12-2001

The Factors Associated with the Use of Computers in the K-4 Classrooms of the Maryville City School System.

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The Factors Associated with the Use of Computers in the K-4
Classrooms of the Maryville City School System

A dissertation
presented to
the faculty of the Department of Educational Leadership and Policy Analysis
East Tennessee State University

In partial fulfillment
of the requirements for the degree
Doctor in Education

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December 2001

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Keywords: Computers, Technology, Education,
Implementation, Barriers to Computer Implementation

ABSTRACT

The Factors Associated with the Use of Computers in the K-4
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The purpose of this study was to examine the use of computers for instruction in the K-4 elementary schools of the Maryville City School System. A survey was distributed to every regular education classroom teacher in each of the four elementary schools of the system. Respondents were asked to provide: (a) demographic data in regard to age, gender, years of teaching experience, grade level taught, level of education, home computer ownership, and technology committee membership; (b) an implementation score based on teacher response to grade-level student performance indicators provided by the International Society for Technology in Education (ISTE); and (c) responses to statements pertaining to possible barriers to computer implementation including vision, planning, training, time, and support.

The sample consisted of 83 regular education, K-4 teachers in the Maryville City School system. Data analyses were constructed to analyze three research questions. All testing was conducted at the .05 level of significance. t-tests were used to describe the relationships between the implementation scores provided by respondents and the demographic variables of gender, home computer ownership, technology committee membership, and grade level taught (K-2 or 3-4). A one-way Analysis of Variance was used to describe the relationship between the implementation scores provided by respondents and the demographic variable of level of education. Pearson product-moment correlation tests were used to describe the relationships between the implementation scores provided by respondents and the demographic variables of age and experience as well as respondent scoring as to the presence of the possible barriers of vision, planning, training, time, and support.

The results of the data analyses indicate a statistically significant difference in the perceived implementation scores of K-2 and 3-4 teachers. There were also statistically significant correlations between implementation scores and the possible barriers of vision, planning, training, time, and support. Information gained from this study will be helpful in the design of future technology programs, professional development activities, and ultimately the proper implementation of computers into the K-4 classrooms of the Maryville City School System and those similar to it.

DEDICATION

I would like to sincerely thank:

Dr. David Messer

For the idea

Mr. And Mrs. Lewis P. Robinette

For the opportunity

Mr. And Mrs. Neubert Harless

For their support

Mrs. Jenny Fowler

For the red ink

My Wife

Jennifer H. Robinette

For the motivation

My Children

Patton, Payton, Paxton, and Preston

For the time

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CHAPTER 1

INTRODUCTION

"But he who had received one [talent] went and dug in the ground, and hid his lord's money" (Bible, Holy. Matthew 25:18). The preceeding quote is a famous Biblical anecdote about a man who gives a few servants money to invest on his behalf. Some invested wisely, others, like the man above, did not. The story, though quoted from the Bible, has been told in countless ways and with numerous interpretations, however the basic message is always the same: If you do not use the gifts that have been given to you in a productive manner, if you cannot produce positive results, the gifts will be taken away and given to someone who can.

Schools and school systems throughout the United States have been charged with the care of enormous investments in the form of computers and computer related technology. With the extensive push for school reform, local, state, and federal governments have approved massive funding, which, along with donations from private institutions, provide schools with the latest in educational programs and innovations. Massive financial contributions made available by various sources have enabled educators to update academic facilities with modern technological tools designed to give teachers and students the scholastic edge. Yet, many of these investors feel, and a number of studies show, that the results they are seeing in the form of increased test scores are minimal at best. This lack of productivity has raised questions as to the wisdom of investments made in educational technology (Trotter, 1997a).

Statement of the Problem

The focus on technology in the field of education has shifted. The primary concern is no longer with simply providing technological hardware to schools. The emphasis on investment of available resources is now being used to provide professional development and to evaluate the effectiveness of the technology programs that currently exist (McNabb, Hawkes, & Rouk, 1999, p. 1).

If technology usage is to be effective, programs must be properly implemented in the classroom. The latest research shows an alarming number of teachers who, for various reasons, have access but are not utilizing the computers and equipment available to them (Fatemi, 1999). This study will determine the extent of, uses for, and barriers to the implementation of computer technology in the elementary classrooms of the Maryville City School System.

Purpose Of The Study

The purpose of this study is three-fold. This study, according to the perceptions, attitudes, and experiences of the teachers, will identify: (a) the extent to which the teachers in the system's K-4 schools are using computers in accordance with grade-level standards established by the International Society for Technology in Education (ISTE), (b) whether teacher age, gender, education level, experience, computer ownership, school of employment, or grade level taught affect the degree of computer implementation, and (c) to what extent the presence of program vision, program planning, teacher training, teacher time, and technical support affect the use of computers in the K-4 classrooms across the system.

Information obtained from this study will contribute to the growing body of research in the area of technology assessment. This study will also be a valuable resource for the system being studied. The results will provide feedback and input to help determine the direction of the technology program and future professional development activities for the faculty and staff of the elementary schools.

Significance of the Study

The use of technological innovations in classroom instruction has been an issue with American educators since the inception of public education. In the quest to be the best, to produce the finest students in the world, the stakeholders in America's educational system have long been enthusiastic about providing students and teachers with the latest technological advances promising the needed edge in learning (Cuban, 1986).

Oppenheimer (1997) used the cyclic history of technology in the schools to support his contention that the stakeholders in the American educational system are misguided and misinformed about the positive effects of computers on learning in the classroom. He questioned the massive amount of financial resources being spent on these technologies, at times at the expense of other educational programs. Furthermore, the cost of computers is difficult to justify when school budgets are already stretched in providing ongoing maintenance of facilities, classroom supplies, and constant repairs (Dede, 1997; Quick, 1997).

A few American schools experimented with computers in the 1960s, 1970s, and in the early 1980s. However, after the release of A Nation At Risk in 1983 and the discouraging picture it painted of the American public education system, computers fast became the proposed panacea for ailing American school systems (Bitter & Pierson, 1999). Stakeholders spent millions upon millions of dollars buying computers and related software for their schools' classrooms.

This buying trend has continued into the new millennium. Schools continue to buy and upgrade computers as improvements are made in technology. Demand for computers in the classroom has increased on an annual basis. In 2000, over 5.7 billion dollars were spent nationwide, supplying schools with computers and related hardware, software, and networks (Doherty & Orlofsky, 2001).

However, a growing number of reports insist that many technology programs in schools are ineffective. Although some reports on the effects of computer use in the classroom are promising, the gains in student achievement have been minimal. Questions have arisen concerning the wisdom of the massive investment American schools have made in technology programs. Much has been expected, but little in the way of measurable improvement has actually been realized (Viadero, 1997).

Technology proponents are calling for proof in the form of hard data that will substantiate the investment in computer technology for the schools. The evaluation of educational technology programs is now the primary focus for educational technology personnel. The emphasis is no longer on providing schools with computers. Stakeholders want proof of the computer's effectiveness on learning in the classroom (McNabb, Hawkes, et al., 1999).

Research shows that many factors contribute to the minimal effect of computers in the nation's classrooms. Most of these factors relate to classroom teachers. They have failed to implement the programs and integrate the computer into their instruction (Bulkeley, 1997). The technological tools have been given to schools, but many teachers are reported as seldom using them in instructional practices, and many of those who do, use them for games and other questionable practices (Viadero, 1997). The failure to implement computer resources in classroom instructional practices make it difficult to justify further allocation of resources in the area of technology (Bulkeley).

Research Questions

The research questions that will guide this study are:

1. To what extent are the educators in the K-4 classrooms of the Maryville City School System implementing computers into their instructional practices according to ISTE standards?
2. Do teacher age, gender, education, experience, computer ownership, or technology committee membership affect the degree of implementation?
3. Do teachers perceive program vision, program planning, teacher training, teacher time, or technical support as barriers preventing further implementation of computers in the K-4 classrooms throughout the system?

Limitations and Delimitations

This study will held to the following delimitation: only 83 teachers in the regular education, K-4 classrooms in the four elementary schools of the Maryville City School System located in East Tennessee participated in the study.

This study is subject to the following limitations: (a) the results, conclusions, implications, and recommendations of this study are generalizable to only those teachers, students, and schools involved in this study, and (b) data acquired in this study was limited by the accuracy and honesty of the respondents.

Overview of the Study

This study is organized into five chapters. The first contains an introduction, a statement of the problem to be studied, the purpose of the study, the significance of the study, the research study questions, the limitations and delimitations of the study, and an overview of the study. Chapter 2 is a review of the available literature that will provide background information on the history of computers in education, evidence for and against the use of computers in schools, the investment that has been made to provide schools with computers, and some common barriers to the implementation of computers into the instructional practices of educators. Chapter 3 will describe the methodology used in the study. This will include the type of research, data collection and procedures, and the statistical analyses. Chapter 4 will describe the results of the data analysis. This will include the reliability of the data, a description of the data, and the hypotheses testing. Chapter 5 will report the summary of findings, recommendations, and conclusions.

CHAPTER 2

REVIEW OF LITERATURE

The computer has become an integral part of the lives of people around the globe. More and more, computers are becoming an essential component for success in this technological culture. The use and mastery of these modern technological devices have proven the difference between success and failure in the business world. Many are predicting that these machines will provide similar success for the educational system (Gates, 1995; Thomas, 2000).

Over the past three decades a tremendous amount of effort and resources have been bestowed upon schools in the form of the most up-to-date technologies. However, the positive effect these tools have had on students and their achievement has been minimal at best. Computers and other technologies are being misused or, in some cases, never used at all. Merely having such powerful instruments available to students in classrooms is not enough. Educators must move toward a more thorough and responsible utilization of the technological tools they have been provided.

The purpose of this chapter is to provide a comprehensive review of available literature on the following main topics: (a) technology for education, (b) the computer in the classroom, (c) the opposition to computers in the classroom, (d) the support for computers in the classroom, (e) the implementation of computers in the classroom, and (f) the barriers to computer implementation.

Technology for Education

The Printing Press

Although the computer, as we know it today, has only been present in most schools for less than two decades, technology, in one form or fashion, has long played a role in the education of our students. In the mid 1400s, the invention of the printing press sparked an education revolution in Europe. Before the invention of the printing press, it is estimated there were approximately 30,000 books on the entire continent of Europe. By the year 1500, there were more than nine million. No longer was information a privilege reserved for the wealthy and the monks. Books and reading material became widely printed and distributed. For the first time in history, valuable information and knowledge in the form of the printed word were made available to the multitudes. This mass dispersion caused social structures and the balance of power to be drastically altered (Gates, 1995).

The Filmstrip, Radio, and Television

In the quest to gain or maintain an educational advantage, learning efficiency has, is, and will be a central issue. Those interested in education have persistently tried to find new techniques, methods, and tools to help aid the speed and quality of the education process. Most of the tools, like the printing press, have come in the form of the latest technological wonder of a particular time period (Cuban, 1986).

In 1913, Thomas Edison attempted to move beyond the printing press. He envisioned classrooms without textbooks. He felt very strongly about the educational benefits of the filmstrip and believed it would totally replace the need for textbooks in the classroom. A few years later, Benjamin Darrow, a radio promoter, made similar claims about the effects of a radio in the classroom. He called them textbooks "of the air" and they too would replace the textbook and "bring the world to the classroom" (Cuban, 1986, p. 19).

Millions of dollars were spent in supplying schools with movie projectors, educational filmstrips, educational radio broadcasts, and radios. By 1945 neither the filmstrip nor the radio had grown to replace the textbook or become as popular as the blackboard (Cuban, 1986).

In the early 1950s, attention turned toward the use of instructional television. Again, promises were made concerning the educational value of the television in the classroom. It was supposed to alleviate a growing concern in the area of teacher shortages across the nation as well as address growing concerns for better school quality as well. Students could be exposed to a world of knowledge via television sets. Teachers were to let the television perform the instruction and they, in turn, would act in a supervisory capacity (Cuban, 1986).

The Teaching Machines

The "teaching machines" of psychologist B.F. Skinner were introduced between 1950 and 1970. These machines, along with their programmed instruction, were supposed to revolutionize teaching. Skinner proclaimed that students would be able to learn more efficiently with the use of his machines (Oppenheimer, 1997). Other machines called computers were being built during the same time period. Research and academic institutions, mainly at the university level, showcased large, stand-alone computers and developed courses on programming (Viadero, 1997).

The Computer in the Classroom

The Demand for Computers in the Classroom

Educators began showing more interest in the computer in the late 1970s and early 1980s. Scattered reports suggested the positive effects computers could have on student learning. Although some schools and school systems began experimenting with the use of computers for instructional purposes, most public school facilities were not privileged to computer access. Until 1983, "computers used for instruction were a rarity in American schools" (Mergendoller, 2000, p. 1).

In 1983 a report from The National Commission on Excellence in Education entitled A Nation at Risk, brought national attention to the state of the American educational system. The report stated:

> We report to the American people that while we can take justifiable pride in what our schools and colleges have historically accomplished and contributed to the United States and the well-being of its people, the educational foundations of our society are presently being eroded by a rising tide of mediocrity that threatens our very future as a Nation and a people ... Knowledge, learning, information, and skilled intelligence are the new raw materials of international commerce ... Learning is the indispensable investment required for success in the 'information

age' we are entering (The National Commission on Excellence in Education, 1983).

The report went on to say that due to the state of the educational system, America's position in the world was no longer secure. It also prescribed several proposed solutions, including the study of technology being fundamental to every curriculum. Technology skills would be a must if Americans wanted to compete in the global economy of the future (The National Commission on Excellence in Education, 1983).

Stakeholders in the American educational system panicked. Fixing the wavering educational system became a national priority. American schools and students would need every advantage possible to help turn the tide of the educational system (Bitter & Pierson, 1999).

A Computer in Every Classroom

With the popularity of A Nation at Risk (three million copies sold) and several well-publicized research reports on the positive results and effects of the computer in the classroom, the computer was promoted as a panacea for the problems facing the school systems. Many felt the computer in the classroom would produce higher test scores and put America's students back where they needed to be, at the top (Bitter & Pierson, 1999).

According to annual nationwide surveys completed by Quality Education Data, in the 1983-1984 school year the ratio of students to computers in K-12 schools was 125:1(Quality Education Data, 1984). In the 1990 -1991 school year Quality Education Data reported 98% of all schools having microcomputer access on premises. The number of students per computer had been reduced drastically from 125:1 to 20:1 in less than 10 years (Quality Education Data, 1991). By 1999 schools had been able to reduce the student to computer ratio to an average of one computer for every 5.7 students (Fatemi, 1999).

The Educational Testing Service Policy Information Center (ETS), in a report titled Computers and Classrooms: The Status of Technology in Schools (1999), stated that the six to one ratio is a best-case scenario and is only present in a few states. Their surveys indicated an average national student to computer ratio at a much more conservative 10 to one. This includes all computers, even the out-of-date machines such as the Apple computers introduced in the early 1980s (Coley et al., 1999).

The Cost of Computers in the Classroom

This acquisition of computer hardware and software occurred at considerable cost. By 1997, over 70 dollars per student, across America, were spent on computers and related hardware, software, and networks (Bulkeley, 1997, p. R4). Private institutions have provided funding and donated equipment, and local, state, and federal governments have, to a degree, increased funding or at least provided funding opportunities in the form of grants to aid in the purchase of computers. However, in no way have these gifts and additional funds been able to offset the capital expenditures schools have used toward their technological purchases. The total bill for schools and school systems nationwide has reached an annual total of well over five billion dollars for the purchase of new technology and the upkeep and upgrading of old (Archer, 1998). This massive bill has taken a toll from other areas of education.

In Opposition to Computers in the Classroom

Cutting Programs to Fund Computers in the Classroom

There is no substitute for experience in the learning process. Experience enables a student to process and record information in ways that cannot be duplicated technologically. These experiences are integral to the development of the brain and come in a variety of educational and real world settings. In schools, they can take place in classes like art, physical education, and music - classes that, in some systems, have taken a back seat to or have been replaced by the pursuit and acquisition of computers and other technologies (Healy, 1998).

More and more, school officials are cutting funding to other programs in order to meet technology demands. Most often art, music, physical education, and vocational programs are those that are adversely effected--the programs that psychologists like Healy (1998) say students, especially young students, need more of .

Oppenheimer (1997) relates several such instances. In 1996, New Jersey cut funding to several school districts and then, in-turn, spent 10 million dollars on computers for classrooms.

An elementary school in Los Angeles discontinued its music program so that it would have the funds to hire a technology coordinator. And, all over the country, shop and vocational programs, which used to teach kids building skills, are being replaced with technology labs and programs. True, if schools and educational programs were funded properly, officials would not be forced to make such decisions. But, far too often when superintendents and administrators are forced to choose, they side with technology (Oppenheimer, 1997).

The Cyclic History of Technology in Education

There are others who question or caution against a reliance on the computer in education. The history of the use of technology in the American classroom has been less than stellar and a perpetuating cycle. Cuban, a former school superintendent and education professor at Stanford University, noticed that technological implementation over the past century has formed a very distinctive pattern. The implementation begins with educational promise backed by research done by the developing parties. This is followed by a lack of implementation on the part of the teachers and little to no improvement in academic achievement. The finger is usually pointed at the lack of funding and not long afterward, schools are being sold on a new wave of technology (Cuban, 1986).

Questionable Research on the Positive Effects of Computers in the Classroom

Concerned groups and individuals are stepping forward, questioning the findings of research that supports the positive effects on student achievement obtained by using computers in the classroom. Proponents of computers in the classroom have long claimed that computers can improve education (Conyers et al., 1999). But, most of the research to date has been conducted by these proponents or by researchers who use only one or two classrooms for samples. The findings for most studies have been widely discredited for one reason or another (Archer, 1998).

At the forefront of this opposition is an educational psychologist and author, Jane M. Healy. In her latest book, Failure to Connect (1998), she questioned the claim that computers produce positive results. She also questioned the small number of studies that have produced positive results. She states that many of these have been conducted by individuals who are more concerned with employment in the computer industry than in conducting proper research. She claimed that research with valid evidence of benefits for education has not been completed to date (Healy, 1998).

Oppenheimer (1997) expressed many of the same concerns calling the research exalting computer usage in schools, "prodigious" and producing anecdotal evidence. He, like Healy, claimed the research was primarily industry funded and designed to find benefits that are not really there. In fact both opponents and proponents on the issue of computers in the classroom agree that the research on the effects of computers on student achievement is at best inconclusive (Healy, 1998; Oppenheimer, 1997; Trotter, 1998b; Viadero, 1997).

The Side-Effects of Computers in the Classroom

The real concern with computers is how they are used in the classroom. Even the flag bearers of computer usage in the schools state that if not used wisely, more harm than good can be expected (Archer, 1998), especially if this takes place in the early stages of a child's development. The most important things young children need are social, emotional, and physical acclimation to their world, the real world. Children need to experience certain activities and stimulation when they are young in order to promote proper brain development. Computers tend to de-synthesize information, and the presentation of data that can prevent children from receiving the stimuli needed for proper brain development. "The losses may be irrevocable" (Healy, 1998).

The overuse of computers by students can cause them to distance themselves from their classmates. Naisbitt, Naisbitt, and Phillips (1999) say that school officials need to design programs to prevent this type of abuse. Some people have made technology their lone relationship and mode of communication. These people rarely leave their homes and are totally disconnected from the real world. Students trying to connect via e-mail can actually cut themselves off socially from their peers. The authors compared this to a parent who actually misses out on experiencing a child's little league ball game while trying to record it on film (Naisbitt et al., 1999). There is a real danger in disconnecting socially, one that educators must guard against. "Anyone who's directed away from social interactions has a head start on turning out weird...No computer can teach what a walk through a pine forest feels like. Sensation has no substitute" (Stoll, 1996, p. 96).

The goal of the opponents of computers in the classroom is not to rid the schools of computers and computerized instruction. Although they do state there is very little room for them in early childhood education, these critics acknowledge there can be positive results if and when computers are used wisely (Healy, 1998; Oppenheimer, 1997; Stoll, 1996).

In Support of Computers in the Classroom

Following the Corporate Lead

"With over nine million computers in America's schools, we are just beginning to understand how to use them as effective learning tools" (Mergendoller, 2000, p. 1). The computer has completely changed the face of the business world, globally. The manner in which business is conducted has transformed since the introduction of the microcomputer. The access, acquisition, and communication of information are the new keys to success in commerce (Gates, 1995).

Although schools are well behind business in the use of computer technology, very few doubt that the computer will play an ever increasing and important role in the schools of the 21st century. Bill Gates foresaw the computer as a tool that will revolutionize the education world, much as it has revolutionized the business world. It is all about information. Computers have the capability to provide students with instant "access to seemingly unlimited information, anytime and any place" (Gates, 1995, p. 184). This, according to Gates, "will lead to downstream benefits in every area of society" (1995, p. 184).

Individualized Instruction and Access to a World of Information

Schools have long been faced with the problem of catering to the individual learning needs of students. The computer will allow teachers the ability to customize learning to meet the needs and learning style of every individual student in their class. Software will allow the accommodation of varied rates of comprehension and learning. The information highway will provide teachers and students access to entire libraries of digitized information as well as presentations from other students, teachers, professors, authors, and field experts all over the world. "Teachers will be able to draw on this material, and students will have the opportunity to explore it interactively" (Gates, 1995, p. 185).

Job Skills for Tomorrow

There are many people who look at education solely as the training ground for the future employees of industry and business. This is an extremely popular view and its advocates have made their opinion clear on the subject of computers in schools. To them, computers and the skills needed to use them will be a necessity for members of the workforce and students need as much exposure to them as they can get as soon as they can get it. Supporters for using education in this manner feel technology is needed to acclimate students to the tools of the workplace so that they will have the skills and preparation to enter and survive in the workforce of tomorrow. "Technology is everywhere, the thinking goes, and if today's children don't know how to use it, they'll lack the skills they need for the jobs of the future" (Zehr, 1998, p. 1).

Industry and business have gone to great lengths to see that students are acquiring the skills they feel are vital to the success in the corporate world. Schools have reaped the benefits of these efforts in the form of funding and hardware. These efforts have motivated states and education associations to adopt grade-by-grade technology curriculum guidelines. In 1998, 41 states had developed statewide technology standards and required technology skills for graduation. However, the life span of these may be short-lived. Some believe that neither computers nor computer skills need to be center stage. If technology is used in the correct way, as a supplement instead of the primary focus, the skills can be learned through the context of the preexisting core curriculum (Zehr, 1998).

The Need for Technology Oriented Teachers

Although some fear the computer will replace the need for the teacher in the classroom, Gates states that those fears have no basis. The teacher will be needed more than ever. The role of the teacher will shift from a provider of information to a facilitator of resources. The classroom will change as well. The nature of homework and the design and presentation of projects will be enhanced by the capabilities of the computer and available software (Gates, 1995).

Future Uses of the Computer in the Classroom

Kurzweil (as cited in Thomas, 2000) states that educators are deficient when it comes to the utilization of technology in the classroom. Even though educators will trust in the importance of computers in the classroom by the year 2010, schools will not have even scratched the surface of the tools available to them.

By the year 2009, Kurzweil (as cited in Thomas, 2000) predicted the replacement of keyboards by voice-to-text and text-to-voice technologies. By the year 2019, Kurzweil has predicted paper books and documents will be a rarity. He also said that most teaching will be done by intelligent software, students will be guided by a handful of adults serving in a counselor-like capacity, and will share ideas and socialize in virtual meeting centers (Thomas, 2000).

Although these predictions seem far-fetched, one cannot discount the fact that educators are behind in the utilization of technology. The impact of technology is inevitable. Like the printing press, the computer has started an information revolution. Information is available in quantities and presented in forms never before seen. This revolution, like the one caused by the printing press in the mid 1400s, is changing cultures worldwide. The sooner schools are able to tap into the technological resources available to them, the better off the culture of American education will be.

The Implementation of Computers in the Classroom

The Latest Research on Computers in the Classroom

In the 1990s, more credible research began to surface. In 1999 the Milken Exchange on Educational Technology published a report by John Schacter which summarized the findings, both positive and negative, of five of the largest, most valid studies to date as well as two smaller studies Schacter found relevant. The five studies included: 1) a meta-analysis study conducted by James Kulik in 1994, 2) a research review by Jay Sivin-Kachala in 1997, 3) an evaluation of the Apples Classrooms of Tomorrow (ACOT) by Baker, Gearhart, and Herman in 1994, 4) an evaluation of West Virginia's Basic Skills/Computer Education (BS/CE) Statewide Initiative by Dale Mann in 1999, and 5) Harlold Wenglinsky's National Study of Technology's Impact on Mathematics Achievement in 1998 (as cited in Schacter, 1999).

In his meta-analysis study, Kulik drew from the results of more than 500 individual research studies dealing with a particular type of instruction that uses the computer to customize instruction and practice to fit the needs of each individual. Kulik's study found that when students used this type of instruction they scored higher on achievement tests, learned more in a shorter amount of time and developed more positive attitudes work and study. Kulik did note that this type of instruction did not produce positive results in every area studied (as cited in Schacter, 1999).

In the research review by Sivin-Kachala, the results from 219 research studies from 1990 to 1997 were evaluated. He found that students working in classrooms that were rich in technological resources increased achievement in all major subject areas and improved their self-concept and attitude toward learning. In his inconclusive findings, he stated that effectiveness is determined by: the student population, the software, the teacher, and the amount of access to the technology (as cited in Schacter, 1999).

In the ACOT evaluation, similar findings were reported in student attitudes. The evaluators noted a change in the teaching methods of the instructors and noticed new classroom activities that promoted the development of higher level thinking skills; however, this observation was deemed inconclusive. They did not find any evidence to support gains on achievement tests. The students in the ACOT program scored no better when compared to other national groups (as cited in Schacter, 1999).

The evaluation of West Virginia's BS/CE program showed gains in student scores on the Stanford 9 test. Evaluators noted a correlation between student access, positive attitudes from teachers and students, teacher training, and the results students received on their tests. The evaluators took their analysis a step further by making financial comparisons to other proposed reform measures. They concluded that the BS/CE was most cost effective when it came to student achievement, more so than reducing student to teacher ratios, adding instructional time or improving tutoring programs (as cited in Schacter, 1999).

Wenglinsky studied the effects of simulation and higher order thinking technologies on the math achievement scores of 6,227 fourth graders and 7,146 eighth graders using the National Assessment of Educational Progress (NAEP) test. Wenglinsky's study found that teacher training in technology and the use of technology to promote higher order thinking skills had a positive impact on student achievement. Increasing the amount of time a student spends on the computer had no effect on social skill, but too much time spent on the computer did have a negative effect on achievement. The study also highlighted the finding that the use of computers to teach lower order thinking skills (i.e. skill and drill practices) had a negative impact on achievement and social environment. Wenglinsky found that, "when they are properly used, computers may serve as important tools for improving student proficiency in mathematics, as well as the overall learning environment in the school" (Wenglinsky, 1998).

Four of the five studies found convincing evidence of the positive effects (i.e. increased achievement, positive attitude, more efficient learning, improved self-concept, higher order thinking skills, etc.) computers can have on students utilizing them in the classroom. A key in each of the studies was proper implementation, teachers promoting the use of computers and related technologies in ways that improve student learning.

Current Classroom Use of Technology

School systems and supporters like to compare and promote their educational technology efforts by touting student to computer ratios – a figure that has been drastically reduced over the last two decades, nationwide (Doherty & Orlofsky, 2001). Another figure that has been publicized deals with the amount of time students use computers while in the classroom. This statistic too has improved over the past two decades. The United States Department of Education has reported that student use of computers, although nowhere near what it should be, is increasing. Between the years of 1984 and 1996, student computer use nationwide improved almost four-fold (U.S. Department of Education, 1998).

Knowing the extensive investment that has been made in supplying computers, most schools have seen to it that students have been given access and time with these machines. But, something must be lacking as most schools have yet to produce the hard data that will validate such an enormous investment in financial resources and educational time. The few well organized, funded, and monitored programs (i.e. the ACOT program and the West Virginia BS/CE program) have established that achievement gains can be made using computers in the classroom. But, these gains have not taken place nationwide. With tools of such promise, the access that schools have been given in the way of hardware, software, and internet service, and the amount of usage being reported, a growing number of stakeholders are beginning to demand results and the numbers just are not there (McNabb, Hawkes, et al., 1999).

The number of computers in a classroom and the amount of time students use them are important, but the most important factor in providing an effective implementation program that will produce positive results is the way in which the computers are used. Successful programs not only make sure students have ample access to up-to-date technology, they also make sure that time is well spent, and productive. As Glennan and Melmed (1996) noted, it is not the quantity of time, it is the quality of time.

<u>Defining Proper Implementation</u>

Most schools are not anywhere close to where they need to be in the amount of quality computer time provided in the classroom. Although the reported use of technology by students in schools is on the rise, the use for learning and instructional purposes has remained dismally low. The Educational Testing Service (1999) reported that a majority of students never used a computer for schoolwork. Fourth graders and eighth graders said most of their time spent on computers was used for playing games (Coley et al., 1999).

The International Society for Technology in Education (ISTE) has compiled a list of student performance standards that indicate proper implementation in the classroom. These standards are outlined and discussed in the ISTE's National Educational Technology Standards (NETS). According to the NETS, prior to completing grade 2, students should be able to:

1. Use input devices (e.g., mouse, keyboard, remote control) and output devices (e.g., monitor, printer) to successfully operate computers, VCRs, audiotapes, and other technologies.

2. Use a variety of media and technology resources for directed and independent learning activities.

3. Communicate about technology using developmentally appropriate and accurate terminology.

4. Use developmentally appropriate multimedia resources (e.g., interactive books, educational software, elementary multimedia encyclopedias) to support learning.

5. Work cooperatively and collaboratively with peers, family members, and others when using technology in the classroom.

6. Demonstrate positive social and ethical behaviors when using technology

7. Practice responsible use of technology systems and software.

8. Create developmentally appropriate multimedia products with support from teachers, family members, or student partners.

9. Use technology resources (e.g., puzzles, logical thinking programs, writing tools, digital cameras, drawing tools) for problem solving, communication, and illustration of thoughts, ideas, and stories.

10. Gather information and communicate with others using telecommunications, with support from teachers, family members, or student partners" (International Society for Technology in Education, [ISTE], 1998).

And "prior to completion of Grade 5, students will:

1. Use keyboards and other common input and output devices (including adaptive devices when necessary) efficiently and effectively.

2. Discuss common uses of technology in daily life and the advantages and disadvantages those uses provide.

3. Discuss basic issues related to responsible use of technology and information and describe personal consequences of inappropriate use.

4. Use general-purpose productivity tools and peripherals to support personal productivity, remediate skill deficits, and facilitate learning throughout the curriculum.

5. Use technology tools (e.g., multimedia authoring, presentation, Web tools, digital cameras, scanners) for individual and collaborative writing, communication, and publishing activities to create knowledge products for audiences inside and outside the classroom.

6. Use telecommunications efficiently to access remote information, communicate with others in support of direct and independent learning, and pursue personal interests.

7. Use telecommunications and online resources (e.g., e-mail, online discussions, Web environments) to participate in collaborative problem-solving activities for the purpose of developing solutions or products for audiences inside and outside the classroom.

8. Use technology resources (e.g., calculators, data collection probes, videos, educational software) for problem solving, self-directed learning, and extended learning activities.

9. Determine which technology is useful and select the appropriate tool(s) and technology resources to address a variety of tasks and problems.

10. Evaluate the accuracy, relevance, appropriateness, comprehensiveness, and bias of electronic information sources" (International Society for Technology in Education, [ISTE], 1998).

Proper implementation involves the integration of the computer and related technologies into the daily activities of the classroom. Teachers and students should not see the computer as a subject to teach or learn. The computer should be a tool that is used to enhance the educational processes already present in the classroom. Computer skills will be learned as students use technology to access, organize, use, and present information; communicate with other students; or complete projects (McNabb, Valdez, Nowakowski, & Hawkes, 1999).

Does proper implementation require change? Yes, and most of the change will involve classroom teachers. Teachers will need to do several things in their quest for ISTE standard implementation practices. These include: (a) Becoming technology literate. Teachers will need to know how to use the available hardware and software so that they can show their students. (b) Changing the learning environment from teacher-directed to learner-centered. Educators will move further toward a role as facilitator rather than that of the bearer of knowledge. (c) Redesigning lesson plans and desired outcomes. Students will be asked to participate in technology driven activities, and they will produce projects that are the result of technology access. Teachers will need to rethink what the desired outcomes need to be (McNabb, Valdez, et al, 1999).

When technology programs are effectively implemented, they can be powerful tools for developing individualized learning. When used appropriately, teaching strategies incorporating computers can bridge the gap between an educational experience and conceptual understanding. Computers can provide students experiences and gains in achievement that were never before thought possible. With technology, the opportunities for students to gain experiential knowledge and learning are boundless (Viadero, 1997).

The Barriers to Computer Implementation

Teacher Demographics

If computers are so promising, why are they not being used in the instructional process? Is the computer just another failed technological innovation in a never-ending cycle? Research reports vary in their findings and observations as to the most significant reasons for the lack of use of computers in the classroom. Several such reasons are recurring throughout available literature.

When questions concerning the lack of use first began to arise, researchers looked to the surface of the problem. If given identical equipment and software, certain teachers would successfully use the technology while others would not. The effective implementation of computers in the classroom became associated with certain demographic characteristics of the teacher. Younger teachers were more inclined to use technology in the classroom, as well as those who owned their own computer or had experience in using the equipment (U.S. Department of Education, 1998).

Other research reports findings that minimize the influence of demographics. In a survey conducted by Education Week, teacher age was not a factor in reported student computer use in the classroom. Neither were other demographic variables such as home computer ownership. The study found that the root of the problem lied in a teacher's foundation. Those teachers who effectively use computers in the classroom have similar backgrounds consisting of components like proper training, access, time, and support (Fatemi, 1999).

When elements of a solid technological foundation are lacking, they become barriers to computer implementation in the classroom. A growing number of reports have highlighted unique lists of barriers that prevent teachers from fully using computers as learning tools (Boyd, 1999; Fatemi, 1999; Webb, 1999). Although these studies have reported the presence of multiple barriers, those common to most are: (a) the training teachers are given for using computers, (b) the vision provided for teachers on how computers are to be used in the classroom, (c) the planning for technology programs (d) the time provided for teachers to explore new tools, techniques, and various sources and examples of effective use, and (e) the technical support teachers receive in the form of updating and repairing equipment.

A Technology Program Vision

The foundation of effective implementation lies in the leadership of schools. The beginnings of a solid computer program lie in the development of a vision.

> The first step in any organizational effort is developing the vision for the organization. This means that everyone associated with the school needs to gain an understanding of what constitutes this vision, best achieved through a vivid and comprehensive description of a desired future (Cunningham & Gresso, 1993, p. 78).

The development of a common shared vision is critical in the implementation process. Educators have had computers thrust upon them and most have no idea of how to use them for instructional purposes in the classroom. Not only do most teachers not know, many principals, supervisors, and superintendents do not have the knowledge either. The hardware and software have been supplied, but someone forgot to pass along the snapshot of what it is all supposed to look like.

> A major barrier in the path of bringing computer usage into schools is the lack of vision and visionary leadership on the part of school leaders and teachers. If computers are to be integrated successfully into the school, strong leadership must be evident at both the district and school levels. Unless educators have a clear vision of how computers can be used to enhance learning, they will not be used in ways that will make meaningful differences in classrooms. (Boyd, 1999, p. 51)

A vision should not be limited to the provision of a picture. A vision can also be an effective instrument of motivation especially in the event it is shared, or developed by all persons involved. With everyone working toward a common vision, the entire organization works more effectively toward the completion of desired tasks and goals. (Cunningham & Gresso, 1993).

For a technology program vision to be effective, it must be created by the school or district organization, and embodied by every member of the organization. The superintendent or principal should be instrumental in initiating the process and providing the resources, knowledge, and possible key components, but all those involved should take part in the process of manufacturing the desired picture. If implemented correctly, a school's or district's vision will have a profound impact on everyone involved. "A clearly articulated vision provides everyone with a picture of the future that will motivate them to move in the right direction and coordinate their efforts" (Webb, 1999, p. 14). A good vision "provides the bridge between useful knowledge and purposeful, coordinated action...More precisely, it is the link between dreams and action" (Cunningham & Gresso, pp. 80,96).

Technology Program Planning

Once the dream or vision has been established, an effective technology plan must be developed. Most technology plans are inadequate because they concentrate on the acquisition of hardware and software. A technology plan is not simply deciding on how many computers to buy. Planning is the never-ending process of defining and redefining the goals and objectives of a program as well as determining the steps that will be taken in reaching those goals and objectives and the measures used in the evaluation of the program. A vision defines the final destination. A plan defines the steps it takes to get there. A good technology plan concentrates on the vision. It states what all those involved should be able to do with technology and this in-turn dictates the resources that are needed (Anderson, 1999).

As with vision, the involvement of administrators, staff, faculty, students, and community in the planning process is integral to its effectiveness. Most suggest the development of a school-wide technology planning team or committee. The team should represent every facet of the school community, all those who have an invested interest in the school (Anderson & Perry, 1994). Team members must be able to envision the effective integration of technology into the classroom and they need to be able to engage their cohorts in the vision of integration (Webb, 1999). Each member should have specific responsibilities and ample resources to perform those responsibilities. There should be open communication. Every member should feel free to offer input on any issue brought before the team (Anderson & Perry).

According to Larry S. Anderson, the Founder and Director of the National Center for Technology Planning, "technology planning is both a noun and a verb" (1999, p. 2). All too often planners seem to think that once a plan in the form of a document is created, the process is over. Anderson states further that "A wise planners will examine both the noun and the verb aspects." In other words, there is more than just a document. Planning involves a great deal of action after the document has been created. For a plan to be effective, the planning team must experience the entire process. They must be there from the inception to the evaluation and back again (Anderson).

As far as the technology plan is concerned, schools must be allowed to develop their own. Each situation is unique and each plan needs to be individualized to fit the needs, concerns, and vision of the school it represents. However, all plans require the determination of several key elements. In an effective plan, each school must determine the goals and objectives of the program and how the effectiveness of the program will be determined. A good plan will also determine those responsible for action, a time frame for completion of those actions, as well as the resources available, the resources needed, and the means for acquiring those needed resources (Webb, 1999).

Computer Training

Once the plan has been established, the teachers need to be trained in how to carry out the plan in their classrooms. They must be taught how to achieve the goals and objectives set forth by the technology plan. In far too many situations around the country, technology is bought, placed in the classroom, and the teachers are told to use it without any kind of professional development on how to integrate computers into their daily instructional practices (Zehr, 1997).

Teacher professional development opportunities are essential if school systems want to ensure that the substantial investment made in computers does not go to waste (Archer, 1998; Boyd, 1999; Brand, 1998; Wenglinsky, 1998; White, 1997). Wenglinsky (1998) stated teachers who had taken part in any amount of technology professional development were much more likely to use computers effectively in the classroom. He also stated that students who had technology trained teachers performed better than other students. Any amount of technology training produced gains in the form of student achievement, "which leads one to think that more elaborate training might post even greater gains" (Wenglinsky, p. 7). The teaching profession lacks in the area of professional development:

> Teachers receive less technical support than does any other group of professionals...The average worker in America can take advantage of $50,000 worth of capital invested in that job; the comparable figure for teachers is $1,000 (Ellmore, Olson, & Smith, 1995, p. 7).

States spend millions of dollars on the supply of hardware and software for schools, and less than two to three percent on training their teachers (Bull, cited in Zehr, 1997). What has been spent on training has usually gone toward developing teachers' own skills. In the past very little training in the way of integrating technology into the classroom has been done. Although more professional development opportunities of this type are now available, a 1999 survey conducted for Education Week, reports that only 29% of teachers said they had received any type of training on integrating the use of computers into the curriculum (Fatemi, 1999).

For the most part, teachers do not know how to integrate computers into the classroom. They are being asked to use technology as a tool that will enhance the learning of students, but they have not been given the opportunity to see or learn how this can be done. Terry Crane, president of Jostens Learning Corporation, may have said it best when she said, "You're not going to get a technology-literate student if you don't have a technology-literate teacher" (Crane, cited in Zehr, 1997, p. 5).

Time to Collaborate, Experiment, and Share

If teachers need training to be effective users of technology in the classroom, they will need a much more substantial investment in the resource of time to attend and properly implement the training. Teachers:

> Need after-school workshops, summer sessions, and time off from their classes to learn how technology is being used elsewhere. They need to be able to observe their colleagues' classrooms and talk with them so that they can unlearn old practices and build new ones (Ellmore et al., 1995).
>
> Administrators in school systems and at the school level have not been able to provide the time teachers need to learn how to implement technology programs in the classroom. If training is what teachers need, they must be afforded the time in which to train (Brand, 1998).

But training is not the only thing for which teachers need time. The effective implementation of technology in the classroom will require teachers to totally rethink and change their teaching practices and lesson plans. Developing the competencies necessary to integrate technology into their classrooms requires that teachers make more of a time commitment than simply attending district provided training. It requires a major revamping of everything from lesson plans to the physical configuration of the classroom (Webb, 1999).

The investments in time needed for teachers to master these modern skills and processes are projected to be substantial. The President's Committee of Advisors on Science and Technology (Cited in Webb, 1999) reports that this training should take anywhere from three to six years. And this does not take into account the changing nature of technology itself. But, this time is essential. If it is not made available to teachers, the process of technology integration as a whole could be seriously undermined (Webb, 1999).

Technical Support

Once a vision and plan have been established and teachers have been provided training and time, one final barrier to effective implementation stands out, technical support. Teachers are being asked to rely tremendously on machines, and machines tend to break down. When computers fail or glitches occur in software, teachers need to be provided assistance that can quickly and efficiently resolve the situation (Webb, 1999).

Teachers can be trained to take care of minor maintenance on computers and peripherals, but there is a need for much more than that. Computers often need major repair, upgrading, service and cleaning. Most teachers do not have the training, knowledge, or time to perform such duties (Uebbing, 1995). In the past, schools have relied on teachers with technical backgrounds and interests to provide most repairs and service, but when there is technical trouble help is needed immediately and teachers should not be interrupted during class. But, if teachers have to wait hours, days, or even weeks to have a glitch worked out, they will be prone to abandon use of the technology altogether (Webb, 1999). Schools need to fund positions for professional technical assistance if they are going to attempt implementation on a wide scale (Uebbing, 1995).

Summary

The history of failures of the educational use of technology in America's schools haunts modern reformers. The promise of, and financial investment in, television, radio, and filmstrip within the past century are ever-present reminders to those pushing for the implementation of computers in the classroom. Many see the computer as just another innovation doomed to gather dust in some warehouse or storeroom. But the computer is different. Much like the printing press in the 1400s, the computer has sparked an information revolution. It, along with public access to the Internet, has transformed much of the world by providing people with access to seemingly limitless sources of information.

The computer has the ability to transform the process of education. It is a powerful tool that, if used appropriately, can open up educational opportunities and provide learning experiences never before possible. Using computers and available software, teachers can literally individualize content to meet the needs of each of student. Students can access, process, and present information as well as foster communication and creative, higher order thinking skills.

Although tremendous amounts of financial resources have been used in the acquisition of computers for schools, educators have been slow in using this promising resource. There is growing concern that schools may lose support needed to sustain technology programs if they cannot validate the need with stakeholders. This will require the removal of several key barriers. The identification of the presence of key barriers is the focus of this study. Chapter 3 discusses how they were identified.

CHAPTER 3

METHODOLOGY

The purpose of this study was three-fold. It attempted to determine: (a) the extent to which the teachers in the system's K-4 schools are implementing computers into instructional practices, (b) whether teacher age, gender, education level, experience, computer ownership, technology committee membership, or grade level taught affect the degree of computer implementation, and (c) to what extent the program vision, program planning, teacher training, teacher time, and technical support affect further implementation of computers in the K-4 classrooms across the system.

The information gained from this study will have an impact on the direction of the system's elementary school technology program, future professional development and future research opportunities. Included in this chapter are descriptions of the research design, the population studied, the instrumentation, the method of data collection, and the methods of data analysis.

Research Design

This study sought to develop knowledge through the collection of numerical data on observable behaviors of a sample of 83 teachers from the K-4, regular education classrooms of the Maryville City School System. These data were then subjected to numerical analyses, and in that respect might be labeled as "positivistic" (Gall et al., 1996, p. 28). The observed phenomenon or dependent variable addressed was the extent to which computers are incorporated into the learning environment. The implementation of computers is assumed to be influenced by the independent variables of program vision, program planning, teacher training, teacher time, and technical support. The theme of potentially inadequate implementation has been established in numerous studies discussed in the literature. This study attempted to identify the factors that contribute to the implementation of computers by collecting and analyzing numerical data provided by the system K-4 regular classroom educator population.

A causal-comparative research design was utilized in an attempt to investigate the relationship between the extent of computer implementation and those key barriers discussed in Chapter 2. This study was formative in nature. The information obtained is valid to the K-4 elementary schools of the system studied or to any other K-4 schools having similar demographic and infrastructure characteristics (Gall et al., 1996). The knowledge gained will be used to make improvements in the existing programs, future professional development activities, and for future research projects.

Sample

The sample studied consisted of the 83, K-4, regular education teachers of the four elementary schools in a small school system located in East Tennessee. All four elementary schools had been provided with computer resources. Each school had a student-to-computer ratio of five-to-one or better. Each classroom had at least one printer and one computer station connected to the internet. Each school employed a part-time technology coordinator whose teaching salary was supplemented by the school system. This coordinator assisted a team of technicians provided by the City of Maryville that oversaw maintenance of the citywide network that the school system was connected to.

Instrumentation

A survey was used to acquire the needed information. The review of literature produced several studies and previously used survey instruments, but none of these addressed the five key barriers to be addressed in this study. Therefore, the survey instrument was constructed of items gleaned from various surveys and adapted to fit the needs of this particular study.

The survey instrument consisted of a cover page and three sections. Section I consisted of eight demographic questions inquiring of the respondent's age, gender, computer ownership, level of education, years of teaching experience, grade level taught (current year), and membership on the school technology committee. For this study, those were considered confounding variables because they could have had an impact on the dependent variable.

Attempts were made in the data analysis to account for and determine the presence of any relationship of these variables to the extent of implementation.

Section II was designed to determine the level of classroom computer implementation of the respondent. Each teacher scored their perceptions, attitudes, and experiences involving the use of computers in their classrooms. A five-point Likert scale was used in response to a list of grade level performance indicators adapted from the International Society for Technology in Education (ISTE). Respondents were asked to denote which indicators were evident in their classroom. They did so by circling a response ranging from (SD) strongly disagree to (SA) strongly agree in reference to each of 10 individual indicators. Each response was assigned a numerical value ranging from one to five. The response values were totaled to provide an individual implementation score for each teacher.

The final section of the survey (III) consisted of 20 statements relating to the most common barriers to computer implementation in the classroom. Four statements were assigned specifically to the barriers of teacher time, teacher training, and technology program planning. Three statements were assigned to the barrier of technology program vision, and five were assigned to the barrier of technical support. As in section II, the data being collected were based on teacher attitudes, perceptions, and experiences and responses were formed using a five-point Likert scale. There were five possible replies ranging from (SD) strongly disagree to (SA) strongly agree. Each response was assigned a numerical value ranging from one to five. The response values for each independent variable were totaled and averaged to provide a score on each independent variable for each teacher. These scores ranged from one to five and were used to determine the respondent's perception of the presence of each barrier.

In order to determine the face validity of the instrument and individual survey statements, the survey was subjected to review by a panel of experts (Gall et al., 1996). This panel made suggestions as to needed revisions in the instrument. Face validity, as well as construct validity and reliability, were determined through pilot testing. The survey was issued to 10 teachers at an elementary school in a neighboring county. The content validity of each individual survey item was established using comments from the respondents of the pilot test and the actual pilot test results. The reliability of each section of the survey instrument was determined using Cronbach's alpha test (Gall et al., 1996). Each section of the pilot survey scored above .70. According to Huck and Cromier (1998), a test is accepted as reliable if it scores above .70. Needed revisions were made according to feedback from the panel of experts and the pilot survey respondents concerning the administration, wording, and content of the survey.

Data Collection

With permission from the system-wide technology supervisor (see Appendix B) and each school principal (see Appendix C), time was allotted to distribute the survey at a system-wide K-4 in-service meeting on March 19, 2001. At this meeting, a verbal introduction was made that included a statement of the purpose of the research. Instructions were verbalized as well as written on the cover sheet of the survey instrument. The entire process of introduction, completion, and collection of the survey instruments was estimated to have taken a maximum of fifteen minutes.

Data Analysis

This study was designed to test the following null hypotheses:

HO1: There is no significant correlation between the age of the teachers and their perceived level of computer implementation.

HO2: There is no significant difference between male and female educators in their perceived level of computer implementation.

HO3: There is no significant difference in the perceived level of computer implementation between those educators who own home computers and those who do not.

HO4: There is no significant difference between educators with differing levels of educational background (B.S., M.S., and Ed.S./ Ed.D.) in their level of computer implementation.

HO5: There is no significant difference between educators who have been members of the technology committee and those who have not, in their perceived level of computer implementation

HO6: There is no significant correlation between the perceived level of computer implementation and the amount of teaching experience.

HO7: There is no difference in the level of perceived computer implementation between educators teaching at different grade levels (K-2 or 3-4).

HO8: There is no significant correlation between the perceived level of computer implementation and the perceived presence of a technology program vision.

HO9: There is no significant correlation between the perceived level of computer implementation and the perceived presence of program planning.

HO10: There is no significant correlation between the perceived level of computer implementation and the perceived presence of technology training.

HO11: There is no significant correlation between the perceived level of computer implementation and the perceived presence of available time for observation, exploration, and collaboration.

HO12: There is no significant correlation between the perceived level of computer implementation and the perceived presence of technology support.

When data were gathered, the responses to the survey were tabulated, calculated, and analyzed using the Statistical Package for Social Sciences (SPSS) computer program. Data for each participant were entered and then rechecked for accuracy of data entry.

Descriptive statistics including the mean, median, mode, and standard deviation, were calculated to determine variation and the appearance of data distribution. Exploratory data analysis in the form of Q-Q charts were performed to visually check the distributions, formulate other possible questions about the data, and pinpoint any outlier scores.

Inferential statistical testing was used for prediction purposes in relation to both the control and independent variables. A t-test was used to test for significant differences in implementation scores among the control variables of gender, computer ownership, technology committee membership, and grade level taught. Analysis of variance (ANOVA) testing was used to compare the amount of variance between groups in the control variable of level of education. The Pearson product-moment correlation test was used to determine a correlation coefficient between perceived levels of implementation and the demographic variables of age and teaching experience, and the perceived presence of vision, planning, training, time, and support.

Summary

This study was conducted by gathering data from a sample consisting of the 83 K-4, regular education elementary school teachers from the Maryville City School System. This quantitative data was collected using a survey questionnaire. The data were analyzed using descriptive and inferential testing procedures. The significant difference or correlation between variables were tested using “t-test,” ANOVA, or Pearson product-moment correlation coefficient methods as appropriate. Chapter 4 discusses these data analyses.

CHAPTER 4

ANALYSIS OF DATA

Data were collected using a survey prepared for this study (Appendix A). The SPSS program was used to perform all data analyses. An alpha level of .05 was set to protect against Type I errors.

Reliability of the Survey Instrument

In assessing the reliability of the survey instrument, the Cronbach's Alpha test was performed on Section II and Section III (for both K-2 and 3-4 grade levels). According to Huck and Cromier (1998), a test is generally accepted as reliable if it scores .70 or above. Section II of the survey instrument yielded a reliability coefficient of .8939. Section III (K-2) yielded a reliability coefficient of .8100. Section III (3-4) yielded a reliability coefficient of .8190. All sections received scores well above Huck and Cromier's accepted standard of .70.

Description of the Data

Section I of the survey yielded data on the respondents' age, teaching experience, level of education, gender, grade level taught, home computer use, and technology committee membership. Section II and Section III of the survey were composed of responses to several statements using Likert type scales. There were five responses to choose from; SD – strongly disagree, D-disagree, U-undecided, A-agree, and SA-strongly agree. The statements in Section II were designed to measure the respondents' perceptions on the presence of five barriers to implementation being studied (Time, Training, Support, Planning, and Vision). After assigning numerical equivalents to each response (SD=1, D=2, U=3, A=4, and SA=5), they were sorted according to the barrier reference, totaled, and averaged - thus giving each respondent a weighted average score for each of the five possible barriers. The 10 responses in Section III were also assigned numerical equivalents. These data were summed for each respondent. These sums were used as the respective implementation score for each respondent.

Demographics

Section I of the survey yielded demographic information on the sample being studied. Of the 83 members of the population, 80 were female and three were male. Twenty-seven held a bachelor's degree, 46 held a master's degree, nine held educational specialist degrees, and one held a doctorate (Figure 1). Fifty-three of the respondents taught in grades K – 2 and the remaining 30 taught in grades 3 – 4. Seventy members of the population used a computer at home and seven were members of their respective school technology committees. The minimum age was 24 and the maximum was 60. The mean age was 41. The minimum years of experience was one, and the maximum was 30. The mean number of years of teaching experience was 14.9.

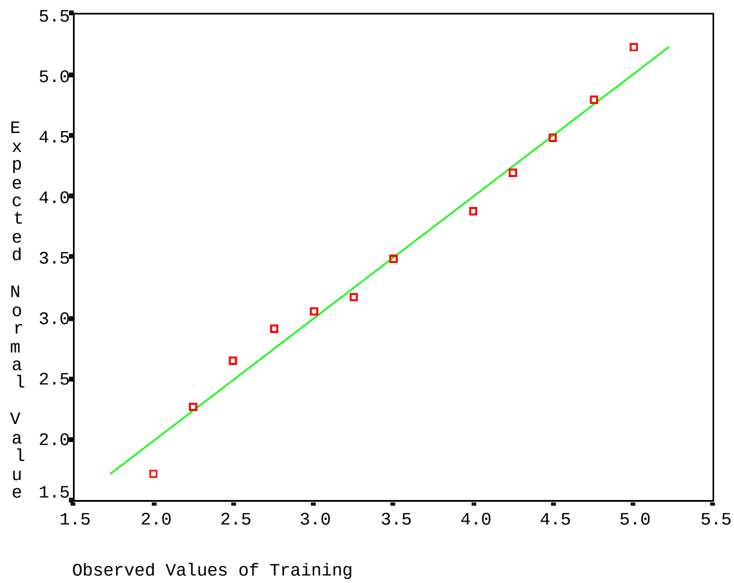

Figure 1. The Number of Respondents According to Level of Education.

Respondent Scoring

Section II of the survey yielded data that was used to establish respondent scoring in the area of perceived barriers to implementation. The Likert type scale used in Section II of the survey was composed of 20 statements; four referred to the possible barrier of time, four referred to the possible barrier of training, four referred to the possible barrier of planning, five referred to the possible barrier of support, and three referred to the possible barrier of vision. The numerical equivalents of the responses from each respondent for each barrier were totaled and then averaged, giving each respondent an average score for each of the five possible barriers. Figure 2 summarizes the frequency of scores for the barrier of time. All 83 members of the sample received a score for this barrier. The mean score was 2.5 and the standard deviation was .73. Figure 3 summarizes the frequency of scores for the barrier of training. All 83 members of the sample received a score for this barrier. The mean score was 3.56 and the standard deviation was .75. Figure 4 summarizes the frequency of scores for the barrier of planning. All 83 members of the sample received a score for this barrier. The mean was 3.20 and the standard deviation was .91. Figure 5 summarizes the frequency of scores for the barrier of support. All 83 members of the population received a score. The mean score was 3.12 and the standard deviation was 1.01. Figure 6 summarizes the frequency of scores for the barrier of vision. Again, all 83 members of the sample received a score. However, 35 members of the sample stated that they had no knowledge of the technology vision. Therefore, these respondents received a score of zero. The mean score was 2.1 and the standard deviation was 1.9.

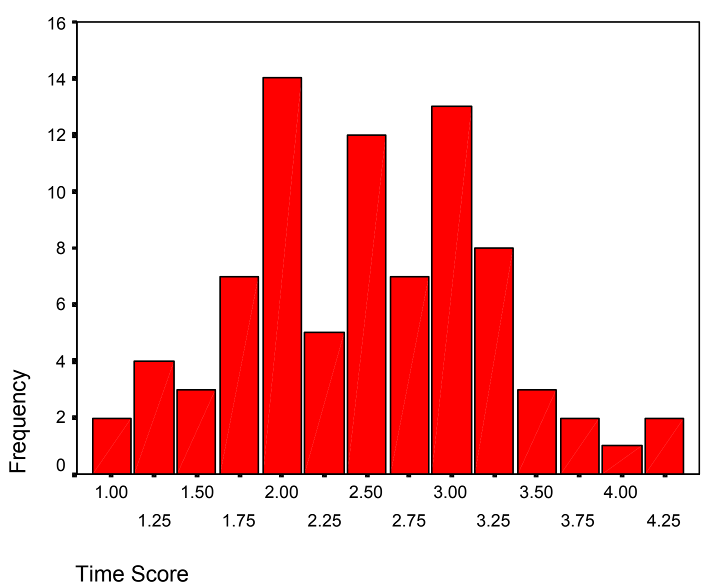

Figure 2. The Numerical Equivalent Scores (Averages) for the Respondents on those Likert Type Scale Statements Referring to The Barrier of Time.

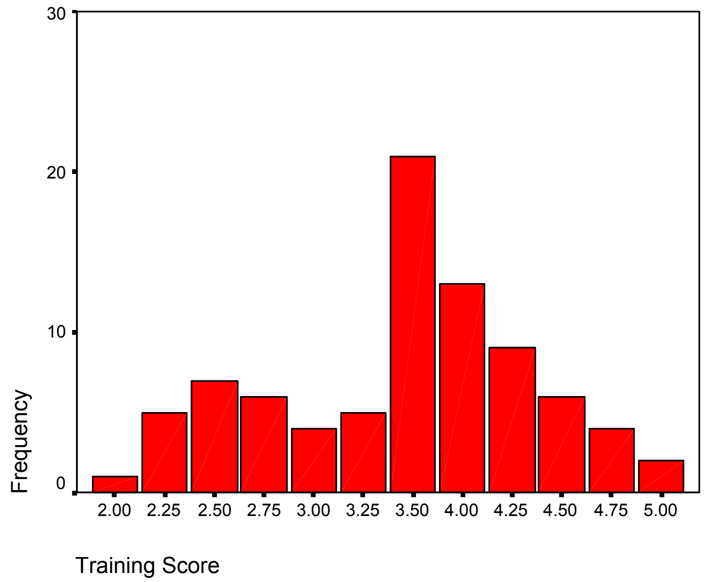

Figure 3. The Numerical Equivalent Scores (Averages) for the Respondents on those Likert Type Scale Statements Referring to the Barrier of Training.

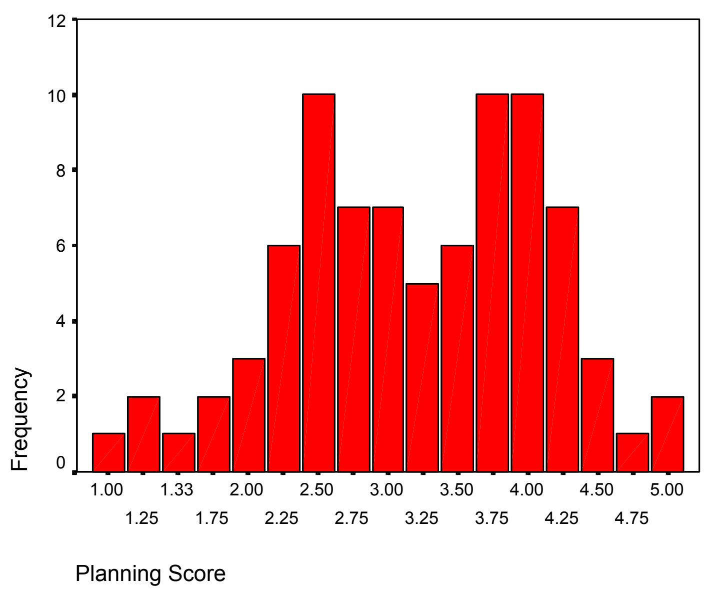

Figure 4. The Numerical Equivalent Scores (Averages) for the Respondents on those Likert Type Scale Statements Referring to the Barrier of Planning.

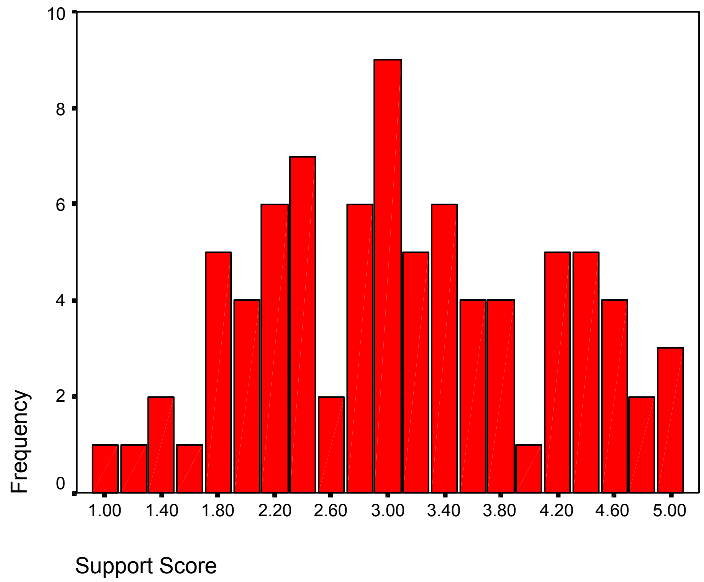

Figure 5. The Numerical Equivalent Scores (Averages) for the Respondents on those Likert Type Scale Statements Referring to the Barrier of Support.

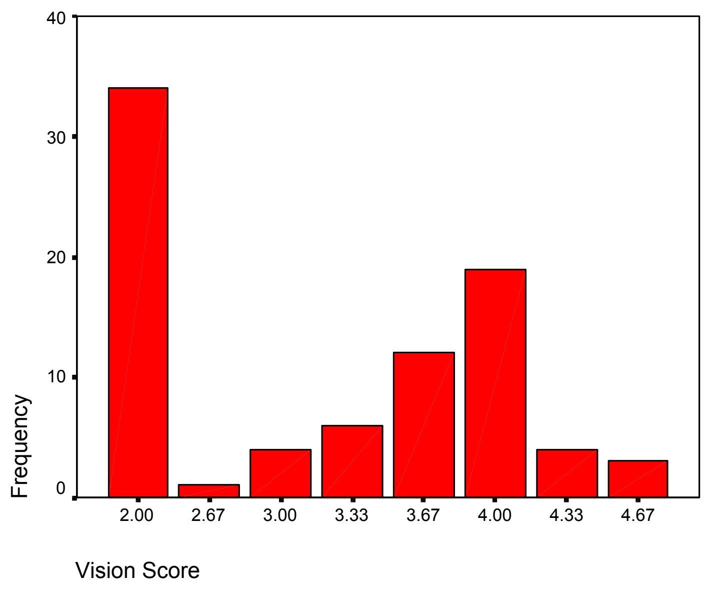

Figure 6. The Numerical Equivalent Scores (Averages) for the Respondents on those Likert Type Scale Statements Referring to the Barrier of Vision.

Section III of the survey yielded data used to establish respondent scoring in the area of perceived implementation of technology by respondents. The Likert type scale in Section III was composed of 20 statements referring to grade level appropriate performance standards provided by the International Society for Technology in Education (ISTE). K-2 grade level teachers responded to 10 of the 20 statements, and 3-4 grade level teachers responded to the other 10. The Likert type scale responses were each assigned numerical equivalents (SD=1, D=2, U=3, A=4, SA=5). The responses for each grade level standard were totaled and averaged giving each an average score on a scale of 1 to 5. These scores were then labeled according to scale. Any score of 4 or greater was labeled "as expected." Any score from 3 to 4 was labeled "below expectations." Any score below 3 was labeled "well below expectations." The scores for the K-2 standards are shown in Table 1, and Table 2 shows the scores for the 3-4 standards.

Table 1

Summary of K-2 Responses (Numerical Equivalent) to ISTE Standards

Standard	N	Mean
Use of input devices (K-2)	53	4.132
Directed and independent learning via computer (K-2)	53	3.584
Technology terminology(K-2)	52	3.346
Use of multimedia resources (K-2)	53	3.245
Cooperative learning using computers (K-2)	53	3.830
Positive social and ethical behaviors while using computers (K-2)	53	4.150
Responsible student use of systems and software (K-2)	53	4.094
Development of multimedia products (K-2)	53	2.490
Use computer resources (K-2)	53	2.547
Gather information and communicate using computers (K-2)	53	2.547

The K-2 teachers taking part in this study graded themselves “as expected” on three standards: 1) utilization of input devices (4.132); 2) responsible use of systems and software (4.094); and 3) positive social and ethical behaviors while using computers (4.150). Four of the standards for the K-2 teachers received labels of “below expectations.” These included: 1) directed and independent learning via computers (3.584); 2) technology terminology (3.346); 3) use of multimedia resources (3.245); and 4) cooperative learning using computers (3.830). The remaining three standards received scores in the “well below expected” range. These included: 1) development of multimedia products (2.490); 2) use of computer resources (2.547); and 3) gathering information and communicating via computers (2.547).

Table 2

Summary of 3-4 Responses (Numerical Equivalent) to ISTE Standards

Standards	N	Mean
Use of input devices (3-4)	30	3.733
Discussion of “real-life” technology use (3-4)	30	3.366
Discussion of responsible technology use (3-4)	30	3.300
Use of productivity tools and peripherals (3-4)	30	3.000
Use of computers for writing, publishing, and communication (3-4)	30	1.933
Use of telecommunications and information resources (3-4)	30	2.866
Use of online resources	30	2.200
Use of computer resources for problem solving	30	3.100
Determination of appropriate and useful applications	30	2.700
Student evaluation of electronic information sources	30	2.666

The grades 3-4 teachers did not rate themselves “as expected” on any of the 10 standards provided for their grade level. Five of the standards received scores in the “below expectations” range. These included: 1) the use of input devices (3.733); 2) discussion of “real life” technology use (3.366); 3) discussion of responsible technology use (3.300); 4) the use of productivity tools and peripherals (3.000); and 5) the use of computer resources for problem solving (3.100). The remaining five standards received scores in the "well below expectations" range. These included: 1) the use of computer tools for writing, publishing, and communication (1.933); 2) the use of telecommunication and information resources (2.866); 3) the use of online resources (2.200); 4) the determination of appropriate and useful applications for the computer (2.700); and 5) the evaluation of electronic information sources (2.666).

The only standard common to both grade levels was "the use of input devices." The K-2 teachers (4.132) scored themselves four-tenths of a point higher than their 3-4 counterparts (3.733).

The 10 responses from each respondent in Section III were totaled giving each teacher an implementation score on a scale of zero to 50. A summary of the implementation scores by grade level is shown in Table 3.

Table 3

Summary of Implementation Scores by Grade Level

GRADE	N	M	SD	Minimum	Maximum	Range
K-2	53	33.9057	5.96871	22.00	50.00	28.00
3-4	30	28.8667	6.13488	18.00	42.00	24.00
Total	83	32.0843	6.46794	18.00	50.00	32.00

<u>Hypotheses Testing</u>

Hypothesis 1 (HO1) states that there is no correlation between the age of a teacher and their perceived level of computer implementation (implementation score). In testing hypothesis 1, the Pearson product-moment correlation test was used. Figure 7 and Figure 8 show the "Q-Q" charts for each variable indicating both are normally distributed with very few outlying scores.

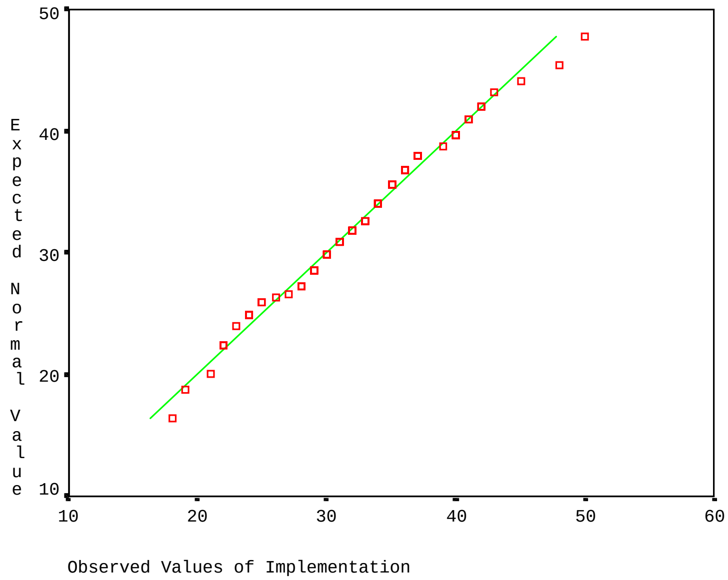

Figure 7. The Normal Q-Q plot of the Implementation Scores Provided by the Respondents.

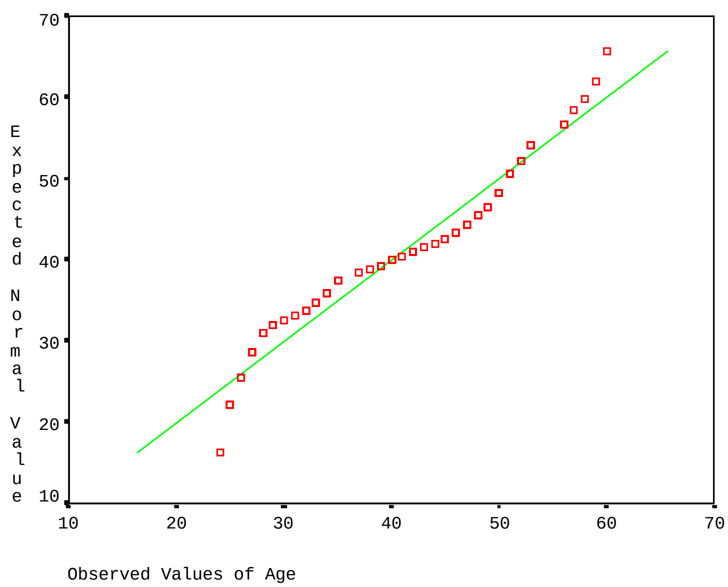

Figure 8. Normal Q-Q Plot of the Respondents' Ages.

The Pearson product-moment correlation was equal to -.067. This is very close to zero and indicates that there is not a significant correlation between the two variables.

Hypothesis 2 (HO2) states that there is no difference between male and female educators in their perceived level of computer implementation. This hypothesis was tested by comparing the mean implementation scores of the male teachers to those of the female teachers in the study. The mean scores for each group are shown in Table 4. The comparison was accomplished using an independent-samples t-test. Determination of a normal distribution of the dependent variable was confirmed using a "Q-Q" chart shown in Figure 7.

Table 4

Summary of Implementation Scores by Gender

Gender	N	M	SD	Variance	Maximum	Minimum
Male	3	25.6667	9.07377	82.333	36.00	19.00
Female	80	32.3250	6.30205	39.716	50.00	18.00
Total	83	32.0843	6.46794	41.834	50.00	18.00

The Significance (Sig.) for Levene's test for equality of variance is .388, which is greater than .05. This indicates the variances between the male and female groups are approximately equal. The t-test significance is equal to .080, which is greater than .05. These results indicate that there is no significant difference in the mean implementation scores of the male and female teachers in the sample. However, the testing results could have been effected by the discrepancy in size of the two groups being studied (Male = 3, Female = 80).

Hypothesis 3 (HO3) states that there is no difference in the perceived level of computer implementation between those educators who use a computer at home and those who do not. An independent-samples t-test was used to compare the mean implementation scores of those who use a computer at home and those who do not. The mean scores for the two groups are shown in Table 5. Normal distribution of the dependent variable (implementation scores) was confirmed using Figure 7.

Table 5

Summary of Implementation Scores by Home Computer Use

Home Computer Use	N	M	SD	Variance	Maximum	Minimum
Yes	70	32.5571	6.46873	41.845	50.00	18.00
No	13	29.5385	6.07749	36.936	41.00	19.00
Total	83	32.0843	6.46794	41.834	50.00	18.00

The Significance (Sig.) for Levene's test for equality of variance was equal to .654, which is greater than .05. From this, the assumption of approximately equal variances between the two groups is satisfied. The significance of the t-test between two groups with approximately equal variances was equal to .123, which is greater than .05. These results indicate that there is no significant difference in the mean implementation scores of those who use a computer at home and those who do not.

Hypothesis 4 (HO4) states that there is no difference between educators with differing levels of educational background (B.S., M.S., and Ed.S./Ed.D.) in their perceived level of computer implementation. In testing this hypothesis an ANOVA test was used to compare the mean implementation scores for the four groups of educators. The mean scores for each group are shown in Table 6.

Table 6

Summary of Implementation Scores by Level of Education

Level of Education	N	M	SD	Variance	Maximum	Minimum
Bachelors	27	32.6296	6.89006	47.473	50.00	19.00
Masters	46	32.6304	5.76718	33.260	48.00	22.00
Specialist/Doctorate	10	32.0843	7.59313	57.656	41.00	18.00
Total	83	32.0843	6.46794	41.834	50.00	18.00

The significance (Sig.) of the test was equal to .231, which is greater than .05. These results indicate that there is no significant difference in the level of implementation among the four groups with different levels of academic qualifications.

Hypothesis 5 (HO5) states that there is no difference between educators who have been members of the technology committee and those who have not in their perceived level of computer implementation. An independent-samples t-test was used to test this hypothesis by comparing the mean scores of the two groups. The mean implementation scores for the two groups are shown in Table 7. Again, a normal distribution of the dependent variable (implementation scores) was assumed and confirmed using the "Q-Q" chart information in Figure 7.

Table 7

Summary of Implementation Scores by Technology Committee Membership

Committee Membership	N	M	SD	Variance	Maximum	Minimum
Yes	7	30.4286	5.99603	35.952	39.00	21.00
No	76	32.2368	6.52558	42.583	50.00	18.00
Total	83	32.0843	6.46794	41.834	50.00	18.00

The significance (Sig.) of Levene's test for equality of variance was .656, which is greater than .05. This satisfies the assumption that the two groups have approximately equal variances. The t-test significance is equal to .482, which is greater than .05. Results indicate that there is no significant difference in the perceived implementation score means between the two groups.

Hypothesis 6 (HO6) states that there is no correlation between the perceived level of computer implementation and the amount of teaching experience a teacher has accrued. In testing hypothesis 6, the Pearson product-moment correlation test was used. In using this test both variables must be normally distributed. Figures 7 and 9 show the "Q-Q" charts for each variable indicating both are normally distributed with very few outlying scores.

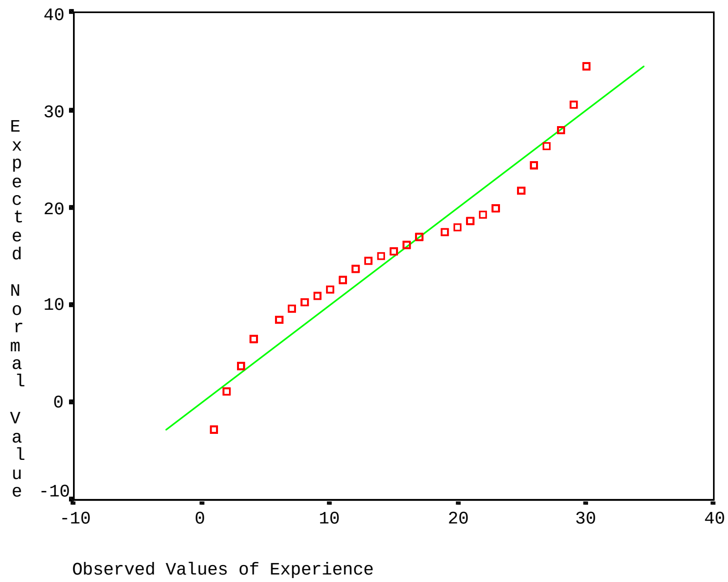

Figure 9. Normal Q-Q Plot of Respondents' Experience.

The Pearson product-moment correlation coeffecient is equal to -.086. This is very close to zero, and indicates that there is not a significant correlation between the two variables.

Hypothesis 7 (HO7) states that there is no difference in the perceived level of computer implementation between educators teaching at different grade levels (K-2 or 3-4). An independent-samples t-test was used to test this hypothesis by comparing the mean implementation scores of the two groups. The mean scores are shown in Table 8. Again, a normal distribution of the dependent variable (implementation score) was assumed using the "Q-Q" chart information in Figure 7.

Table 8

Summary of Implementation Scores by Grade Level Taught

GRADE	N	M	SD	Variance	Maximum	Minimum
K-2	53	33.9057	5.96871	35.626	50.00	22.00
3-4	30	28.8667	6.13488	37.637	42.00	18.00
Total	83	32.0843	6.46794	41.834	50.00	18.00

The significance (Sig.) of Levene's test for equality of variance is .335, which is greater than .05. This satisfies the assumption that the two groups have approximately equal variances. The t-test significance is equal to .000, which is less than .05. Results indicate that there is a statistically significant difference in the mean implementation scores between the two grade level groups.

Hypothesis 8 (HO8) states that there is no correlation between respondents' perceived level of computer implementation and their perception of the presence of a technology program vision. In testing Hypothesis 8, the Pearson product-moment correlation test was used. In using this test both variables must be normally distributed. Figures 7 and 10 show the "Q-Q" charts for each variable indicating both are normally distributed with very few outlying scores.

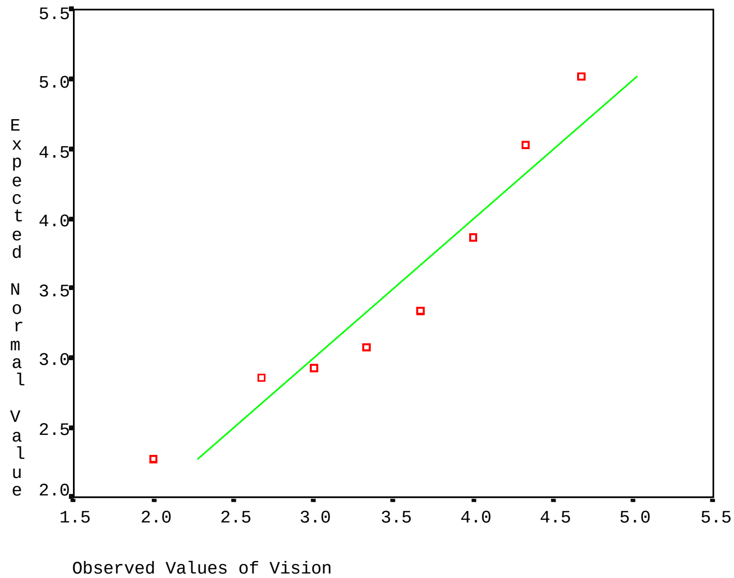

Figure 10. Normal Q-Q Plot for the Numerical Equivalent Scores (Averages) Provided by the Respondents on those Likert Type Scale Statements Referring to the Barrier of Vision.

The Pearson product-moment correlation coefficient is equal to 0.291. This score indicates that there is a significant correlation between the two variables at the .01 level. The score is significant and positive which indicates, within this population, perceived vision scores increase as implementation scores increase.

Hypothesis 9 (HO9) states that there is no correlation between respondents' perceived level of computer implementation and their perceptions of the amount of technology program planning. In testing hypothesis 9, the Pearson product-moment correlation test was used. In using this test both variables must be normally distributed. Figures 7 and 11 show the "Q-Q" charts for each variable indicating both are normally distributed with very few outlying scores.

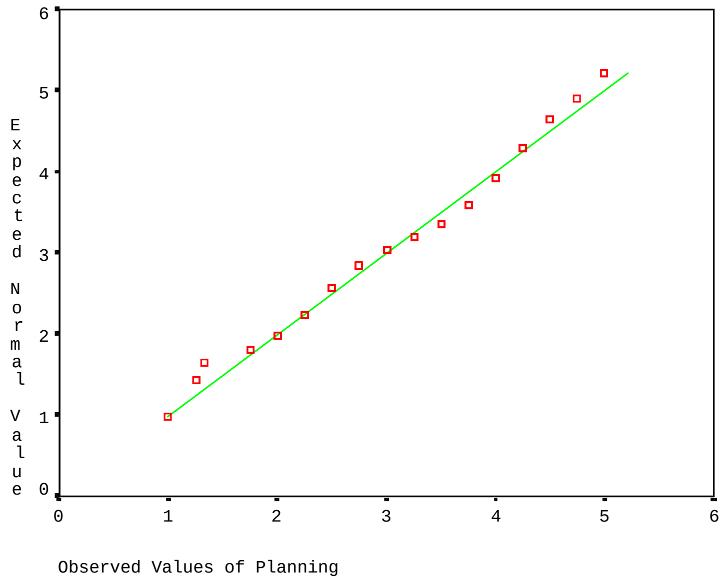

Figure 11. Normal Q-Q Plot for the Numerical Equivalent Scores (Averages) Provided by the Respondents on those Likert Type Scale Statements Referring to the Barrier of Planning.

The Pearson product-moment correlation coefficient is equal to 0.278. This score indicates that there is a significant correlation between the two variables at the .05 level. It is significant and positive which indicates, within this population, perceived planning scores increase as implementation scores increase.

Hypothesis 10 (HO10) states that there is no correlation between respondents' perceived level of computer implementation and their perception of the amount of technology training. In testing hypothesis 10, the Pearson product-moment correlation test was used. In using this test both variables must be normally distributed. Figures 7 and 12 show the "Q-Q" charts for each variable indicating both are normally distributed with very few outlying scores.

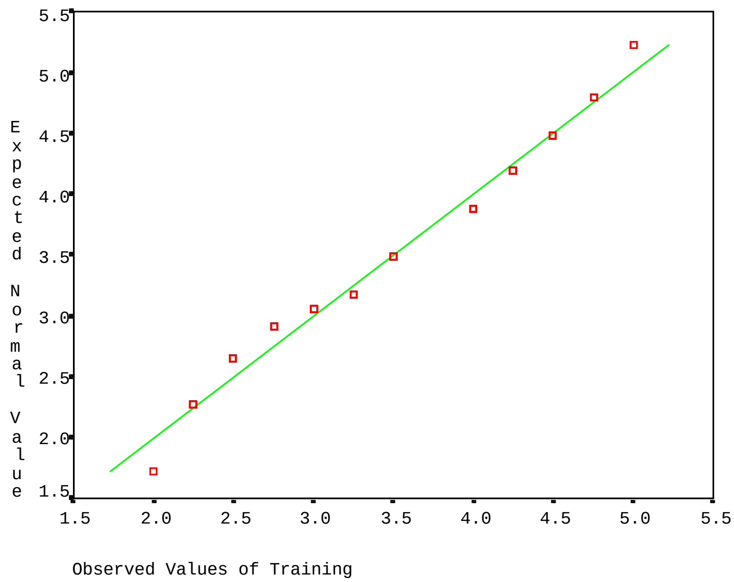

Figure 12. Normal Q-Q Plot for the Numerical Equivalent Scores (Averages) Provided by the Respondents on those Likert Type Scale Statements Referring to the Barrier of Training.

The Pearson product-moment correlation coefficient is equal to 0.433. This score indicates that there is a significant correlation between the two variables at the .01 level. It is significant and positive, indicating within this population, perceived training scores increase as implementation scores increase.

Hypothesis 11 (HO11) states that there is no correlation between respondents' perceived level of computer implementation and their perception of available time for technological observation, exploration, and collaboration. In testing Hypothesis 11, the Pearson product-moment correlation test was used. In using this test both variables must be normally distributed. Figures 7 and 13 show the "Q-Q" charts for each variable indicating both are normally distributed with very few outlying scores.

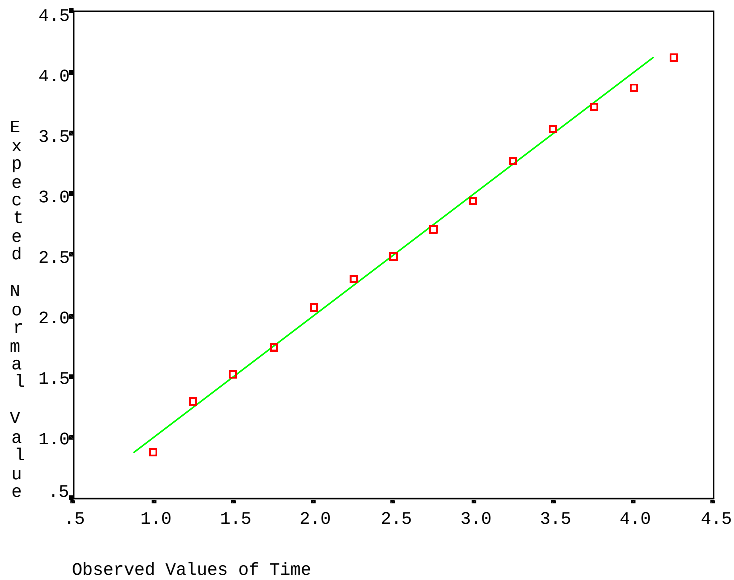

Figure 13. Normal Q-Q Plot for the Numerical Equivalent Scores (Averages) Provided by the Respondents on those Likert Type Scale Statements Referring to the Barrier of Time.

The Pearson product-moment correlation coefficient is equal to 0.439. This score indicates that there is a significant correlation between the two variables at the .01 level. It is significant and positive, indicating within this population, perceived time scores increase as implementation scores increase.

Hypothesis 12 (HO12) states that there is no correlation between respondents' perceived level of computer implementation and their perception of technology support. In testing hypothesis 12, the Pearson product-moment correlation test was used. Figures 7 and 14 show the "Q-Q" charts for each variable indicating both are normally distributed with very few outlying scores.

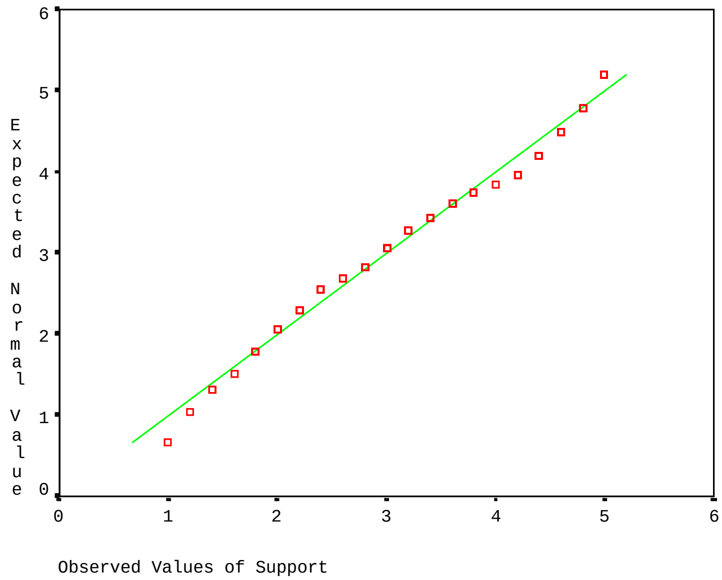

Figure 14. Normal Q-Q Plot for the Numerical Equivalent Scores (Averages) Provided by the Respondents on those Likert Type Scale Statements Referring to the Barrier of Support.

The Pearson product-moment correlation coefficient is equal to 0.395. This score indicates that there is a significant correlation between the two variables at the .01 level. It is significant and positive which indicates, within this population, perceived time scores increase as implementation scores increase.

Chapter 4 has shown the results of the hypotheses testing. Chapter 5 will offer a summary of these findings and some recommendations for further research and conclusions based on these findings.

CHAPTER 5

SUMMARY OF FINDINGS, RECOMMENDATIONS, AND CONCLUSIONS

Summary of Findings

The purpose of this study was to 1) assess the current status of computer implementation by the teachers of the K-4 classrooms of the Maryville City School System, 2) determine if certain teacher demographic variables are indicators of the extent of computer implementation in the classroom, and 3) determine if barriers reported in previous studies are inhibiting further implementation of computers in the classroom.

The study sample comprises the 83 K-4 regular-education classroom teachers of the Maryville City School System. Data were collected via written surveys, which were distributed and collected at a system-wide K-4 faculty meeting.

This study addressed three research questions: 1) What is the scope of computer use by students in their daily learning activities? 2) Are the teacher demographic variables of age, gender, experience, level of education, home computer ownership, technology committee membership, or grade-level-taught indicators of the extent of computer implementation by the K-4 teachers of the Maryville City School System? 3) Do the barriers of teacher time, teacher training, program planning, program vision, or technical support inhibit the implementation of computers in the K-4 classrooms of the Maryville City School System?

Research Question One

What is the scope of computer use by students in their daily learning activities? The intent of the investigator in asking this question was to obtain a snapshot of the level of computer implementation throughout the K-4 classrooms of the Maryville City School System. Teachers evaluated themselves against student performance standards issued by the International Society for Technology in Education (ISTE). The ISTE supplies 10 standards for grades K-2 and 10 standards for grades 3-5. Teachers provided self-ratings on Likert-type statements pertaining to these standards. Each teacher was given a score on each standard based on the response given.

The responses for each grade level were then averaged and labeled “as expected,” “below expectations,” or “ well below expectations.”

The K-2 teachers taking part in this study only scored their student classroom use as “as expected” on three standards: 1) use of input devices; 2) responsible use of systems and software; and 3) positive social and ethical behaviors while using computers. Teachers scored their student use of computers as “below expectations” on four ISTE standards. These included: 1) directed and independent learning via computers; 2) technology terminology; 3) use of multimedia resources; and 4) cooperative learning using computers. Teachers scored student computer use in the “well below expected” range on the remaining three standards. These included: 1) development of multimedia products; 2) use of computer resources; and 3) gathering information and communicating via computers.

The grades 3-4 teachers did not rate themselves “as expected” on any of the 10 standards provided by ISTE for their grade level. Five of the standards for student use received scores in the “below expectations” range. These included: 1) the use of input devices; 2) discussion of “real life” technology use; 3) discussion of responsible technology use; 4) the use of productivity tools and peripherals; and 5) the use of computer resources for problem solving. The remaining five ISTE standards received scores in the “well below expectations” range. These included: 1) the use of computer tools for writing, publishing, and communication; 2) the use of telecommunication and information resources; 3) the use of online resources; 4) the determination of appropriate and useful applications for the computer; and 5) the evaluation of electronic information sources.

The only standard identical to both grade levels was “the use of input devices.” The K-2 teachers scored themselves slightly higher than their 3-4 counterparts. The K-2 teachers scored student performance “as expected,” while the 3-4 teachers scored “below expectations.” Both grade levels (especially 3-4) scored low on standards involving the student use of computers as tools (multimedia projects, presentations, publishing etc.).

Overall, neither grade level scored well on the survey. K-2 teachers do tend to have a more positive perception of the student use of computers in their classrooms than do their 3-4 counterparts. This may be attributed to the difference in their standards. The standards for K-2 teachers were fairly concrete, action oriented and more easily measured. The 3-5 standards were more abstract and involved the discussion of computer related issues (computer ethics, morals, etc.). The discrepancies in scores could also be attributed to a lack of fifth grade scoring. The standards provided by the ISTE are to be demonstrated by students "prior to completion of Grade 5" (ISTE, 1998).

Research Question Two

Are the teacher demographic variables of age, gender, experience, level of education, home computer ownership, technology committee membership, or grade level taught indicators of the extent of computer implementation by the K-4 teachers of the Maryville City School System? Although not statistically significant, data analysis did show a negative correlation between computer implementation and the teacher variables of age and experience. This indicates computer implementation declines as teacher age and experience increases. These were expected results. They confirm the findings of other studies involving the measured use of computers and demographics of age and experience (U.S. Department of Education, 1998).

Interestingly, the only demographic variable shown having a statistically significant effect was that of grade level taught. An independent samples t-test showed a significant difference in the mean scores of the two grade levels. The teachers of grades K-2 rated their use of computers in the classroom, according to ISTE standards, significantly higher than the teachers of grades 3-4.

Research Question Three

Do the barriers of teacher time, teacher training, program planning, program vision, or technical support inhibit the implementation of computers in the K-4 classrooms of the Maryville City School System? Teachers' implementation scores were compared to their responses to a series of Likert type scale questions referring to the five possible barriers being studied. Statistical analysis was performed on the data to test for correlation among the variables using the Pearson product-moment correlation test. Each of the five barriers produced a correlation coefficient (r) showing the strength and effect it had on the implementation scores of the teachers.

Data analysis showed a positive and statistically significant correlation between the teachers' reported perceptions of adequate time and their reported current level of classroom implementation. This indicates implementation scores increased as teacher perceptions of adequate time increased.

Data analysis indicates a positive and statistically significant correlation between the teachers' reported perceptions of adequate computer training and their reported current level of classroom implementation. This indicates implementation scores increased as teacher perceptions of adequate training increased.

Data analysis showed a positive and statistically significant correlation between the teachers' reported perceptions of the presence of technology program planning and their current level of classroom implementation. This indicates implementation scores increased as teacher perceptions of the presence of technology program planning increased.

Although weak, data analysis showed a positive and statistically significant correlation between the teachers' reported perceptions of the presence of a technology program vision and their current level of classroom implementation. This indicates implementation scores increased as teacher perceptions of technology program vision increased.

Data analysis showed a positive and statistically significant correlation between the teachers' perceptions of adequate technical support and their current level of classroom implementation. This indicates implementation scores increased as teacher perceptions of adequate technical support increased.

This study has shown that the teachers of the K-4 regular education classrooms of the Maryville City School System feel there are systemic barriers that prevent them from utilizing computers in their classrooms. All five barriers tested (program vision, teacher time, teacher training, program planning, and technical support) were shown to have a correlation with the implementation scores provided by the teachers.

Recommendations

The research and testing completed in this study do not conclude specific resolutions or courses of action. However, the data in this study strongly suggests that teachers' implementation of technology in the classroom could be markedly improved by addressing the barriers of program vision, teacher time, teacher training, program planning, and technical support and the demographic of grade-level. The following recommendations might aid in the pursuit of further computer and technology implementation by the regular education teachers in the K-4 classrooms of the Maryville City School System.

Recommendations for the System

Like many systems across the country, the Maryville City School system has made great strides in establishing a technology infrastructure for its K-4 classrooms of the system. Likewise, the technology is used infrequently and in ways that do not begin to meet the full potential of the powerful technology systems that are in place. The System can take steps to remove the barriers for further, more productive implementation in the classrooms.

First, the school system should consider the development of a system-wide vision for technology use in the classroom. This vision needs to be developed by representatives from the central office and each school. It needs to be conveyed to each and every administrator, technology coordinator, teacher, and teacher's aide in the system. It is imperative that each and every person involved ascertain a well painted picture of the desired product.

Secondly, the school system should consider developing a detailed plan and timeline for the process the system intends to use to achieve their desired vision. The system-wide and school technology coordinators, along with advisement from administrators and teachers, need to establish a system-wide plan to improve classroom implementation in the schools. This plan needs to have attainable goals and objectives and must be adaptable to the ever-changing and growing world of technology. Regular formative and summative evaluations must be an integral part of the plan. And all those involved must have full knowledge of this plan and all its details.

The system must also provide time for teachers to explore software and computer uses for the classroom. Teachers need time and resources (i.e. websites such as http://coe.etsu.edu/technology/etrc/index.htm) so that they feel free to experiment, exchange, and share information. This time can come in the form of in-service or school days in which teachers are provided substitutes and are encouraged to attend educational technology trade shows, seminars, and conferences.

The system must continue to provide training on how computers can be used as tools in the classroom. Although many teachers are still learning the basics of computer use, all teachers need to be exposed to effective uses for their classrooms. Training for teachers must be individualized to meet the needs, schedule, and interests of the individual teacher.

Finally, the technical support of the system needs to be constantly upgraded. As teachers learn to use educational technology, the demand for various types of technologies will increase, and so will the demand for reliable and efficient support. Full-time personnel for the purpose of technology support need to be provided for each school, not only to install and repair equipment, but also to train and expose teachers to new technologies, software, and classroom implementations. Teachers must have confidence in the reliability of their equipment so that they do not become discouraged when they attempt to put them into good use. And they need a technology liaison that is willing to research and experiment with new computer strategies in the classroom.

Recommendations for the School

The K-4 schools of the Maryville City School System must support the central office by promoting and encouraging the system-wide technology vision. Efforts at the building level must be made to implement the technology plans and evaluations that have been created by the system-wide technology committees. Each individual school needs to develop and maintain an active technology planning committee, made up of the school technology coordinator, technology support personnel, administrators, faculty, staff, and parents. Technology planning committees must be established and play an active role in the planning and evaluations at the school level. Technology purchases and training expenditures at the school level must be made according to the system-wide vision and plan.

Recommendations for the Classroom

Teachers must use the resources provided by the school and the system wisely. If time is provided for training, research, exploration, or experimentation then this time must be used for the intended purpose. Teachers must familiarize themselves with the technology visions and plans established by their school and system. They must take time to experiment with various applications, share good ideas, and collaborate on technology projects and uses. They must take part in technology evaluations and use the results to grow in their own classroom practices. They need to help building-level coordinators and support personnel know what is needed in the way of training, software, and equipment. They need to let them know what does and does not work, and why. In order for well-guided decision-making to take place, the decision makers must have valid and reliable information.

Recommendations for Further Research

1. This study was conducted in the elementary schools of one system in Maryville, Tennessee. It may not be representative of the system, the district, or region as a whole. Additional research is needed to investigate other grade levels, systems or populations.
2. Technology implementation at the local level should be evaluated by using methods established at the regional or national level.
3. This study focused on the K-4 regular-education classrooms of the Maryville City Schools. Additional research might investigate computer implementation in classrooms serving the special education population.
4. This study was quantitative in its epistemology. Additional research might investigate using a qualitative approach to monitor teacher implementation and student utilization of computers in the classroom.
5. This study measured teacher perceptions and attitudes at one particular point in time. Additional research might be conducted over a period of time or several points in time.
6. This study was based on the implementation expectations of the International Society for Technology in Education. Additional studies might be conducted using standards derived by different sources.

Conclusions

Today, the use of computers permeates almost every facet of our society. Their capacity, speed, and efficiency have made computers a necessity for any business, person, or organization wanting to stay competitive in the modern marketplace. The computer, like the printing press before it, has sparked an information revolution that is quickly dividing the world into the "haves" and "have nots."

After years of experimentation and debate over the place and purpose of computers in schools, the educational system is slowly realizing the urgent need for and critical function of computers in the classroom. We know that computers will not replace the teacher. Indeed, computers have compounded the need for qualified, technology oriented educators in classrooms across the country. We also know that computers alone will not produce "across the board" increases in standardized test scores as one might expect. But, computers and related technologies can do so much more than just improve test scores. When implemented as tools at the disposal of our students, they can produce, among other things, gains in student productivity, creativity, communication, and access to information. The computer has a place in the classroom. With implementation according to ISTE standards, the disparity among the "haves" and "have nots" in access to information can be minimized at least at the classroom level.

This study examined teacher attitudes and perceptions concerning the use of computers in the regular-education, K-4 classrooms of the Maryville City School system. According to the grade level standards provided by the ISTE, and self reported data provided by the teachers of the regular-education, K-4 classrooms of the Maryville City School System, there is room for improvement in the system's quest for improved implementation and utilization of the powerful technology tools that have been provided. Teachers report not only sub- ISTE-standard student computer use and knowledge, but also the presence of several common barriers that have a direct effect on teacher implementation efforts. In order to ensure the students of the Maryville City School system remain competitive in the marketplace, efforts at the system, school, and classroom levels must be made to remove the barriers to further implementation.

The findings of this study can be used as a baseline by other school systems in their efforts to assess the effectiveness of computer implementation in their classrooms.

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APPENDIX A

Survey and Cover Letter

Dear Educator,

I would like to begin by thanking you for your time and cooperation. I am a doctoral student, fellow educator, and colleague. Your responses will provide the data required to complete this research project involving the barriers to computer use in the classroom. I assure you that the anonymity of you responses were maintained. If you are interested in the research results, please do not hesitate to contact me.

Sincerely,

Jesse A. Robinette

SECTION I

Please fill in the following.

1. Gender __________

2. Age__________

3. Years of teaching experience__________

4. Level of education (i.e. B.S., Masters, etc.)__________

5. Grade currently teaching__________

6. Do you use a computer at home?__________

7. Are you a member of the school technology planning committee?__________

SECTION II

Please circle the response that best represents your perceptions (SD - Strongly Disagree, D - Disagree, U - Undecided, A - Agree, or SA - Strongly Agree) after reading each of the following statements.

1. I am given time during the school year to review and test new software.
   SD D U A SA
2. I am asked for input regarding computer training ideas and workshops.
   SD D U A SA

3. When a problem occurs with my classroom computers or software, assistance is provided immediately.

SD D U A SA

4. I have enough confidence in my own computer skills to utilize computers in my classroom.

SD D U A SA

5. My school has provided me with training on how to use my computer for the completion of professional responsibilities.

SD D U A SA

6. I have been given time during the school day to observe and confer with colleagues who are integrating computers in their learning activities.

SD D U A SA

7. When I want to explore computer software, members of the technology staff are a valuable source for advice and support.

SD D U A SA

8. I have access to sufficient computer resource materials in my school building (e.g., printer cartridges, disks, replacement hardware, etc.).

SD D U A SA

9. I have been provided training on how to use computers in my classroom.

SD D U A SA

10. My school has an active technology planning committee.

SD D U A SA

11. There is not sufficient time in the school day to incorporate computer activities into my lesson plans.

SD D U A SA

12. I am aware of the standards for success outlined in my school's technology plan.

SD D U A SA

13. I have been given the opportunity to provide input pertaining to my school's technology plan.

SD D U A SA

14. I have been provided a copy of my school's technology plan (goals and objectives).

SD D U A SA

15. I have been given time during the school year to attend workshops or conferences that provide ideas and examples of proper classroom computer use.

SD D U A SA

16. My computers are regularly upgraded, serviced, and cleaned.

SD D U A SA

17. My school promotes computer use by conducting consistent evaluations and providing formative feedback.

SD D U A SA

18. I know what my school's vision is for computer use in the classroom.

Yes No

If you circled <u>No</u> after statement 18, go on to SECTION III

19. My school's vision for computer use in the classroom is achievable.
SD D U A SA

20. The teachers at my school are inspired by the vision for computer use in the classroom.
SD D U A SA

SECTION III

Find your classroom grade level. Read each national performance indicator and circle the response (SD - Strongly Disagree, D - Disagree, U - Undecided, A - Agree, or SA - Strongly Agree) that best represents your perceptions of your student's current practices and abilities. ***Complete only the section corresponding to your current classroom****. (Performance indicators adapted from the National Educational Technology Standards for Students).*

<u>Teachers of Grades K-2</u>

1. My students use input devices (e.g., mouse, keyboard) and output devices (e.g., monitor, printer) to successfully operate computers.
SD D U A SA

2. My students use computers for directed and independent learning (e.g., classroom assignments, reading, writing).
SD D U A SA

3. My students communicate about computers using appropriate and accurate terminology.
SD D U A SA

4. My students use multimedia resources (e.g., interactive books, educational software, elementary multimedia encyclopedias) to support learning.
SD D U A SA

5. My students work cooperatively and collaboratively with staff and peers when using computers in the classroom.
SD D U A SA

6. My students demonstrate positive social and ethical behaviors when using computers.
SD D U A SA

7. My students practice responsible use of computer systems and software.
SD D U A SA

8. My students create developmentally appropriate multimedia products with support from teachers, family members, or student partners.
SD D U A SA

9. My students use computer resources (e.g., puzzles, logical thinking programs, writing tools, digital cameras, drawing tools) for problem solving, communication, and illustration of thoughts, ideas, and stories.
SD D U A SA

10. My students gather information and communicate with others using computers, with support from teachers, family members, or student partners.

SD D U A SA

Teachers of Grades 3 and 4

1. My students use keyboards and other common input and output devices efficiently and effectively.

   SD D U A SA
2. My students discuss common uses of technology in daily life and the advantages and disadvantages those uses provide.

   SD D U A SA
3. My students discuss basic issues related to responsible use of technology and information and describe personal consequences of inappropriate use.

   SD D U A SA
4. My students use general purpose productivity tools and peripherals to support personal productivity, remediate skill deficits, and facilitate learning throughout the curriculum.

   SD D U A SA
5. My students use computer tools (e.g. authoring, "Powerpoint," digital cameras, scanners) for individual and collaborative writing, communication, and publishing activities to create knowledge products for audiences inside and outside the classroom.

   SD D U A SA
6. My students use telecommunications efficiently and effectively to access remote information, communicate with others in support of direct and independent learning, and pursue personal interests.

   SD D U A SA
7. My students use telecommunications and online resources (e.g. e-mail, online discussions) to participate in collaborative problem-solving activities for the purpose of developing solutions or products for audiences inside and outside the classroom.

   SD D U A SA
8. My students use computer resources (e.g., data collection probes, educational software) for problem-solving, self-directed learning, and extended learning activities.

   SD D U A SA
9. My students determine when the computer is useful and select the appropriate tool(s) and resources to address a variety of tasks and problems.

   SD D U A SA
10. My students evaluate the accuracy, relevance, appropriateness, comprehensiveness, and bias of electronic information sources.

    SD D U A SA

APPENDIX B

Central Office Letter

Dear [Superintendent],

I have come to that point in my doctoral program where research data are needed to complete my dissertation. The topic I am researching is the implementation of computers in K-4 elementary school classrooms. I would like to ask for your permission to approach the four principals of your system so that I might ask their permission to use their faculty as sources of data.

All data would be gathered through the distribution, completion, and collection of a survey questionnaire. I would personally be responsible for distribution and collection, but I will need the aid of the K-4 classroom educators for the completion of the survey. All collected data will remain completely confidential. I will be more than happy to provide you with a copy of the questionnaire for review and any results that you desire.

I would greatly appreciate your consideration. Please let me know of your decision at your earliest possible convenience.

Sincerely,

Jesse A. Robinette
Maryville High School

APPENDIX C

Administrator Letter

Dear [Administrator],

My name is Jesse A. Robinette. I am a staff member at Maryville High School and a Doctoral student at East Tennessee State University. I am currently in the process of writing a dissertation on the implementation of computers in K-4 classrooms. I have contacted Dr. Dalton and he has given his consent for me to approach you to ask for permission to use your faculty as a source of data.

I have designed a survey questionnaire that I would like to distribute to your faculty. I would be solely responsible for the distribution and collection. The entire process of completing the instrument should take no longer than fifteen minutes. All data will be completely confidential and I will be more than happy to provide you with a copy of the survey instrument for review and any results that you might desire.

Your cooperation would be greatly appreciated. Please let me know of your decision at your earliest possible convenience.

Sincerely,

Jesse A. Robinette

VITA

JESSE A. ROBINETTE

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Place of Birth: Knoxville, Tennessee
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Maryville College, Maryville, Tennessee; Business, B.A., 1991
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Professional Experience: Teacher, South-Doyle High School; Knoxville, Tennessee, 1992-1995
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