview materials he would change what he bought and spent his money elsewhere.

> If I were going to do this all over again, if they gave me the opportunity to purchase things again, I would change what I bought, 1 computer with the duodoc I wouldn't purchase it. I would get a laptop and it'd be just a color laptop. The duodoc hasn't been very effective. It tends to freeze up and has glitches. Some of the software I would never buy. There are some laser disks that were a complete waste of money, but we didn't have the ability to preview like we should. If I were going to change the program teachers in that training should be able to have time to preview materials and if they don't like them then they should not buy them and spend their money elsewhere (Teacher #11).

Computer Integration

Bringing computers to the classroom, setting them up and finding the means and ways to learn how to use them was one thing that required a lot of time and effort. Integrating computers into the teaching practice was another thing that teachers spent much more time and effort, but in return they got satisfaction with more polished products.

> I spend more hours here in the afternoon. Yeah. You would think technology would make it easier, but you end up with so many things you can do. It increases your options, and so, since you have your options increased, you tend to stick around and see what the

> best approach. Obviously it lets you do a lot of tings quicker, but it gives you so many more options and more polished products (Teacher #10).

Teacher #11 felt that the more she knew about the use of computers, the more she felt that there was to know, which made her spend more time in learning about what she thought she needed to know.

> It is not making it any easier because the more you know the more you know there is to know. So although it will help you do some things faster and more efficiently and actually better, you learn that there is more that you want to know so I would not say it saves me any time. I know it hasn't (Teacher #11).

Integrating computers into teaching practice required teachers to spend more time in school in order to find related information by looking at laser disks and other software.

> Absolutely it takes an incredible amount of time. I stay after school till 6:00. I've got this laser disk. I have one laser disk that has a lot of things that relate to my science program but I have to find the information on the laser disk before I can use it for my classroom. So I'm here at 6:00 at night still going through the laser disk looking for something that relates to material that I'm getting ready to teach, and then I make notes and then next year I'll just open up that book and I'll have it all written out but that's a lot of work (Teacher #10).

> I have more to go through I have more resources to check out and in fact before I allow the students to do any work on the software because if it does something strange and I'm not back there, I have to understand how the software works so I can get out of where they are and correct it (Teacher #14).

Teacher #1 found a solution for staying after school problem, so he bought a computer to use at home.

> It takes a lot to learn how to use this software, much more time. I mean I've tried after all these years, I've tried very hard to get it all finished in school. So I get here very early and sometimes stay late. But with the family I couldn't really stay late I could get here at like quarter to seven in the a.m. and work. I still do but not as much because I did buy a computer so I could do a lot of the work at home now, computer wise. It gave me a good reason to ask my wife if I could buy a computer (Teacher #1).

For teacher #2 it was much easier to teach students in the traditional way than to teach using computers because there was so much to look at and think about.

> In all honesty it is a lot more easier to do the old timey teaching where students all in little rows, and you lecture to them and they leave. And I guess my feet hurt a lot more. I'm on my feet a lot. It has not made it easier for me. If anything, it's probably made it more difficult because I got so much to look at and think about (Teacher #2).

Some software were easier and less time consuming than others. When software was user friendly it could be a time saver for teachers.

> In some ways it requires a lot more time because there's so much information and you've got to narrow it down what you want the students to do and you've got to do a lot of preparation. Sometimes the software is user friendly but not all software is that way, which takes me so long to get used to it. Some of the software I don't know how to use (Teacher #9).

In addition, reading the manual on how to use the software could be very helpful; however, it took a lot of time.

> Because it's something I've not had in my room that long I have to put additional time on it lesson plans developing projects, developing techniques simply learning how to use some of the software. I have to sit down and learn how to use it and that takes time because it's not something I can just sit down and open up a program and immediately be able to do. But I have to read the manual to help me get to the point where I'm comfortable using it. So it takes an awful long time to learn how to use these software, if I have 100 software, that means another 300 hours of extra work. If I have a program that I paid $300 for, then I'm going to be real busy for a month and a half until I learn how to use it (Teacher #14).

Surprisingly teacher #10 and Teacher #11 mentioned that their county did not even purchase the manuals for the software so they could save 5 dollars per copy.

> I spent hours and hours after school and before school and at home learning how to use the software because for some reason the county found out they could save about $5.00 per copy by not getting any of the manuals, so we got absolutely no or very few manuals. Now most of the applications have help screens which are a pain to use, but it would be nice to have some manuals, so you learn how to use it (Teacher #6).

> I think we need to get teachers to experience the use of technology. Once they experience it, and you need someone to take you through the steps. Because the bad thing about this county, what they did with all the software we got, they save five dollars a copy by not ordering the handbooks. So we get the software and no instructions. Their rationale is, "Well it's easy to use. You can figure it out on your own." So that's what takes a lot of time, too (Teacher #11).

Computer Maintenance and Protection

In addition to the preparation time that teachers spent, they also spent time on what they called "trouble-shooting", which meant, they spent time to fix, maintain, and figure

out why these machines did things that they did not understand, and why sometimes these machines stopped working without any observable reasons.

> I spend a lot of time trying to understand why the printer is not printing and why does it say there's no ink when I just put in a new ink cartridge, you know, it is just one thing after another and then you need an immediate help because basically the more you rely on them, the more you have to shut down everything until it's fixed (Teacher #14).

In addition, sometimes students did something with computers that was hard for teachers to figure out, especially when teachers were out for a day or so. It was harder and more time consuming when students did not know what they did, and left it for teachers to figure out.

> Just let me be out a day and come back and not have something wrong. All the TV's run through my VCR. Everything runs through my VCR. That's the way it's all hooked up. My laserdisc, everything. Everything runs through the VCR, so if somebody goes over to the TV and manually changes the channel everything is messed up. Most of the time I don't know what they did to it. I just know it isn't working. And of course, nobody admits to doing anything, but I know it's not working so therefore, we got to go in. I've got to go in and figure out what's wrong and you know I can send out a flare for help, but that may not be answered for a week, meanwhile we can't watch channel one. We can't do anything until we find the mistake and get it corrected (Teacher #6).

Teachers did not understand the messages that the computer gave when something went wrong, which involved a lot of frustration and trouble-shooting time.

> Sometimes, it gives me mean messages that I don't know what they mean, and nobody has time to drop what they're doing to come help me to understand that. So, you know, there's a lot of frustration involved,

> troubleshooting, you really need more people available to help care for the machinery to tell you what and why it's doing this. I've done a lot of slide presentations in this program and I understand about saving your material today, right in the middle of the program. All the backgrounds changed, all the print changed, color just right in the middle for no observable reason it just changed, and there was a light blue background and white letters and it did not show up and you know, it took an hour to go back and redo everything. I don't know why it happened. You know, but it was very frustrating and it took a lot of time and you have to find somebody to help right now, right this minute because I've just got to use this program today. The computer won't print and the printer won't cooperate. So it makes it incredibly hard, but a more polished product (Teacher #13).

The care of the physical aspect of computers was also teachers' responsibilities, which might take a lot of time and effort.

> Using computers makes it easier but harder at the same time, and it's not the thing that I thought would be hard. What's hard is to take care of the physical aspects is always the problem...when the kids come with sticky fingers and before you know, the keyboard is sticky. So, it is my responsibility to clean the keyboard every time students do that (Teacher #3).

When teachers got sick or needed some time out, the protection of the physical aspects of computer was something they had to worry about. Therefore, there was a lot of preparation time that teachers did before taking any time out.

> I watch the computer like a hawk. I mean, every time I leave the door or take time when I'm sick or leave, I take all the keyboards up. At first, I took all the computers up, but I thought, I can't do this all the time. This takes too long, so I take the keyboards up but I have to protect them to a certain extent because it's so much money. I mean we've got $25,000 worth of

> equipment sitting out there and you know I worry when I'm out sick, are they going to knock the 34" screen TV off in the floor and break it. You know, so I guess all around it's created a lot more stress for me, even though I think it's worth it (Teacher #2).

To protect the physical aspects of computers, teacher #1 took computers up every time he was sick.

> Every time I'm sick or something, I have to take everything up cause I don't want the kids working the machines while I'm not here. It is extra time, but it's getting less and less, the more I learn the more I do maintenance to keep the machines from breaking down (Teacher #1).

Teacher #2 felt that having computers in the classroom gave her more responsibilities even at her planning period when she was supposed to be free.

> Yeah, it has, it's made my work harder, I think I work more. I think just you know, just turning on the computers and keeping them functional and keeping the printer from getting jammed, just all of those things that you think are not a big deal. They're time consuming you know, and I know I've got kids during my planning periods a lot of times that are in here even though I'm supposed to be free. I've got kids in here, can I type this report for so and so, can I work on this, can I go on the Internet and find this? (Teacher #2).

Teacher #1 did not want any more computers in his classroom since they were a handful to keep up with, and he hoped in the future to have some more if he could get more help in taking care of the physical aspects of them.

> Would I want to have a lot of them, at this point maybe not, because they are a handful to keep up but I'd say machines that come around maybe more in the future, just like my wife at work, she just has a monitor and a keyboard. She doesn't have to fix it, you know. So maybe that's what will evolve in the classroom. So, then I could accommodate more computers with more kids working (Teacher #1).

Improvement of Teachers and Students' Relationship

Teachers in this study believed that the presence of computers in the classroom had a positive impact on the relationship between them and their students in many ways. Teacher #9 mentioned that students talked to him more when they work on the computer, because they felt more comfortable asking questions when they were not sitting next to somebody.

> Some of them, they won't talk to me a whole lot if they were doing seatwork but if they were back on the computer they ask gobs of questions. Plus when they're on the computer it seems like it's just one on one and it seems that they feel more comfortable about asking questions because they're not sitting right next to somebody (Teacher #9).

Teacher #6 mentioned that the presence of computers in her classroom affected the relationship between her and students. She added that computers created something in common between them to share and talk about.

> I think it helps our relationship because they know that I work with computers, and they like to work with computers. So it gives us something in common. At the age group in middle school they don't see a lot in common with anyone who's not in 7th grade, so anything where we can pull out things that we share in common and like to do, that is good (Teacher #6).

Teacher #7 felt that the use of computers in her classroom made her relationship with students better, because she was more interested and supportive of their projects when they used computers. So, she talked to them more.

> Well, I think it forced me to talk to them more and I think communication between us is probably better than it was. I like to think that I always communicated fairly well with the students, but the fact that I would try to support them in what they're doing if they're are special projects going on, I would want to know about, especially when they create it on the computer.

The use of computers in the classroom created another form of interaction between teachers and students. It gave students a chance to be teachers for some time, and teach teachers how to use computers, and it gave teachers a chance to be learners for some time, and ask students for help. Most teachers in this study perceived that students know about computers more than they did.

> One of the neat effects is that kids tend to know a lot more about computers and are less afraid than adults, and so quite often they'll show me how to do something on computers. I love that. The best teaching is when kids can show you something and show other kids (Teacher #10).

In addition, teachers called some students for help when they had a technical problem, or when they needed help with setting up computers and wire them.

> I have several students that are much more expert at it than I am. I have to call on them for help. "Get me out of here, I'm hung up where can I go? How do I get it to print this? And they can usually come through basically the connection, the networking of the computers in my room, my presentation system to the TV, my VCR, my laser disc and so on all wired by students (Teacher #7).

Teacher #8 had a student in her class that she called a "computer expert" as he helped her with computer problems.

> This afternoon I was printing brochures, little poster about a PTA meeting and I had used a program that I wasn't really familiar with, any sizing was wrong at the bottom and so I called on my "computer experts," and he was interested in doing something else but he tried to help me and he said, "We'll just keep doing that and it'll go up there and I thought he made me lose the program but he didn't (Teacher #8).

Teacher #4, who taught special education classroom, also felt that her students knew more than she did about computers.

> There are things that they taught me for example, in the kid picks program that I did not know that you could do, so, they say "come here, let me show you what I found out and how to do today and I just facilitate them in trying new things. My kids are really brave and adventurous when it comes to computers. I've got one kid who is an LRD kid. He just tears me up in this one educational game. He can outdo me on it no problem. He's got an IQ like 60 and just beats the stuffing out of me on this one game every time and he thinks it's the greatest thing in the world (Teacher #4).

Teachers who had gifted and special education students perceived that the use of computers equalized students and helped the disadvantaged students feel that they know as much as the gifted students.

> When kids get back on the computer and get used to the program and how it works, they're on it. Nobody is at a disadvantage. So, it is sort of an equalizer once they get used to working with it, it does not matter what the background, the special education kids will be able to work on it as well as the gifted kids and all of them want to be in charge (Teacher #9).

Teacher #7, who also taught gifted and special education students had a different opinion about gifted students. She

mentioned computers made gifted students more popular and needed, because everybody in the classroom needed their help.

> The smart kids that you know is too smart for their own good, and now they still there but everybody needs their knowledge, the computer experts become very popular in the class. And that's a new role for that child. I would think because the boy or the girl whose going to be the computer expert. I think 5 years ago would be the nerd of the class. And now everybody wants to stay friends with that boy, because he'll help them when they get stuck (Teacher #7).

Although most teachers felt that the use of computers affected their relationship with their students, teacher #2 said it did not affect her relationship with her students.

> No, I don't think that computers affected the relationship with my students, because since I use a cooperative group, I'm walking around a lot anyway, even if the computers were not in here, I interact with the kids and because I'm team leader, I think the kids come to me with their problems so I never had any problem with interaction (Teacher #2).

Complexity of Classroom Management

Many teachers in this study mentioned that the use of computers in the classroom made the classroom management harder, it allowed some teachers to move from whole class lecturing to group activities. Teachers who never did that before thought that it was much harder.

Teacher #8 had never done group activities before she had computers in her classroom. She felt that it was harder.

> I've always had the whole class doing the same thing at the same time because I thought in math this is what you do. Now, I've got what we call rotations probably you used to hear them called centers where I have 3 activities going on at once. I can get a third of my students on the computers. I can put two students on each computer so that's about ten kids, then I have maybe a lab going on because on the other side of this curtain we have a nice science lab. And it allows me to get out in the class and work with them one on one, which is something different. I've never done that before, but it's hard (Teacher #8).

Teachers suggested many reasons which made classroom management harder when computers were used. The reason mentioned most often was the limited number of computers in the classroom. Teachers in this study had on the average of 30 students with the average of six computers. A teacher who allowed two students to work in each computer would have an average of twelve students working on six computers with six different programs. In most cases, teachers would have one copy from each program in order to protect the copyright. When twelve students work on the computers, teachers still had the rest of the class to engage with a meaningful seatwork.

> Now, it's much harder. See, I can't entertain all these students at the same time. I mean I tried at one time to put three or more but it did not work. Two is the max at each computer. So, I have to get the other half of the class. Today, we have some that have thirty, and so that means half the class has to be doing seatwork. So you have to be able to concentrate on the computers and when they ask you something, you know. I've got to think the process through to either fix it or explain to them because I could have six different computers and six different programs running at the same time (Teacher #1).

Moreover, when students used the Internet, teachers had to be careful and made sure that students did not go to the inappropriate sites which were time and effort consuming.

> The Internet we've used a little bit, but I've been a little disappointed. There's been so many restrictions, all the slut and stuff that's on the Internet, we have to be so careful with it. I have the capability of putting the Internet on all of these computers but the county has chosen and I think they wisely said just one computer where we can watch, monitor but I even go to the point of when they get on the Internet I sit with them. So, but they have used it and they've enjoyed it, you know. Some days it's slow, some days it hardly moves at all (Teacher #1).

Other reasons that teacher #5 mentioned that could make classroom management harder was that using computers in the classroom required more scheduling time for students who were going to be working on computers for each day, and more time was required for planning class activities that students could handle. In addition, when computers were used there was more movement and more noise in the classroom.

> It has not made it easier if anything it's probably made it more difficult scheduling time, helping them, and of course if they're at the computer and they raise their hand, they think you should be there that moment. You know, it is difficult to plan activities that they can handle and that I can have other students who are waiting doing something useful and meaningful too. So that we circulate around. There's movement, there's more noise but they're learning so that was hard the movement the noise was hard for me to accept, but I just decided well if I'm going to do this I'm going to have to have some of that too. So just be prepared and adjust for it (Teacher #5).

Teacher #2 also mentioned another reason for considering classroom management as harder. When computers were used, she had to be mindful of several things. For example, she had to make sure that computers were being used properly, the Internet was being used appropriately, and the printer was working.

> It is hard, you have several things that you have to be mindful of that you would not have had to give any attention to before that. Probably a little harder. Well, you have to be sure the computers are being used properly and you have to be sure that the Internet is being used appropriately and you have to be sure that the printer is working and all those kinds of things, which people don't think that it's a big deal but sure it is.

Classroom Management Accommodation

Teachers reported many ways of dealing with the classroom management challenges. Some teachers asked for help from other teachers; others did not use computers when they did not have extra help, and others accepted the movement and noise as long as they felt students were learning. Teacher #1 had a teacher's assistant who came and helped him, and if the assistant was sick or couldn't come for any reason, teacher #1 did not use the computers at that time.

> Sometimes I have people aids that come and help me, and if the aid is sick or can't come, I just refuse to do it. So, you know, it's a real juggling act. I feel like a clown in the circus a lot but that's really what teaching is (Teacher #1).

For teacher #5, if she really had a bad day, she would not use computers even though the students kept asking her to use them.

> It's a little rowdier, it really is. If I'm really having a bad day I slack down on that because oh, I just can't make myself sick with it and sometimes students will make you do that because they're al wanting to use it, and they always go, "Can I be next, can I be next and we have a schedule and if someone is absent everybody wants to take that person's spot. They're not here today, can I have that spot? but I mean this is a lot more scheduling time for me. OK, let me put it this way. I have to work as much on scheduling the time as I do what I'm going to do in that time (Teacher #5).

For teacher #8, managing the classroom got so difficult to the point where she had special places for misbehaving students.

> I have a few that I have a special place for them, but not for all of those that misbehave, you know it's bad. Especially when they get up moving around, you can't just turn them loose. sometimes, they cannot handle it. They will reach each others book bags, run around the room, pushing, shoving. If I'm having rotation where I'm having 3 groups moving around I can't be over in the lab and expect them to be sitting here doing book work. Sometimes it is chaos, so I have some children that leave (Teacher #8).

Teacher #7 accepted the noise, movement, and other responsibilities as long as students were learning. So far, she has not figured out a way to use computers and keep students silent.

> You have to recognize that they're real excited about what they're learning. They're not going to be silent and if you expect them to be silent I haven't figured out the way to make them to be silent. So, you've got to have a certain noise tolerance level and say they're noisy but they're on tasks and to make that distinction between being off task and being quiet is hard for a

> lot of older teachers because they have this particular idea that students are not on task unless they're silent. I don't want my class silent. The only days they have to be silent is test days (Teacher #7).

Also, teacher #9 said that classroom management was hard when computers were used, and thought that the more he used computers the easier it was.

> OK, with computers I have to give a little control and since I only have 5 computers I can have 6 or 12 at the computer. I really can't have the whole class work on computers at the same time, so I have to give a little control and let them work on their own more independent work. It sometimes can be harder, but the more they get used to it the easier it is for me to control them and they understand what they can do and what they can't do.

Most teachers in this study mentioned that it was difficult to manage classrooms when computers were used. For teacher #12 and teacher #14, who taught gifted kids, classroom management was much easier.

> It is a lot easier. Boy you get those kids on the computer, and there is not a sound. They're just so engrossed into the computer. I don't have a whole lot of problems with them and you know, in a gifted class you really can be so structured. I always called it a very organized chaos because they're so busy.

Incentive methods

Most teachers in this study mentioned that they used computers as a reward for students who finish their work.

> The use of computers can be a plus or a minus if a child has not turned in their work. You can say, "No you can't turn this on, you can't go to the computer till you turn your work in. So, it can be the carrot

> that you hold out and it can also be the reward if you've done a really good job. I'll say, "Why don't you go a little bit early to the computer so that's one way it can be used. It's not the only way. So it works (Teacher #5).

Teacher #1 had a big banner in his classroom that said, "chewing gum, no computer time." Also, he rewarded students when they finished their work with extra computer time.

> I did not want to do this at first threateningly, but it's worked, if you don't do you homework, if you don't cooperate in class, you don't go to the computer. And since it's review work, they're not losing anything from their curriculum. But if some kid sits back here and want to talk to other kids, then when I check their work, they don't have their work done, they don't go back to the computer. And it works well (Teacher #1).

Other teachers used computers as a plus or minus for students who misbehaved in their classrooms or in other teacher's classrooms.

> If they're behaviors's inappropriate they won't be getting near the computer. so I don't have that many behavior problems any more . It's when they go out to other classes and they don't have that inspiration there, so a few of them when they've gotten out of hand in the other classes I've kind of had to pull back the computers in here. And they really dislike that they grumble and growl about it, but it helps sometimes (Teacher #4)

Teacher #8 also used computers as a way to discipline her students. She stated that "as far as helping with discipline, my class, they'll behave otherwise they don't need to be on the computer." Teacher #6 used computer time as a reward for students who got A's and B's on their tests. Students who got A's on their tests could use computers

while other students went over their test and fixed their mistakes on the test.

> Often sometimes if a class or if we've given a test and when we're going over it, all those that made As can go to the computer and work while the rest of us go over the test maybe the As and Bs can do that while the rest of us go over our tests or maybe students who earned a reward for something get extra computer time in a rotation. Those that want to earn computer time may choose to do some extra credit. There's different ways that you could handle it (Teacher #6).

Teacher #5 used computer time as an incentive for students who did not like to do any written work

> I've got 3 little boys and 2 girls that it's a great incentive for those students who do not like to do any written work. so they get free time to play games on the computer if they've done their written work (Teacher #5).

Teacher #9 did not believe that the use of computers should be a reward for students in any way, because it should be part of the teaching/learning process. However, he did use it to print a certificate to reward students who completed their work.

> I've used the computer if students complete work, when a student completes all the bookwork and the worksheets and the cartoons and other stuff. I would then print up a reward you know. I use the computer to design myself a certificate to say you've completed all the work. I don't see it as a reward. I see it as part of a classroom that's something to be used and not necessarily a reward. I just I'm not big on reward. The materials are to be learned, the learning and the knowledge you gain is the reward and I don't hand out rewards (Teacher #9).

Teachers #3, #10, #11, and #7 did not believe that computers should be used for rewards, rather they saw the computer as part of the teaching and learning process that students should use as much as they could.

> No I never used it as a reward. I want all students whether they have been little hellions or not to have their chance to use computers. I want them to be used in the classroom as much as possible (Teacher #3)

Students' evaluation

Only two teachers mentioned that they added other ways to the way they evaluated their students. Teacher # 5 mentioned that students long reports had to be on a computer disk and visual for her to see and for her students to talk about.

> Years ago, they would have written a 5 page paper for me and number of words, I don't allow that to happen any more. The English teachers going to have to read all of that. From now on they will do 1 or 2 page reports a little short something for me, but their long reports must be on a computer disk must be visual for me to see and for them to talk about. I think it's good experience for them and it's great for me to grade you know, I save a world of time.

Teacher #1 mentioned that he came up with another way to evaluate his students, by giving his students a sheet of paper every six weeks which represented how many points they earned when they used computers. This sheet would be interpreted as one test grade.

> With different methods, this is my present one with the sheet, it's a review sheet. It's a sheet that they get once every six weeks. And they have to get so many

> points up to 100. and they show me how much they've accomplished by how many points that they've earned. I interpret that as like one test grade in making period so they might have one or two other major tests so it's like a half or a third of their grad. And you know, before that I would just evaluate it just on if they could get into a program. Now I'm getting a little bit more refined (Teacher #1).

Teacher #6 mentioned some reasons for not using computers to evaluate her students. Some of these reasons were because she taught 150 students, it took a long time to list all students names, and also not every student got equal time on a certain program. This made it hard to use computers for evaluation.

> In terms of using the computers for evaluations, I have not set up a program yet. Many of these programs that I have an option where you can list all the students names and every time they work on this program, then they're going to get a score or you know, a printout of whatever. Well, I have not set those up you know. If you have 150 kids come in and you've got 4 classes and you set up everything and it takes you a while to do this and then everyone doesn't have equal time on the computers for the program then that doesn't do me as much good as perhaps it could. There are other programs that I might prefer that they work on that I don't have that database built in, so I have not used them for that at this time.

Summary

Teachers in this study perceived a variety of impacts on their teaching practice. Many teachers believed that the use of computers in their classroom enhanced and diversified

their instructional strategies by making it possible to use different means and ways to get the point across, which made the teaching process more interesting. Teachers also believed that the use of computers helped them meet their best teaching style, especially teachers who did not enjoy lecturing all the time and liked to do more hands-on activities. Using computers in the classroom gave teachers who had taught for a long time new horizons to look for and provided them with the change that they needed. The use of computers gave teachers a chance to be facilitators instead of being traditional instructors for all the time. In addition, teachers perceived that the presence of computers in the classroom had a positive impact on the relationships between them and their students.

Although all teachers perceived positive impacts on their teaching practice, they also perceived some challenges. The presence of computers in the classroom required teachers to spend more time and effort. They spent extra time and effort in order to bring computers to their classroom, set up and wire them, learn how to use computers, prepare students' activities, find related information and choose software and hardware. Teachers also perceived that the classroom management was harder when computers were used, because it allowed teachers to move from whole class

lecturing to group activities. Due to the limited number of computers, teachers had to deal with several groups of students at the same time. Rotation of these groups resulted in more movement and more noise in the classroom.

Impact of Computer Use on Learning

All teachers in this study perceived positive impacts in their students' learning as a result of computer use in their classrooms. These impacts were:

Motivation of Students

All teachers in this study mentioned that the use of computers in their classroom motivated their students to learn. Teacher #1 believed that computers motivated all students in his classroom, even the really bad sleepers who did not want to do anything.

> It's really exciting to kids. I mean they really enjoy using the computers, even the really bad sleepers kids who just don't want to do anything want to go back and work on the computer. There are times when kids don't want to do anything (Teacher #1).

Teacher #5 felt that her students enjoyed coming to class more and paid attention more than before she had computers.

> I feel that my students really enjoy coming in here more and if they enjoy coming in they're not going to be behavior problems and they're not going to loose interest as quickly. For 6th graders anything that catches their attention makes life a whole lot easier and there're days when they came in and they've had an

> argument with their little girlfriend and they're just kind of off tasks anyhow and sometimes get their minds off that (Teacher #5).

Teacher #3 mentioned another reason for students to be motivated when computers were used. She believed that when students printed their projects they looked very neat, which made them excited, and when they printed the cover page and the dedication page, it gave them a sense of accomplishment.

> The students are excited when we use computers in my class and when they print projects that they have, they feel a sense of accomplishment when they see their printed project look so nice with a cover page and a dedication page and it looks really, well, it looks good when it comes out (Teacher #3).

Teacher #4 who taught special education students felt that the use of computers in her classroom has been a great motivator for her students because they had a chance to do some activities independently, and they found out that there were a lot more activities to enjoy and learn about.

> It has been a great thing for disadvantaged kids like that, it gives them a window on the world they did not have. I have seen quite a leap of progress with my kids most of the time, they have been motivated, because they found out about more things out on the computer that they can play with and learn about. It inspired them to read a lot more. I have a group that started out with me last year that could not read basic words. I have a list of basic site words on the computer. Now they are able to read all 400 words on the list and move on to somebody else's reading group this year. It made me push my kids to read more (Teacher #4).

Although all teachers mentioned that computers motivated their students, teacher #11 mentioned that it did motivate her students, but not equally.

> I think it affects their motivation positively but I'm finding that really differ with the child because I've had classes where you know this is my 3rd year and the first 2 years I had students who would fight each other for the computer if I allowed that. This year I don't have that I have kids that they don't care one way or the other.

Improvement of Student Academic Achievement

Many teachers in this study mentioned that the use of computers helped students' academic achievement. Teacher #7 believed that her students picked up information quicker when they used computers, because they got information in three ways. They read it, heard it read to them, and saw it which involved more than one sense.

> I think they pick up things quicker. Yes, I do. Plus, lots of times they're getting to read it, to hear it read to them, and to see it. You know and that's involving more than one sense. So they're getting information in three ways. I think with that they're mor likely to pick up the information and retain more of that information (Teacher #7).

Another reason that teacher #7 mentioned in relation to the importance of student's academic achievement was that students got to see information at their own pace. She felt that the pace that teachers established for students might be too fast or too slow.

> Well, again just the exposure they get to see it more time, they get to see it at their own pace if they're doing rather than the pace that I established when I do my presentation. If I go fast I will loose them, and if I go slow they will get bored and wonder off to something else. If they can do it electronically, they can set their own pace (Teacher #7).

In addition, Teacher #7 believed that the academic achievement of her students improved since students could get help from each other and teach each other.

> You train one and you put an unknowledgeable student with knowledgeable student and they train each other and it's kind of a reflection back into the classroom. I will say, "Can you go help John over there do his vers. Yeah sure, I'm going to work back here on these computers with these kids. Would you go over there and help them." And so it's helped. It's like kids helping kids, but like I said when it comes to computers we all kind of feel like we're the same (Teacher #7).

Teacher #9 believed that the use of computers in his classroom helped his students to remember things more and to read more which may increase their academic achievement.

> Well, I think they probably remember things that they see on the computer and some kids just don't want to read but it's funny because they say, "Oh, I don't like to read. You know you give them a book to read, and they don't want to read. But you can give them a program which is a lot of reading on it they will read off the computer but they don't think that's reading. I don't know why that is, but they don't think that's reading even though it's almost the same thing as opening a book and reading it. Somehow they read better and remember what they read longer (Teacher #9).

Teacher #2 believed that she saw an improvement in her students' academic achievement, especially with the lower level students. Also, she felt that students were turning in their projects more.

> Well, I guess if I looked at, for instance in math we have seen a lot of improvement in students' academic achievement, especially the lower level kids in doing their homework and understanding fractions. I think

> the kids benefit more than anybody maybe because they don't have access to computers at home, but I think the kids are getting a whole lot form the math programs. Science wise, I have seen an increase in the number of kids that turn in projects because they have access to this. I have very few kids that just don't do anything now because some of the kids that wouldn't have done a project before will do it now because either they've got access to information off the computer which is more exciting than looking at a book or they've got access to a computer to print it out which they think is real cool. So, I see an increase in motivation to actually do the work (Teacher #2).

Teacher #5 also believed that her students remembered things better when they used computers, because they could go deeper on their own, and found things that interested them.

> The children will go deeper on their own. They will find things that interest them and research on their own a little bit better. I think because they enjoy using the technology and if the child enjoys what they're doing they're going to remember it better and I think that does help they're achievement (Teacher #5).

Accommodation of Students' Learning Style

Many teachers in this study perceived that the use of computers in the classroom helped teachers to meet their students' learning style. Teacher #10 mentioned that computers let his students pick their best learning style.

> I think it allows the students, since the students don't all learn the same way as you know, and it lets them pick their best learning style. Some listen. Some listen well. Some remember better if they can see it. Also, it gives me or it helps me as much as anything to try to meet those different learning styles. There were sometimes and I found this true before technology too especially in labs and hands on type activities there often are kids who aren't making A's academically in the subject cause they're not a

> kind of person who memorizes very well. They can come in and they can show other kids how to use a piece of software or how to turn the computer on whereas you may have a kid who makes all A's and he or she may not have a real understanding of how to work the software so that's kind of a nice effect when someone who is the wallflower or someone who doesn't ever make any grades can come in and show someone else how to use something and that's - I like that when that happens (Teacher #10).

Teacher #9 mentioned that the use of computers helped him to deal with students who did not like to listen to long lectures. With computers, he could give them a short lecture, quick instruction and put them to work.

> They allow some students who wouldn't learn other ways to learn. It allows teachers another tool to reach students. Some classes, if I'm standing up and talking, they are real quiet. Other classes, if I'm standing up and talking they talk so, it varies how the class reacts. So, when I have a hard time lecturing, I give short lectures, quick instructions and get them to work because they are very task-oriented and can do this if they want to get something done. They don't want to sit there and listen and have to think about something. They just kind of want to do something. So, computers help them because they go back and do something on the computer (Teacher #9).

For teachers #12 and Teacher #14, who taught gifted students, computers enabled gifted students to go as far as they could imagine. This made the teaching process easier since teachers did not have to prepare extra curricular activities for gifted students.

> The gifted can take it farther than you would ever imagine, give them a little time on the Internet and they will be pulling out this and that. It is almost a natural thing because according to their abilities, they can access what they know how to do and I can teach them things with it and so for the gifted students they can go as far as they need to go. You

> know, it probably has made that part of teaching less onerous because they have the ability to go farther without me having to prepare a lot of extra stuff or you know dig things out for them because it's there for them you know, they can access the encyclopedia or whatever (Teacher #14).

Compensation for Different Learning Disabilities

Many teachers mentioned that the use of computers in the classroom helped students with different disabilities in writing or spelling to share their thoughts with others.

> I have a boy that has a learning disability where he can put no words on paper, but he can speak to someone and they will type for him what he thinks and his work is lovely but he in his learning disability can only really write his name but he has very normal intelligence but it's been very interesting so for him it's like freedom. Of course he has to have somebody typing in the words because he has no ability to spell or write anything like that but he has a big vocabulary and he has wonderful thoughts that are just really locked away for anybody to share (Teacher #11).

Teachers #7 and #3 believed that the use of computers helped them reach those students that otherwise they couldn't. Students who could type, but could not write would be able to submit their assignments on a computer disk, so teachers could check it strictly from the disk.

> I believe that in order to teach them, you've got to reach them. And for some children that's how you reach them. I've got 1 little boy that you cannot read what he writes, his writing is atrocious. He does most of this assignments on the computer and he has his own disk and they get their disk and they save what they want to save onto it. Some assignments I just pull the disk and check their assignments strictly from the disk and others they have to print it out and put it in some kind of folder and give it to me (Teacher #7).

> We have a child that, and I just had maybe one or two computers in here at the time, but he did a lot better if he did his work on the computer. You know, and so he did everything. I mean vocabulary lists. He used everything on the computer and it took him longer but that was one of the ways we could get him to do his work. I think part of it went to his hand writing was real poor and he was very self-conscious of it, and although I could read it because I can read any chicken scratching now he was real offended by his handwriting and so we let him do his assignments on the computer. so for him, if we hadn't done that, he probably would have just failed. So, in that way that was an incentive for him to do what he was capable of and I think he made the honor roll several times because of that. So I think it's good to have even if you've just got one computer (Teacher #3).

Summary

Teachers in this study perceived many impacts on their students' learning. They believed that the presence of computers in the classroom motivated their students to learn and made students enjoy coming to the classroom more. Another impact that teachers perceived in relation to their students' learning was the improvement of their students' academic achievement. Teachers believed that when computers were used, students could get information in three ways. They read it, hear it read to them, and see it which involved more than one sense. Another reason that teachers mentioned was that students got to see information at their own pace. Teachers felt that the pace that they established

for students might be too fast or to slow. In addition, teachers believed that when computers were used, students could remember better, faster, read more and turn in their projects more.

Accommodations for students' learning style was another impact that teachers perceived. The use of computers in the classroom helped teachers to meet their students' learning style, especially students who did not like to sit and listen to long lectures. With computers, teachers could give them a short lecture, quick instruction, and put them to work. For teachers who taught gifted students, computers enabled students to go as far as they could. Teachers did not have to prepare extracurricular activities for gifted students.

Compensations for different learning disabilities was another impact that teachers reported. Teachers believed that the use of computers in the classroom helped students with different disabilities in writing or spelling to share their thought with others, and helped teachers to reach those students that otherwise they could not.

Teachers' Level of Satisfaction

Although teachers in this study perceived many positive impacts of the use of computers on their teaching practice.

However, these teachers were still working on finding the best and more effective ways to use computers in the classroom to its fullest extent.

> I'm happiest now with all the technology that we have I was lucky two years ago to get a 21st Century Classroom. I'm trying to use them as much as I can, but I still look for new ways and more effective ways to use them because finding a way to use them in the classroom to its fullest extent is a very hard job.

Teacher #9 felt a lot of frustration at the beginning of the year when she was trying to find a way to fit computers in her classroom.

> I felt at the beginning of the year, I felt real frustrated 'cause I wanted to do it all right now and I had to finally decide that I just couldn't do it all at once. I felt that I had to be satisfied with the way I'm doing, you know, so I thought I will do this much this year and do a little bit more next year and each year I do a little bit more. I just couldn't do it all at once (Teacher #8).

Teacher #11 did not know how to integrate computers in her teaching practice at the time she got computers in her classroom, but she knew that there were different philosophies on integrating them. After using computers for 3 years she changed the philosophy that she used when she first started. At first, she tried to find out how to fit technology into what she was doing, which she thought was a backwards way. Now, she thought about what technology would let her reach out and do.

> I'm sure there are different philosophies. I started because I didn't know anything about technology. You know, except what I had done in the computer lab which was word processing. I started trying to figure out

> how to fit technology into what I was already doing. That probably is a backwards kind of way to do it, but it was all I knew. Now, I think about what technology will let me reach out and do via the Internet, and I look for things there to bring back into the classroom rather than figuring out how it can supplement my regular program. It becomes part of the search for teaching data (Teacher #11).

Teacher #12 felt that after 10 years of using computers, she only knew a little bit of the big picture, and still there was so much to learn.

> Just to have computers in the room is not enough. You have to know how to fit these computers into your schedule. I mean, I have been using computers for all these years, and I feel like I only know a little bit of the big picture. There is so much out there to learn and I'm sure if you say these computers have a 100% capacity, I probably only use about 15-20% of what computers can do (Teacher #12).

There were many things that teachers in this study were trying to figure out in order to implement computers to the fullest extent. The only way for teachers to figure out how to do that was by trying different ideas, repeating whatever worked well for them and eliminating the ones that crashed and failed. However, this process was not easy.

> It's not easy and I'm not at the level I want to be yet. As I said, I've had the computers in the room 3 years ago, but I'm still nowhere near the level I want to be in 2 or 3 years, and as I have ideas that I think will work, I try to integrate them and sometimes they crash and fail and I say whoops I don't want to do this again. But usually run fairly smoothly and it goes in a file and I say next year I'm going to try this one again and it's something you build on daily and weekly basis this core of ideas and methods to create projects and activities (Teacher #7).

Teacher #14 was trying to figure out how to integrate computers into her daily presentations

> Right now, I'm putting individual bits and pieces together. We use the computer, VCR and camera, but within 3 years, I want them to be able to do more technological presentations that we have developed instead of using only one aspect of it. We use multimedia programs and that is something that have to grow gradually as I added to my expertise. Then I can direct the kids because they do have to have directions in how to use it and so right now we're using a piece here and a piece there. The whole presentation probably isn't put together at the level I want to be (Teacher #4).

Teacher #10 was still working on the best way to let students access computers.

> I haven't perfected how I want to let the kids access the computers. With only six computers and you know that sounds bad, "only six computers." It's still difficult to find the time to get them on the computers. So, I'm still working on how I want to do that. I have not in my mind come up with what I think is a very effective way (Teacher #10).

Teacher #7 was still working on scheduling time for students to use computers and so far, she could not come up with a way that she could use all the time.

> We have a schedule; however, they see the schedule, if someone is absent everybody wants to take that person's spot. They'll go, "They're not here today. Can I have that spot?" This means more scheduling time for me, and it means that I have to work as much on scheduling the time as I do on what I'm going to do in that time. Scheduling is a big thing and nothing has worked so well that I want to say I'll stay with it this way (Teacher #7).

With all this trial and error time, teachers in this study felt that things were getting better, and they felt a sense

of accomplishment. However, what made the task difficult was the big number of students compared to the limited number of computers.

> So, I think that we're getting to a point where things are going to be better, but for me there's always the problem of listening. We've got 35 kids in the class. You know, it's just hard to do (Teacher #2).

Teacher #7 felt that she already made great strides and great leaps. She saved all her work for the past year, so she could use it next year.

> It's increased now. Once I get those things done, you know, I can save them and use them next year and hopefully someday, I will have a nice little file of all of these things that I can do. But I'm still developing and I would say it will take several years almost up until retirement time to develop that, but that is ok. I'm willing to put in the time and enjoy it. In the run of the years, if every student could have an opportunity to do that once or twice then you know, we have made great strides and great leaps (Teacher # 7).

Teacher #5 believed that, to integrate technology was something that could not be forced. It had to be developed naturally. Thus, she felt that she took the right route in trying to get to the level that she wanted to be at.

> See, you can't just integrate technology for the sake of integration. You've got to make sure it's valid and important thing. It is something that you can't force. It has to be something that develops kind of naturally. But I do think that's the route to go. And you know we're trying to get there (Teacher #5).

Summary

Although teachers in this study perceived many positive impacts on their teaching and their students' learning, teachers mentioned that they were not satisfied with the way they were using computers. These teachers tried many ways to fit computers into their classrooms, scheduling students, and grouping students. All these teachers mentioned that they were still working on finding the best way to use computers to the fullest extent, and they had already made a big improvement.

Teacher's Computer Choices

Teachers in this study mentioned many reasons that made them use computers for teaching. The most mentioned reason was the awareness of the need to prepare students for the information society. Teacher #2 felt that if education denies students technology, then this would give students an unrealistic view of the world, since technology was being used everywhere.

> I think that to deny them technology is to give a little bit of unrealistic view of the world because it seems that everywhere you go you see computers. Even the grocery stores use computers and I can't really think of very many places that don't use the computers

> any more. So, you know, I felt like I need to keep up with the times (Teacher #2).

Teachers #9 and 10 also felt that the use of technology in schools was important because society now relies on technology to do simple jobs that students would have in the future. If students use computers in schools then they would be less intimidated when they graduate, and have to rely on a computer.

> I really realized how much society runs on technology on just simple jobs kids are going to have in the future will require computer training. I'm glad to see in the high school that they have to have it as requirement to take keyboarding before students didn't have to take (Teacher #10).

> Students are going to be exposed to it when they get out of school no matter where they work. They're going to have to know something about computers to work and I think by using the computer it makes them a little more less intimidated when they get out and have to rely on a computer in their job. They've already been exposed to it and now that they know how it works they're used to the different software. That just makes it easier for them later on (Teacher #7).

Teacher #11 mentioned that the purpose of using computers in her classroom was to prepare students for the future. Now she had developed a different, and more important purpose which was to give students a satisfying education.

> To me, education should prepare students for the future as well as be satisfying. Right now, technology makes it very satisfying for them. Like for instance they were able to use a photo scanner and they were able to use a bulletin board back here and they chose pictures that had to do with the 1930's and scanned them and reproduced them and put them on the bulletin board and they felt a lot of satisfaction. I used to think that you need technology in the classroom to prepare students for the future but I don't think so much now.

> I think you need it more to have satisfying educational experiences now. Not that you can't without it, not at all, but I think you can do so much more if you have it (Teacher #11).

Another reason that teachers mentioned for computer use in the classroom was that it kept them fresh and new. Teacher #6 mentioned that although the use of computers was a big responsibility and she did not blame other teachers for not using them, but it kept her updated with what was going on in the outside world.

> Not many people want to take on that responsibility and I do not fault them for that. I do not blame them just give me their computers and I will take them and take care of it because I've got another 14 years if I live that long to teach and so therefore I better learn what's going on. I don't want to sit around and have the world pass me by and have everyone else know how to do all this stuff and have me going well I heard about it but I don't know how it works. You've got to stay fresh. You've got to stay new. Teaching is not a static profession. It has to stay in movement. It has to be changing. Our culture changes . We have to change too.

For teacher #14, teaching sometimes got to the point where teachers became a little burned out. The use of computers gave something new to keep their spirit alive.

> Well, it was, you know, teaching is probably sometimes get to the point in your life where you get a little burned out. You need something new. Something new and something where nobody has a professed expert at anything. It was everybody was equal ground. I saw it as an opportunity to step right in there and keep my spirit alive anyway and it has. It's done a good job. You know things like verbs and adjectives and thing like that get pretty dry and you get up into high school and they really get basically the same stuff every year and it just lightens everything up a little

> bit, makes school more enjoyable for teachers and students (Teacher #1).

Teacher #6 used computers because the students love them.

> With all the frustration that we teachers have in using computers in the classroom, I think it's worth it. I would not trade them in. I wouldn't give them back. I still with all the frustrations it beats what we've had and I feel like it is the thing to do and the way to go. The kids love them and I think they appreciate what we're trying to do (Teacher #6).

For teacher #13 the use of computers in his classroom helped him enjoy teaching more. He enjoyed seeing the smiles on the students faces as they enjoyed school. Therefore, he said that he wanted to keep computers working until they fall apart.

> If these computers are taken away, I would probably mis the change the shifting of the thought processes, the accomplishments of the kids. It would go back to just teaching the classroom. I see a lot of smiles on kids faces where they enjoy school. I would probably have to resort back to more of my imagination where in the old days we used chalkboards and colored chalk and things like that. I'd have to go back to that because this is my colored chalk, these are my felt boards back here and they never took the place of the teacher working and these will never take the place of my teaching. But they really help a lot, so I would, I'll keep these things going until they fall apart (Teacher #13).

Summary

Teachers in this study chose to use computers for several reasons. The most mentioned reason was the awareness of the need to prepare students for the technology

they would face outside of schools. The second mentioned reason was to stay on top professionally. Other reasons that teachers mentioned for the use of computers in the classroom were that it made teaching more exciting and it helped teachers to pass their excitement on to their students.

Chapter Summary

This chapter answered the research question which was how a selected group of teachers who were part of the 21st Century Classroom program in Knoxville, Tennessee used computers and how the continued use of computers affected teaching/learning process. It was presented in six sections. Section one dealt with participants' profile which was a description of teachers who participated in this study, including who they were and a brief history of their teaching and computing experience. Section two dealt with the way teachers used computers. Data analysis revealed many common patterns among teachers. Teachers in this study used computers to retrieve and access information, enhance and expand their curriculum, and to develop research projects. Teachers also used computers to develop classroom presentations by using few presentations and multimedia

programs. Drill and practice was another use for computers, especially for below average students, or for special education students. Teachers also used computers to keep their students' records, for example, grade books, letters to parents, or field trip forms. Section three dealt with the impact of computers on the teaching practice. Teachers in this study perceived a positive impact of computer use on their teaching. Most teachers in this study believed that the use of computers enhanced and diversified their teaching strategies by making it possible to use different ways and means to get the point across. Teachers also perceived that the use of computers helped them meet their best teaching style, and improved their relationship with their students. For teachers who taught for many years, computers gave them the change that they were looking for. Also, it helped them to be a facilitator for some of the time instead of being an information provider for all of the time.

Teachers in this study perceived some challenges. The use of computers required teachers to spend more time and effort in order to implement computers in their teaching practice. Due to the insufficient number of computers in the classroom, the use of computers allowed teachers to deal with many different groups in the classroom, which could made classroom management harder.

Section four dealt with the impact of the use of computers on students learning. Teachers in this study perceived many positive impacts as a result of the use of computers on their students' learning. Teachers believed that the use of computers motivated their students to learn, and made them enjoy coming to the classroom more. Also, it improved their academic achievement since they could get information in three ways, read it, hear it read to them, and see it which involved more senses. Also students could see information at their own pace rather than the pace that the teacher established for them. Moreover, teachers perceived that the use of computers helped teachers to accommodate students' learning style, and compensate for different learning disabilities, especially for students who had problems in handwriting. Therefore, teachers in this study believed that the use of computers helped them to reach students who otherwise could not.

Section five dealt with teachers' level of satisfaction. Although all these teachers perceived many positive impacts on their teaching, and on their students' learning, these teachers were not satisfied with the way they were using computers. They tried different ways to present their ideas, to group their students, and to manage their classroom. These teachers used computers as they knew

how to use computers at that time. However, they knew that there were other, better, and more effective ways to use computers which they were working hard to figure out.

Section six dealt with teachers' computer choices. Teachers in this study mentioned many reasons for using computers in their classroom. Among these reasons was the awareness of the need to prepare students for the technology they would face in the future, to stay on top professionally, and to make teaching and learning more interesting.

CHAPTER V

SUMMARY, CONCLUSIONS, DISCUSSION, IMPLICATIONS AND RECOMMENDATIONS

Summary

Stated in the literature and presented in chapters I and II, teachers were the major determinant of the extent and the nature of the impact which computers may have on the teaching/learning process. How comfortable and how clearly the teacher understood and accepted the nature of this innovation could generally determine its impacts on the teaching/learning process.

To recapitulate, the purpose of this study was to determine how a group of teachers who were part of the 21st Century Classroom Program in Knoxville, Tennessee used computers and how the continued use of computers impacted the teaching and learning process. As stated in Chapter I, the research problem was: that most of the literature related to the impact of the use of computers on the teaching and learning process was based on supposition. Many educators relied on their experience to predict and judge the future. In addition, the majority of research

determined the effectiveness of computers as an instructional device, and did not focus on at ways which teachers used computers. According to many researchers, teachers were the major determinants of the impact of computer use on the teaching and learning process. Given the nature of this problem, a phenomenological-based, open-ended interview technique, discussed in chapter III, was used to determine the impact of the use of computers in the classroom as seen from the teacher's eyes. Fourteen teachers were interviewed about their perceptions of computer use and its impact on their teaching and their students' learning. Interviews were tape-recorded, transcribed and analyzed. The results, presented in Chapter IV, were the themes associated with how teachers used computers and how teachers perceived the impact of computers on the teaching/learning process. A discussion of the findings, conclusions, implications, and recommendations follows.

Conclusions and Discussion

Research questions focused on ways in which teachers used computers in their teaching and how the continued use of computers affected the teaching and learning process.

Data analysis revealed some common patterns among teachers that were consistent with research on impact of computers on teaching and learning. However, there were some surprises. Findings from this study pointed to several conclusions. Some were closely related to the research question of the study while others emerged from the responses. These findings were:

Teachers in this study used computers for different teaching activities including enhancing and expanding curriculum, developing classroom presentations, drilling and practicing basic skills, developing research, keeping student records and developing problem solving abilities.

As teachers went through the curriculum at the beginning of the school year, they anticipated chapters or subject matter they would be teaching in the current year, discovered the area(s) in the curriculum that were not detailed enough or expanded very well, then found the related software that could supplement the missing information in the particular chapter or area. Teachers who had at least one computer connected to the Internet used software that was related to their topics and searched the Internet for more and current information.

Developing classroom presentations was another use for computers in the classroom that teachers mentioned. Teachers used a number of presentation and multimedia

programs to develop their classroom presentations. Among these programs were Powerpoint and Hyperstudio. However, none of the training workshops that these teachers attended dealt with teaching teachers how to use these programs. They taught themselves and each other how to develop these programs. Teachers also helped their students to develop their projects using the same means.

Teachers believed that using computers for practicing the basic skills was important, especially for below average students and students who were in special education classes. Some of these basic skills were required in order for students to score well on certain comprehensive achievement tests, for example, Tennessee Comprehensive Achievement Test (T-Cap). Most teachers in this study had software that covered the basic skills in the subject(s) they taught and other software to cover the basic skills on other subjects as well.

Access and retrieval of information to develop research was one of the computer uses in the classroom that teachers and students enjoyed. Teachers used electronic encyclopedias or different programs to access and retrieve information and when teachers had computers that were connected to the Internet, they searched the Net to retrieve and access more and current information. Another use that teachers in this study mentioned was keeping students'

records. For example, gradebooks, letters for parents, and field trip forms. Developing problem solving skills was one use that was only mentioned by teachers who taught gifted students.

Teachers in this study used computers to increase the effectiveness of their teaching strategies and efficiency of teaching tasks performed. They also used computers to model professionalism to their students. Teachers perceived computers as tools for extending both their own and their students' abilities. However, the majority of these teachers were still struggling with finding the best way to use computers. Nearly all of the teachers in this study mentioned that they were working on finding better and more effective ways to use computers, and they have already made big strides and great leaps.

Teachers believed that the use of computers had contributed towards gains in their teaching practice.

The literature and this study reveal that there was evidence that computers were impacting the classroom. This study showed that teachers perceived many positive impacts of the use of computers in their classroom.

Many teachers in this study believed that the use of computers in the classroom enhanced and diversified their instructional strategies by making it possible to use different means and ways to get the point across. This

variation of ways and means in teaching made teaching and learning more interesting. Teachers could change their presentations to more visually effective presentations. For example, teachers could incorporate maps, charts, and graphics into their presentations which made it easier for teachers to grasp students' attention.

For teachers who did not like to lecture all the time, the use of computers helped them to develop and implement more hands on activities. In addition, using computers in the classroom gave teachers, especially those who had taught for a long time, new horizons to look for in their teaching. It gave them the change that they needed after spending many years doing the same thing every day. It gave them a different atmosphere, different environment, and different ways to teach and learn. Many teachers in this study were considering changing careers before computers came along. The use of computers in the classroom kept them not only from changing careers but also it kept them from changing schools. Since computers were not assigned to them, but assigned to whomever was teaching in that classroom, if teachers changed schools they could not take computers with them.

Moreover, the use of computers gave teachers a chance to be facilitators of learning rather than just providers of information. However, students' level of expertise

sometimes determined the role of the teacher. When students had a good level of expertise in using computers, teachers had a better chance to be facilitators. Since teachers in this study did not have sufficient computers for all students, they moved from the role of facilitator when helping students who worked on computers to that of traditional teacher when helping the group of students who did useful and meaningful seatwork. This shifting of teachers' roles was ignored in the literature reviewed in this study. This finding is not consistent with findings of other studies on academic computing. According to the 1988 Office of Technology (OTA) report, teachers perceived that the role of the teacher in the classroom has been changed from a presenter of information to a facilitator of students' learning.

Relationships with students was another issue that teachers perceived as a gain in their teaching practice. They perceived that students talked to them more when they worked on the computer, because students felt more comfortable asking questions when they were not sitting next to somebody. In addition, teachers felt that the use of computers gave teachers and students something in common to share and talk about. This common interest between teachers and students created another form of interaction between

them. It gave students a chance to be teachers for some time and teach teachers how to use computers, and it gave teachers a chance to be learners for some time and ask students for help. Teachers perceived that students knew more about computers than they did. This has implications for possible changes in the traditional views where only teachers teach and only students learn. Also, teachers could use students or "computer experts" for help when they had a technical problem or when they needed help with setting up and wiring computers.

Teachers believed that the use of computers had contributed towards gains in their students' learning.

Most teachers in this study believed that the use of computers motivated students, and made them enjoy coming to the classroom more. According to these teachers, if students enjoyed coming to the classroom they were not likely to be a behavior problem, and they were not likely to lose interest as quickly. For special education students, using computers was a great motivator because these students had a chance to learn independently.

Improvement of students' academic achievement was another gain in students' learning that teachers perceived. Teachers believed that students picked up information quicker when they used computers, because they got

information in three ways - they read it, heard it read to them, and saw it, e.g. videos, graphics, charts, and maps. This meant that more than one sense was involved. Another perceived reason for improvement of students' academic achievement that teachers perceived was that students got to see and absorb information at their own pace rather than the pace that teachers established for them, which might be too fast or too slow. Furthermore, teachers believed that the use of computers would help students pick their own learning style, read better, remember more, and turn in their projects more. This finding was consistent with the study that was conducted by Tennessee Education Association 1991, Sivin-Kachala, Bialo, 1994 and Kulik and Kulik, 1987). ***Teachers believed that the use of computers in the classroom made the teaching practice technologically enhanced and at the same time more complicated and challenging. These challenges were: More time and effort, lack of hardware and software, lack of training, lack of experience, and lack of administration planning.***

Time and Effort

As these teachers envisioned how the use of computers could enhance their teaching practice, they took the responsibility and went the extra mile to implement computers into their classrooms. They devoted a lot of time

and effort in using computers as well as in learning how to use computers. Some of these teachers spent a lot of time and effort to bring computers into their classrooms. Teacher #1 collected grocery store receipts to raise money and buy computers. Teacher #2 spent time, effort and money when she used her first paycheck to buy her first computer. She said "it costs a lot of money to be a teacher these days. Teaching is a losing business here." Teacher #6 brought her computer from home, and set it up to share with her students. Other teachers mentioned that they spent their own money to buy software. They thought this was helpful for their students. When the 21st Century Classroom Program came out, these teachers were lucky enough to get a number of computers into their classrooms, but still some teachers had the responsibility to bring those computers from the central office to their classroom. Teacher #7 had to make arrangements with another teacher to help her bring computers to the classroom. She taught his afternoon class so he could bring her computers, since he had a truck that was big enough. In addition, it was teachers' responsibility to set computers up and wire them. Teachers sometimes got help from family members, colleagues, or students.

Bringing computers to the classroom, setting them up and finding the means and ways to use them was one thing that required time and effort. Integrating computers into the teaching practice was another thing that teachers spent much more time and effort on, but in return they got satisfaction with more polished products. The use of computers required these teachers to spend many more hours in schools to find related information by looking at laserdiscs and other software. It also required them to try to understand and figure out how the software works. According to these teachers, some software applications were easier to use than others. Reading the manual on how to use some software can be very helpful but time consuming. Teacher #1 mentioned that if he had 100 software programs, that meant another 300 hours of extra work. However, spending long hours before and after school gave teacher #1 reasons to buy a computer for home. Sometimes teachers did not get the software manual. This meant that learning how to use the software required more time and effort. Teachers #10 and #11 stated that their county did not even purchase the manuals for the software so administrators could save $5 per copy. The rationale behind that according to teacher #10 was "well, it's easy to use. You can figure it out on your own." Now, most of the applications have help screens which were, according to teacher #11, a "pain to use."

In addition to the preparation time, teachers spent time on what they called "trouble shooting" which means, they spent time trying to figure out why sometimes these machines did things that they did not understand and why sometimes machines stopped working without any observable reason, especially when teachers did not understand the messages that came out on the computer screen. For example teacher #14 did not understand why the printer was not printing and why it said there is no ink when she just put in a new ink cartridge. When something like that happened, teachers needed immediate help because basically the more teachers rely on these machines, the more they had to shut down everything until this was fixed. Sometimes they could send out a flare for help, but that may not be answered for a week.

As students used computers, a user error or a technical problem might occur. When that happened, it was the teacher's responsibility to find out what the problem was and try to fix it. This could be more difficult because students may not know what they did, and all that the teacher knew was that the machine was not working. The physical aspect of computers was also teachers' responsibility. This required a lot of time and effort. For example, when students came to the classroom with sticky

fingers, it was the teachers' responsibility to clean up the keyboards. When teachers got sick or needed time out, the protection of the physical aspects of computers was something they had to worry about. Therefore, there was a lot of preparation time that teachers did before taking any time out.

Lack of software and hardware

Another challenge that teachers mentioned in this study was the insufficient number of computers. The ratio of the number of computers available to the number of students in the classroom often decreased the amount of time students could use computers. This increased challenges for teachers in dealing with classroom management. Teachers had to deal with several groups of students, schedule time for each student to use computers, and plan computer activities that students could handle while teachers engaged and taught the rest of the class with useful and meaningful seatwork.

In most cases, teachers would have one copy of each program in order to protect the copyright. In this case students would be working on the average of six computers with six different programs which could force the teacher to be mindful of several things. For example, teachers had to make sure that printers were working, computers were being

used properly, and the Internet were being used appropriately. At the same time when students who worked on 6 or more different programs needed help, they expected immediate help from teachers in addition to the help that the other groups of students needed. When students circulated around as a result of not having enough computers, there was more movement and more noise which could make classroom management a complex task.

There were many ways for teachers to deal with classroom management challenges. Some teachers got help from other teachers, others did not use computers when they did not have extra help, or when they had a bad day. Others had a special place to send students who misbehaved as students used computers. According to teacher #1, classroom management was a real juggling act that made him feel like a clown in a circus. Many teachers could not figure out the way to use computers and keep students silent, but they still work on fining the best way to do that. However, these teachers did the best with what they knew how to do at that period of time. Teachers who taught gifted students and special education students did not mention any problem with classroom management when computers were used since teachers who taught these students had more computers and less students than the rest of the teachers.

Lack of Training

Teachers in this study began using and continue using computers because of their own initiatives. They were not trained to teach with computers. Teachers who were part of the 21st Century Classroom Program were required to have a week of training at the beginning of joining the program but those training sessions were never on how to teach with computers. According to these teachers, training sessions consisted of general instruction on how to use computers. However, these sessions offered nothing above or beyond basic skills use. Teacher #6 mentioned that even when there were workshops or training sessions for teachers to learn how to use computers, administrators did not choose the right time or place for teachers to be able to attend, and the topics were often not on teachers' interests. It was not always on what teachers needed to know. Also, when teachers used different computers, they dealt with problems that were not quite like what was on their machines. Teachers wanted to access it from their computers and look for glitches that always appear on their screen, which was not always what was covered in training.

Teachers in this study compensated for the lack of training by learning on their own or asking other colleagues for help. Other teachers learned how to use computers by

subscribing to listserve groups or taking classes and spent money from their own pocket to learn how to use computers. In addition, as teachers became accomplished in using computers, the training workshops had not changed with teachers' growing needs. Therefore teachers reported the need for more "hands-on" workshops that dealt with the challenges that teachers meet when implementing computers in the classrooms and how these challenges can be overcome.

Lack of Experience

All teachers in this study were fairly new to using computers in the classroom as a teaching tool for teachers and learning tool for students. Although some teachers had computers in their classrooms for a long time, these teachers never used computers as teaching tools for instruction. As McMeen (1986) and Plomp and Pelgrum (1992) mentioned, schools need time to build up enough expertise, knowledge and experience among teachers before any impact might be expected. It is important to note that teachers who had more experience in using computers mentioned that the use of computers did get better and easier with each year of experience.

Lack of administration planning

When teachers completed the one week of training, administrators gave them the authority to spend $20,000 on hardware and software which could be a hard decision for the inexperienced teachers. These teachers needed to purchase a lot of software and hardware in order to make $20,000 worth of purchases at the educational prices which are a lot less expensive than what they could get on the open market. As teacher #11 mentioned, "she made a lot of choices knowing nothing."

For the inexperienced teachers, it was easy to make a mistake. Therefore, they purchased some hardware and software that they never used. Teacher #10 mentioned that if he had a chance and the time to preview materials he could change what he bought and spend his money elsewhere. Many teachers mentioned that they bought some laserdiscs that were a complete waste of money. Other teachers found out that their eyes were getting tired when looking at the small screen of the laptop computer for a long time. Many teachers mentioned that if they were going to change the program, teachers should be able to have time to preview materials, and if they did not like them they should not purchase them and spend their money elsewhere.

Moreover, this study found that administrators never considered the size of the classroom before purchasing any equipment or considered teachers who taught in a small classroom as part of the 21st Century Classroom Program. For some teachers, size of the classroom was a major problem to fit the equipment they needed in addition to the students desks. Teacher #1 could not use computers for presentations because his classroom was not big enough to hold computers and a big screen TV. In this case he hoped that administrators would ask the software developers to use bigger printing that would allow him to use computers for presentations without a big screen TV, so a whole class would be able to see, especially the ones that sit far away from the monitor.

With rapid developments and changes in software and hardware one would wonder if administrators had a plan to update the software and hardware in schools, since one of the main reasons for using computers in the classroom is to prepare students for a technology-oriented society. It is a good time for administrators to plan on how can we update our equipment to match what students are going to use in the technological society outside the school.

General Conclusions

Teachers in this study were drawn to use computers by an intrinsic interest. They became interested, and used computers as a result of their own initiatives rather than as a response to an external mandate. As these teachers envisioned how the use of computers could enhance their teaching practice they made the effort, spent the extra time to bring, setup, wire, learn, and use computers in their classroom. This study showed that teachers did not have directions or framework to guide computer implementation in the classroom. For these teachers, implementing computers into their teaching practice was a "trial and error" process which made implementing computers in the classroom a time and effort consuming process. Teachers tried many ideas, repeated the ones that worked and skipped the ones that did not. They tried many ways of presenting their ideas, scheduling and allowing students access to computers, finding the best time for students to use computers, and finding the time for themselves to learn how to use computers. However, all teachers in this study perceived that they were improving. It seems that these teachers were going through a series of developmental stages that were ignored in the literature. Many teachers mentioned that

they had already made "big strides and great leaps." Although these teachers were trying their best with what they had and knew, most teachers mentioned that they were not satisfied with the way they used computers in their classrooms, and still working on finding the best way to use computers. These teachers used computers in the way they knew how to use computers at the time this study was conducted. However they also knew that there were better ways to use computers, but they did not know how and where to find those better ways. Therefore, many teachers thought that the way they were trying to figure out how to use computers was the way to go and the best route to take. They also stated that some day they will get "there" which indicated that these teachers had goals to reach. Sometimes one will wonder what did these teachers mean by "there" and how can we as educators and administrators help them to get to that point in a better, faster, and easier way?

With all the difficulties that these teachers had when using computers, these teachers recognized the potential of computers to enhance their teaching and their students' learning. As teacher # 5 said

> It was very frustrating. It took a lot of time. However, it's getting better, and I wouldn't trade them in. I would not give them back. I still think with all the frustration, hard work and extra time, it beats what we've had and I feel like it is the thing to do and the way to go. The kids love them and I think they appreciate what we're trying to do.

Therefore, the value of computers in the classroom has yet to be fully realized. Teachers, parents, educators, and administrators agreed that computers had the potential to improve our children's education. These teachers who were active in using computers had a unique opportunity to determine the way computers were integrated into educational experiences. They felt that challenges, difficulties and limitations should not be allowed to cloud the potential of using computers in the classroom. These teachers agreed that it was a goal that was worth pursuing.

In addition, the findings of this study confirmed that the use of computers were determined by the individual teachers to a large extent. Teachers determined how to learn and use computers in their classroom, what software and hardware to use, and what was the best way and time for their students to access computers.

Further, this study showed that these teachers devoted a lot of time and effort using computers as well as spending their own time in learning how to use computers with no expectations of reward or recognitions. Internal satisfaction of doing what they could to improve their students' learning and personal gratification of learning new skills to be on the top professionally were key motivators and enough reward for these teachers to do their best in finding the best way to teach and learn.

Implications

Implications related to this study seemed to be best stated in the words of teachers themselves. Therefore, quotes from the interviews were used in this section.

In order for these teachers to reach their goals they had specific needs that they would have liked to meet. Among these needs was having adequate computer resources.

> It would be wonderful if a school this size could maybe have a couple of computer labs that could be scheduled for the different classes. At the present time we do not have a computer lab for that, but how neat it would be to set all my students down at a computer or 2 students down at 1 computer and show them how to use Powerpoint for their presentations, to show them how to do databases. So, I can do instruction at one time and everyone would have a chance to do what I'm asking them to do. I think every teacher kind of thinks about wouldn't it be nice if instead of having to take turns going to the computers there was more computers in the room. I think that's just kind of common sense (Teacher #7).

Teachers needed some time off so they could go and ask specific questions on what they needed to know about the use of computers, or stay in their room, check some equipment, or figure out how to get on line. As mentioned in Chapter 4, time to plan for computer use was reported as a major barrier that could limit the use of computers.

> I mean, I wish I could for example every other week if I had a half a day where I could go and get some good instruction on exactly what I need that would be awesome, or if I could stay in my room to look up some of the equipment or go over there and figure out how to get online. I mean it's all sitting over there, but I

> haven't done it yet. You know, I need time and instruction. I need help with computers from teachers here that are a real good to help me (Teacher #9).

Teachers needed administrators to provide them with the opportunity to explore more creative teaching strategies by visiting other teachers and sharing their experiences and ideas with each other.

> I wish they would give us some time off - professional leave - to go visit some other teachers and see the kinds of things they're doing. That'd be nice because you know I do what I do but it'd be nice to know some other things. Am I doing the same kinds of things other teachers are doing? It would be nice to see (Teacher #5).

Teachers needed to see more programs which integrate the teachers' point of view. Also, as teachers acquired computers they needed to get direction on how to use them with the curriculum.

> I would like to see more programs developed with teachers' viewpoint involved. We need to see more textbooks coordinated with computer topics. You know, where the topic on the CD ROM will coexist and then you can start using the laserdisc which will probably boil down to the CD ROM where you use the barcode to see certain parts of films and things. Why don't we integrate this into the curriculum? I mean it's not going to replace curriculum, but I mean we need to write into the curriculum how to use computers as teachers get them (Teacher #2).

> I would love to see the day come when a group of teachers working together do a lot more integrated projects. I think that's where you're going to see real improvement come in the children and their ability and in their achievement - in working cooperatively within groups and then also with the teachers integrating the material so that a child in my social studies would then go into language arts and be reading

> a novel about the time period that I'm teaching in social studies (Teacher #4).

In addition, teachers needed help with connecting equipment, especially when nobody in the school could do it.

> I need someone to come into my classroom and I need to say, "I do not understand how to do this and I've read the book and it doesn't teach me how to do it." You know I have a music attachment that generates all kinds of music that we can use with our software and nobody knows how to connect it. You know, I've tried to connect it. I've had 3 other people try to connect it and they can't, so I need that connected. So a few things are a little frustrating (Teacher #3).

Teachers needed administrators to check on them and see what they used that worked best, what they used that did not work, why it did not work, and what can they do to make it work.

> I need to have the state people come back to me and ask, "Now what have you used that works? The state communication has completely been cut off in the last year. First they sent me little blurbs in the mail asking how it's going but that's died down. Even here in the county they don't bother me too much. It's like somebody lost their job (Teacher #1).

Recommendations for Further Research

This study touched upon some of the issues involved in teachers' use of computers and how the continued use of computers impacted the teaching and learning process. Many teachers asserted that research should be directed towards understanding the process of the use of computers in the

classroom in order to help teachers use computers to their fullest extent. This study was a step in that direction.

The findings of this study suggested the following recommendations for further research. This study is just a small picture of a puzzle which should be expanded vertically and horizontally. Such research may enhance the effectiveness of the use of computers in the classroom. Replication of this study should be conducted using a larger sample from a wider geographical area to determine the impact of computer use in the classroom. Given the nature of qualitative research, and pulling into consideration that there were many factors that effect the use of computers in the classroom, the results of this study cannot be generalized for all teachers who use computers in their classrooms.

This study showed that teachers go through a series of developmental stages in learning how to use computers in the classroom. Further research in the area of understanding those stages is needed in order to provide administrators, teachers, and staff developers information about the change process, which can be used as they create staff development programs. Also this research can help teachers to become aware of the changes in teaching practice and be prepared for both the changes that accompany classroom computer implementation and the learning stages that teachers go

through in gaining experience with computers. Therefore, these findings may not be accurate at different developmental stages.

This study revealed that teachers use computers to accommodate students' learning styles and teachers' teaching styles. With better understanding of how students and teachers with different learning and teaching styles can interact and learn using a computer, educators could use computers' flexibility to meet students' and teachers' needs.

This study showed that managing the classroom was more complicated when computers were used. A study is needed to investigate those challenges and determine ways to help teachers to meet those challenges. Some of these challenges were dealing with several groups of students, increased demand on teachers' time by students who need help at the computer as they learned how to use various software programs and different equipment, and dealing with noise level of the classroom as a result of using computers, printers, and student movement.

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APPENDICES

APPENDIX A

INTERVIEW QUESTIONS

Demographic data were gathered first: years of teaching, years of using computers when teaching, academic degree, content area, male/female, number of students, number of computers, connectivity to the Internet. Initial questions in the interview included:

1. Why did you choose to use technology in your classroom?
2. What is the affect of the use of computers on:
   A. Your Teaching Practice
      - role as a teacher
      - effort and time required
      - the way you teach
      - classroom management
      - relationships with students
      - student evaluation
      - record keeping
      - incentive methods
   B. Your Students
      - Academic achievement
      - motivation
      - problem solving ability and critical thinking
      - relationships with each other

3. If these computers had to be taken away from your classroom, what would you miss the most?

4. What would you like to see teachers and students be able to do with computers?

VITA

Basma Damiri-Khader was born in Zarka, Jordan, and attended Zarka High School, Zarka, Jordan. After receiving a B.A. degree in elementary education from the University of Jordan in 1979, she worked as a high school counselor in Zarka vocational school.

Her work in the graduate school at Northeastern Illinois University, Chicago, Illinois culminated in a Master's degree in special education/gifted, educational psychology. While working on her M.A. she developed and taught a social studies curriculum for 8th graders in a summer camp for gifted and talented in North Eastern Illinois University.

In 1998 she was awarded a Ph.D. in special education/gifted educational psychology with a primary concentration on media and instructional technologies. During her doctoral studies the researcher held many research and teaching assistantships, including positions as a developer of authentic assessment in teacher education, curriculum developer and teacher in the gifted and talented summer camp, assistant for preservice teachers to use technologies and different teaching materials in the curriculum lab. As a member of the Educational Innovation Office in the College of Education, the researcher worked as a developer of a "creativity" course in order to expose teachers to different creative and innovative ways of teaching.