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Has technology in the elementary classroom caused instruction to improve?

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HAS TECHNOLOGY IN THE ELEMENTARY CLASSROOM CAUSED INSTRUCTION TO IMPROVE?

by
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Abstract

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Dr. Ronald Capasso
Educational Administration

This study described and evaluated the extent to which technology has improved instruction, and thus improved student learning, in elementary schools in Deptford Township, a K-12 district. The study included all K-6 grade teachers. A 31-item survey was completed by 85% of elementary school teachers. Percentages of answers were mathematically calculated and lists of software programs and student systems for computer use were compiled. The majority of elementary teachers described their level of expertise regarding technology as "able to manage as long as everything runs correctly". The results reveal a high dissatisfaction with the type and amount of technology training and/or help that has been offered by the district, but most teachers are willing to receive training in technology uses and integration into instruction. The results show that elementary teachers overwhelmingly believe that technology can improve instruction and are incorporating computers into their classroom routines. The average amount of time allotted for student computer use is 30 minutes per student per week. However, student usage is inconsistent from classroom to classroom and building to building. Additionally, the software programs being used may or may not support the curriculum and are used inconsistently. In conclusion, although computers are being used in the classrooms by teachers and students, technology has not improved instruction in Deptford Township to any measurable degree.

Mini-Abstract

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This study evaluated the extent to which technology has improved instruction in elementary schools in Deptford Township. The results show that although teachers believe that technology can improve instruction, they have not received the proper training in technology uses/integration into instruction. However, they believe they can benefit from such training.

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Chapter 1

Introduction

Focus of the Study

Technology provides increased opportunities and incentives for learning. It gives students the opportunity to develop new levels of understanding and a new perspective and awareness of the way they learn and their role in the classroom. Technology not only expands their knowledge, but allows them to become more self-directed learners. Increased sources and ways to manipulate information give students the ability to work independently of teachers to reinforce or elaborate on classroom instruction. Technology creates increased opportunities for interaction among students. Cooperative learning groups flourish in technology-based learning environments. Increased productivity and an experience of success inspired by this new learning environment enhances self-esteem and confidence. In essence, technology has expanded learning environments beyond the traditional classroom and enabled students to become active participants in their own education.

There are many positive reasons for bringing technology into schools, among them a belief that computer-based technology provides support for thinking processes, allows opportunities for drill and remediation, stimulates motivation and self-esteem, promotes equity, and prepares students for the future (Gentile, Kuperstein & Zwier, 1998). However, teachers have had to adjust their roles, methodologies, and schedules in order to provide their students with opportunities to utilize technology. Technology can become a tool to assist teachers in creating the interactive, collaborative, multidisciplinary, and exploratory learning environments that reform has suggested are necessary to improve our educational system. (Gentile, Kuperstein & Zwier, 1998).

Unfortunately, when teachers are hesitant or reluctant to use technology, for whatever reason, opportunities to enhance or improve instruction through technology may be lost. On the other hand, when teachers are excited about and anxious to use technology, they must be careful to choose those applications that will enhance or improve instruction so that time spent on the computer is beneficial.

Purpose of the study

Computers have been available to teachers in Deptford Township's six elementary schools who wanted to utilize them as an aid to instruction and/or for administrative tasks for the past ten years. As the educational benefit of computers became evident, upgraded computers were placed in each classroom, regardless of whether teachers knew how to use them or not. Opportunities existed for teachers to learn how to use the computers, most of which were outside of the contractual school day.

The most critical decision a teacher can make is that of software selection (Shade, 1996). There are many software programs available for purchase, and teachers have had the opportunity to order software as part of their individual classroom materials budget. This research will determine how the computers are being used in the classrooms, which software applications are being used, and which applications, in the teachers' opinions, contribute to improving instruction.

The purpose of this study is to describe and evaluate the extent to which technology has improved instruction, and thus improved student learning, in elementary schools in Deptford Township now that each classroom is equipped with one or more computers that are networked into the library system and/or have Internet access. Specifically, this study intends to answer the following questions:

1. What is the level of expertise of the teachers who are expected to utilize technology to improve instruction?

* Where did teachers receive training in integrating technology into the classroom?
* What type of training in how to use new hardware and software has been provided by the district?
* What type of demonstrations and advice on how to incorporate technology into instruction has been provided by the district?
* What type of help has been provided by the district when software problems or hardware failures arise?
* What type of help in planning for technology uses and acquisitions has been provided by the district?

2. How has the use of technology applications actually improved instruction?

* Do teachers believe that technology can improve instruction?
* How much time is devoted on average per week for each student to use the computer in the classroom?
* Which software programs are used to enhance or improve instruction in the classroom?
* How often is the Internet used in individual classrooms to enhance or improve instruction?
* What would make teachers more apt to use technology in their teaching?

Definitions

At this stage of the research, **technology** will be defined generally as the utilization of hardware and software applications for the purpose of improving instruction.

Limitations of the Study

The sample size is limited to the elementary classroom teachers in Deptford Township because there are too many variables in studying junior high and high school teachers at the same time as elementary teachers. The high school and junior high have had computers in their libraries for quite some time and additionally have a computer lab for instruction. Computer instruction is not offered to elementary students in a lab setting. This inequity in computer instruction and availability between the junior and high schools and elementary schools is another reason that only the elementary schools were chosen for this study.

One limitation of this study is that the classroom size, diversity of student population, median age of teachers, and different administrative styles related to technology will not be exactly the same. However, limiting the sample to elementary schools reduces other variables such as (a) different administrative techniques between elementary, junior high, and high school, (b) different course contents in elementary, junior high, and high school, (c) different pedagogical methods in elementary, junior high, and high school, and (d) the difference in the age of students. Another limitation of this study is the levels of motivation of the teachers that occur as a result of outside influences, such as family background, desire to obtain technology skills to operate systems at home, and support systems existing outside of the school.

Setting of the Study

The study will include all K-6 grade teachers in Good Intent Elementary School, Lake Tract Elementary School, Oak Valley Elementary School, Shady Lane Elementary School, Pine Acres Elementary School, and Central Elementary School, all K-6 elementary schools in Deptford Township, a K-12 district. There are two half-day kindergartens and three classes each for grade levels one to six at Good Intent School, Lake Tract School, and Oak Valley School. There is one half-day kindergarten and one class each for grade levels one to six at Pine Acres and Central Schools. Deptford

Township is a suburban district with one Junior High and one High School in addition to the elementary schools that will be included in the study.

Each elementary school has a different number of computers placed in its individual classrooms. Additionally, each elementary school has a different number of computers available for student use in its library. Computer instruction is not offered to elementary students unless they receive it from their classroom teachers or as part of library instruction if their school library has computers.

Significance of the Study

Completing this research project will add to the body of research that exists, and hopefully will fill the gap by proving or disproving the notion that technology improves instruction.

The research will be of interest to state officials who, as part of their Goals 2000 planning effort, have been directed to develop technology plans describing how they will use technology to support systemic reform and to help their students achieve the highest standards possible.

The study will result in a report that will enable administrators and board members to recognize, encourage, and monitor the use of effective technology applications to improve instruction in Deptford Township. Additionally, the report will enable administrators to create, collaboratively if so desired, opportunities for staff professional development experiences. The report generated by the research should be a useful tool in identifying and utilizing current technology to assist building principals with management and improvement of instruction within their school.

The report generated from the research will be a useful tool to teachers in determining which software programs produce better results in improving instruction and will give administrators an idea as to what type of professional development to offer to teachers so that the software programs being used in the elementary schools are utilized in the most advantageous way. Selecting software for the classroom is an

opportunity to participate in the choice of technological teaching resources (NEA Technology Brief, 1996).

The report will also benefit parents of students who may wish to purchase software that is comparable to that which is being used at school so that their children can benefit from further practice at home . Ultimately, this research will benefit the students who will be able to utilize the best possible applications to enhance and reinforce the instruction they are receiving from their classroom teachers.

Organization of the Study

Chapter Two will review (a) Current literature on the history of technology usage in schools, (b) legislation regarding the integration of technology into curriculum, (c) the various ways in which teachers are using technology to enhance student learning, (d) the benefits of technology on student learning, (e) the status of the nation's schools in utilizing up-to-date computers and providing Internet access to all students, (f) the extent to which school districts have invested in training teachers to utilize the technology provided to them for instructional purposes, (g) the various plans that districts have created to provide technology to aid teachers in improving student learning, and (h) the proposed technological skills that students will need so that they can be successful, contributing members of society in the 21st century.

Chapter Three will describe the design of the study. A questionnaire will be distributed to each elementary school teacher to determine the level of expertise of the teachers who are expected to utilize technology to improve instruction and whether the use of technology applications has actually improved instruction (See Appendix A). The questionnaire will consist of Section A and Section B. Section A will include questions that pertain to how teachers have acquired knowledge to incorporate technology into instruction. Section B will include questions that pertain to teachers' perception as to whether or not the availability of computers has improved instruction. The questionnaire will be mailed via interdepartmental mail to all elementary teachers. A cover letter

explaining the rationale of the questionnaire will precede the actual questionnaire (See Appendix B).

Chapter Four will present the results of the questionnaire. In Section A of the questionnaire, Question 1 is included to determine the number of computers in each classroom. For Questions 2-8, percentages will be mathematically calculated for each of the five responses to each question to determine the level of training provided by the district. Percentages will be calculated for each of the five responses to Question 9 to determine where each teacher received his or her training. Percentages will be calculated for each of the five responses to Question 10 to determine the literacy level of each teacher. Percentages will be mathematically calculated for each of the five responses to Question 11 to indicate how often the Internet is used in classrooms by students for research purposes. Percentages will be mathematically calculated for each of the seven responses to Question 12 to determine where each teacher received his or her training. Percentages will be mathematically calculated for each of the four responses to Question 13 to determine the computer-literacy level of each teacher. Percentages will be mathematically calculated for each of the five responses to Question 14 to determine where teachers perceive the district's priority lies in providing technology training. For Question 15 and its six sub-questions, percentages will be mathematically calculated for each of the five responses to each question to determine the conditions under which teachers would be more apt to use computers to provide instruction in their classrooms. Percentages will be mathematically calculated for each of the five responses to Question 16 to determine whether teachers would mentor other teachers in integrating technology into their teaching if they received adequate training and achieved a comfort level with technology.

In Section B, for Question 1, percentages will be calculated to determine whether teachers believe that technology can improve instruction. For Question 2, a table will be developed to show how much time is devoted on average for each student to use the

computer in individual classrooms on a weekly basis. For Question 3, percentages will be mathematically calculated to determine whether teachers use a system in their classrooms to allow students to use the computers. For Question 4, a list of systems used to allow student use of computers will be compiled. For Question 5, a list of software programs used by grade level will be created. The grade level taught by each teacher will be determined by Question 6.

Chapter Five will describe the study's major conclusions and their corresponding implications in the form of a narrative report. The report will be of interest to teachers, administrators, parents, and students. The ability of teachers to deliver technology instruction will be of interest to administrators who will then be able to provide and/or supplement training as new systems and software programs become available. Various software programs and classroom techniques that provide opportunities for students to use the computer will be included in the report so that teachers and parents can benefit from the experimentation of others and incorporate their successes into their own educational agendas. The report will also determine whether further study is warranted and, if so, when such study should take place.

Chapter Two

Review of Literature

Introduction

The following literature review focuses on eight areas. The first section, Computer Technology in Education, reviews the ways in which computers were used in schools from the early 1980s to the present. The second section, Legislation, reviews the current administration's goals and efforts to bring technology into all of the nation's schools and ensure that all students become computer-literate by the 21st century. The third section, Uses of Technology, reviews the various ways in which teachers are using technology to enhance student learning. The fourth section, Student Leaning, reviews the benefits that technology has on students' acquisition of skills, self-esteem, and readiness for the 21st century. The fifth section, Effectiveness of Technology, reviews the status of the nation's schools in utilizing up-to-date computers and providing Internet access to all students. The sixth section, Teacher Training, reviews the extent to which school districts have invested in training teachers to utilize the technology provided to them for instructional purposes. The seventh section, District Technology Plans, reviews the various plans that districts have created to provide technology to aid teachers in improving student learning. The eighth section, Need for Technology, reviews the proposed technological skills that students will need so that they can be successful, contributing members of society in the 21st century.

Computer Technology in Education

In Childhood Education (Summer 1997), Gatewood and Conrad state that the first wave of computer technology took place in the early 1980s when a small number of personal computers were used in schools, mostly to teach students how to write programs

using the BASIC language and to run a few educational software titles. They go on to state that the second wave crashed with the introduction of computers into laboratory settings, such as writing and math labs, and with the use of general purpose software, such as word processing and spreadsheets. They go on to describe the early 1990s, when the third wave moved across the education landscape and educational software and reference works started to appear on single CD-ROM disks, which combined text, pictures, sound, animation, video clips and greater interactivity (Gatewood & Conrad, 1997). They state that software for word processing, databases and spreadsheets, as well as for specific subjects, became easier to use, more available and affordable, and expanded the use of computers into areas like the sciences and the arts (Gatewood & Conrad, 1997). They claim that we are presently in the midst of the fourth wave of technology, and that students are using computers to connect to the Internet, send electronic mail (E-mail), browse the World Wide Web (WWW) and share information electronically (Gatewood & Conrad, 1997).

The Digest of Education Statistics reported that in 1997 the number of schools with Internet access has increased rapidly from 35 percent in 1994, to 50 percent in 1995, to 65 percent in 1996 (Snyder, 1997). But although some access is now widespread, most schools are not extensively connected. According to the Digest, only about 14 percent of instructional rooms had access to the Internet in 1996. Of the schools which had Internet access in 1995, more than one-third had access at only one computer, and another one-third had access at 2 to 5 computers. The total computer usage rate of students at school increased from 27 percent in 1984, to 43 percent in 1989, to 59 percent in October 1993. The rate for grades 1 to 8 increased from 52 percent in 1989 to 69 percent in 1993 (Snyder, 1997).

In a speech delivered to the Florida Educational Technology Conference in Orlando, Florida, on February 28, 1997, William Rodriguez, General Manager of IBM, stated that technology has been labor-intensive for the teachers. He claims that

technology has significantly increased the teachers' workload, due to the time involved in designing lessons, learning how the computers worked, solving installation problems, scheduling student computer time, and figuring out how to assess performance and turn it into meaningful information (Rodriguez, 1997).

Legislation

The Department of Education reported on August 31, 1998, that the Clinton Administration has made an unprecedented commitment to bringing technology into the classroom and to ensuring that all children are technologically literate by the dawn of the 21st century. According to President Clinton, nothing is more critical to preparing our public schools for the 21st century than ensuring they have the modern technology to prepare students for the information age. The President challenges the nation to work together in a major new national effort to help every student become technologically literate for the 21st century. Specifically, the President has proposed four goals, or pillars:

> 1) Provide access to modern computers for all teachers and students. To make technology a viable instructional tool requires schools to have enough computers to provide full, easy access for all students, including students with disabilities. Although the national student-to-computer ratio is currently 11:1, the ratio of students to powerful multimedia computers is only 35:1.56. In contrast, many studies suggest that full, easy access requires a ratio of about five students to each multimedia computer.
>
> 2) Connect every school in America to the Information Superhighway. Connections to local area networks (LANs) and the Internet turn computers into versatile and powerful learning tools. Access to these networks introduces students and teachers

to people, places, and ideas from around the world to which they might otherwise not be exposed.

3) Develop effective software in all subject areas. Computer software, video, distance learning courses, and on-line resources are expanding rapidly. For example, over 20,000 educational software titles have been developed, more than a million students take courses through distance learning networks every year, and every day hundreds of new home pages are added to the Internet's World Wide Web. These resources hold promise to improve learning, increase the amount of time students spend learning, and engage students in problem solving, research, and data analysis.

4) Give every teacher the development they need to help students use and learn through technology. Professional development is key to effective technology integration and to increased student learning. Teachers need access to technology and ongoing support while they learn. They need adequate time to acquire new skills to integrate technology into their schools' existing programs and activities. And teachers learn best with, and from, their colleagues. For example, the Office of Technology Assessment estimates that it can take up to five years to effectively infuse technology into schools. All teachers need to be trained and supported over that period (U.S. Dept. of Ed., 1998).

In his 1997 State-of-the-Union message, President Clinton outlined a Call to Action for American Education which, among other educational goals, called for all Americans to join forces and work together to connect every classroom and library to the Internet by the year 2000 and help all students become technologically literate. To help

accomplish this goal, beginning January 1, 1998, every public, parochial, and private school was eligible to receive significant discounts for Internet and telecommunications services through the E-rate, a $2.25 billion fund administered by the Federal Communications Commission. The average discount cuts costs by 60%, and for the poorest schools, access is almost free. The President stated that he will continue to strongly oppose any effort by the Congress to repeal or delay the "e-rate", an expansion of universal service to provide discounted Internet access and telecommunications services to schools and libraries (U.S. Dept. of Ed., 1998).

According to the Department of Education, funding for educational technology more than doubled in 1998, amounting to an almost $600 million investment of funds to help schools acquire hardware, software, and link to the Internet and train teachers in using computers and educational software. Continuing grants, begun by the President during his first term, include the Technology Literacy Challenge Fund, supporting all 50 states, and the Technology Innovation Challenge Fund, helping 62 projects involving 33 states, 548 school districts, 293 businesses, and 140 colleges and universities. As a result of this funding, sixty-five percent of schools and fourteen percent of individual classrooms are now connected to the Internet, up from 1994 when only 9% of schools and 3% of classrooms were wired (U.S. Dept. of Ed., 1998).

In 1998, the federal government planned to step up its efforts to: 1) help ensure all new teachers know how to use technology effectively in the classroom; 2) establish computer learning centers in low income communities; and 3) through technology, allow adults the opportunity to learn anytime, and anywhere (U.S. Dept. of Ed., 1998).

Uses of Technology

In Childhood Education, Robert Gilstrap reported that in 1997 there were more than 2.5 million computers in elementary and secondary classrooms in the United States, a 550 percent jump over the last decade. He claims that most computers, however, are

used for only a fraction of the instructional week and usually for word processing and skill reinforcement (Gilstrap, 1997).

In his speech, William Rodriguez refers to Professor James J. O'Donnell, who claims that the most relevant uses of technology are as tools and communication (1997). O'Donnell characterizes what he calls "authentic" use of technology: It should support student performance of an authentic task; it should be integrated in activities that are a core part of the classroom curriculum; and it should be treated as a tool to help accomplish a complex task, rather than a subject of study for its own sake. To sum it up: students and teachers should be using computers for learning, not learning in order to use computers (Rodriguez, 1997).

Research demonstrates that children who write on word processors compose longer and more complex stories, are less worried about mistakes, and are more willing to revise (Clements & Nastasi, 1993). In Electronic Learning, Holly Holland states that around the country teachers report success with computer-assisted writing (1996). Holland writes that teachers claim that the benefits include the chance to create new audiences for student writing, to reach out to mentors for research and support, and to publish frequently. She further states that teachers also say computers have helped eliminate some of the monotony of writing by reducing the time-consuming task of revising, and rewriting, by hand. However, Holland reports that there are few state or district efforts linking writing to technology. Most work has been done by individual teachers and networks of teachers formed with the help of short-term grants and pilot projects (Holland, 1996).

In Focus on Education, a Region B/2 Title 1 Technical Assistance Center Newsletter, Angela Sekston, Editor, reports on Anita Williams, who returned to teaching after 12 years as a computer analyst and trainer (1995). Sekston reports that Williams looked to computer technology to free up time spent on manual record keeping tasks in order to maximize her instructional time with nearly 40 six-year-olds and that she

presently helps her colleagues at Hanstein Elementary, in Detroit, do the same so that technology can be used to solve problems and save time and money (Sekston, 1995).

Sekston goes on to report that Williams has collaborated with the principal, teachers, and other school staff to identify new applications for computer technology, has created templates of all district and school forms (attendance forms, grade books, etc.) and has developed a classroom database with records for each of her students. She reports that Williams' work has enabled teachers to add new information to the classroom database and then update school and district forms by pressing one key, quickly grouping students according to a variety of factors (Sekston, 1995).

Sekston also reports that Williams has created lesson plan templates and linked teachers' files to a master lesson plan book for the principal in order to streamline the review process and ensure confidentiality. Teachers send their plans to the principal across Hanstein's LAN; the principal composes feedback on her desktop and then routes the plans back to the teacher (Sekston, 1995).

Student Learning

Students are found to be challenged, engaged, and more independent when using technology, according to the U.S. Department of Education (Rodriguez, 1997). Furthermore, a case study by Apple Computer concluded that students provided with technology-rich environments continued to perform well on standardized tests, but were also developing a variety of competencies not usually measured (1995). Students explored and represented information dynamically and in many forms; became socially aware and more confident; communicated effectively about complex processes; became independent learners and self-starters; and knew their areas of expertise and shared that expertise with others (Apple Computer, Inc., 1995).

Rodriguez, in his speech, also refers to a RAND Corporation study which draws the conclusion that successful technology-rich schools generate impressive results for students, including improved achievement, higher test scores, improved student attitude,

enthusiasm and engagement, richer classroom content, improved student retention, and job placements (1997). A U.S. Department of Education-funded study of nine technology-rich schools concluded that the use of technology resulted in educational gains for all students, regardless of age, race, parental income, or other characteristics (Means & Olson, 1995).

Some of the most convincing data can be found in The Effectiveness of Technology in Schools '95-'96, a report published by the Software Publisher Association. Students are shown to have greater self-confidence and self-esteem, and are more motivated to learn, when using computer-based instruction. And certain software, those that develop "cognitive strategies" such as paraphrasing and drawing analogies, give students a learning advantage. Findings apply to students of all ages and skill levels (from preschool to college), with the most dramatic results occurring among special needs and low-achieving students (Software Publishers Association, 1996).

However, in his speech, William Rodriguez reported that although ninety-nine percent of K-12 Schools have computers and ninety-three percent of students use them every day, American students are less computer literate than their European counterparts (1997). He claims that most students don't spend enough time on computers each day to learn how to use them as powerful education tools. He states that the hard realities are that only four percent of schools have a computer for every five students, the ratio deemed adequate for regular use, and only nine percent of classrooms are connected to the Internet. He goes on to claim that while home computer use can partially bridge the gap for some students, it will not for others because home use is disproportionate since students from lower income families and ethnic minorities are less likely to have access to a home computer (Rodriguez, 1997).

Effectiveness of Technology

The School Technology and Readiness (STaR) Report : From Pillars to Progress was prepared by the CEO Forum on Education and Technology, a partnership of 21

leaders from education and business that set out in 1996 to determine whether the nation's schools are preparing students for the 21st century (Woodall, 1997). The pillars referred to in the title are those outlined in President Clinton's Technology Literacy Challenge: 1) hardware; 2) connectivity; 3) digital content; and 4) professional development (Salpeter, 1998). Although the report cautions against viewing technology as a panacea for all educational challenges, its premise is that "the key to creating the best possible learning environment in 21st century schools is the seamless integration of all Four Pillars throughout the curriculum" (Salpeter, 1998).

The study reported that a mere 3 percent of the nation's public schools are using technology effectively to improve student learning and that while the number of computers used for instructional purposes in public schools is growing, the majority of the machines are still outdated and inadequate (Woodall, 1997).

Julie Salpeter reports in Technology & Learning (1998) that the authors of the study, working in conjunction with Quality Education Data (QED), a forum member, conclude that the number of computers in schools is increasing steadily (with a 9-to-1 average student-to-computer ratio in 1996-97), although many funds in recent years have gone to replacing outdated computers rather than increasing totals. On the connectivity front, 65 percent of all schools had Internet access in 1996, but only 14 percent of classrooms were connected; and schools in wealthier areas were 25 percent more likely to have access than those in high poverty areas (Salpeter, 1998).

Salpeter goes on to report that the study finds that nearly 53 percent of schools are looking for more "innovative" software. Professional development is viewed by the CEO Forum as "perhaps the most critical" and, with only 13 percent of public schools mandating technology-related training for teachers, the area in which we still have the furthest to go (Salpeter, 1998).

Teacher Training

A recent report reveals that only a few teachers in a relatively small number of schools have been trained to maximize technology use in classrooms (Gatewood & Conrad, 1997). In his speech, William Rodriguez reported that American teachers receive less computer training than their colleagues in Europe and Japan. He referred to a survey done last year for IBM K-12, wherein more than half the teacher respondents said computers required too much training time, and eighty percent said they wished they were easier to use (Rodriguez, 1997). A recent study by the U.S. Office of Technology Assessment showed that 56 percent of teachers feel they need training just to adequately use a personal computer (Fischer, 1997).

Teacher education in the application of technology in the classroom is still a high priority need (Plotnick, 1995). Plotnick claims that one sign of increasing interest and action in this area is the publication of a new periodical, Journal of Technology and Teacher Education, published by the Association for the Advancement of Computing in Education. The authors are teachers and teacher educators who are actively participating in the movement toward technological "literacy" for themselves and their students. Plotnick cites the National Education Goals (1995) report that claims that despite the many changes in educational technology and student assessment strategies occurring in 1994, only half of all teachers reported any professional development opportunities in those areas.

In his speech (1997), Rodriguez also referred to the NCES, Schools and Staffing Survey of 1993-1994 which reported that only fourteen percent of public school teachers have more than eight hours of computer training in a given year. Writing in Electronic Learning in 1997, Donna Harington-Lueker reports that according to QED, Denver-based Quality Education Data, schools spent more than $3.6 billion on technology in the 1994-1995 school year and were expected to spend in excess of $4 billion in 1995-1996. She states that all told, QED reports, schools spent $94.07 per pupil on technology, but

only four percent of those expenditures, or $3.35 per pupil, went for technology training. Electronic Learning's 1995 survey of technology coordinators reported that 72 percent of respondents spent an average of 8 percent of their technology budgets on teacher training, 28 percent reported not spending any money at all on technology staff development. 66 percent of the respondents said their most recent staff-development offering was a workshop on a specific piece of software or hardware (Harrington-Lueker, 1996).

A 1994 survey by the U.S. Department of Education shows only 15 percent of the nation's teachers had at least nine hours of instruction in education technology (Moulton, 1997). Moulton also reported that while a Jostens Learning Corp. survey found 71 percent of respondents had access to computer training, only 48 percent said that training showed them how to integrate computers into instruction.

Teachers and Technology: Making the Connection, the 1995 report from Congress's now-disbanded Office of Technology Assessment, revealed that U.S. schools spend an average of 55 percent of their technology budgets on hardware and 30 percent on software, compared with 15 percent on staff development and training, half of what technology experts recommend they spend. As the report concludes, "There is little point in acquiring hardware but making no provision for teacher development and support" (Harrington-Lueker, 1996).

More than $4.3 billion was spent in 1996 on technology for America's classrooms, but a study, Technology Counts, conducted by the trade publication Education Week and the Milken Family Foundation, documents a severe lack of technology training for teachers, and a lack of actual access to computers for students (Moulton, 1997).

Harrington-Lueker (1996) reports that some states, Kentucky, Florida, Texas, and California among them, have begun to specifically target technology professional development by requiring local school districts to spend as much as 30 percent of certain state technology funds on teacher training, or by funding regional technology training centers. She goes on to report that for the last two years, Florida has pumped $55 million

a year into schools for technology. The only conditions for receiving the funds: Schools had to tie the money to their school improvement plans, and they had to spend 30 percent of it on training activities for teachers (Harrington-Lueker, 1996).

Harrington-Lueker states that despite calls for preparing teachers to integrate technology into curriculum and rethink their pedagogy, many school districts report that the bulk of the workshops they offer cover basic applications: how to use Windows, operate a Macintosh, or work an electronic gradebook (1996). She goes on to report that other districts wrestle with limited budgets, which often force them either to do without staff altogether or to choose between hiring technicians who can keep the equipment running and curriculum specialists who can address technology integration; and that where technology staff development programs do exist, they often rely in large part on goodwill and an army of volunteers (Harrington-Lueker, 1996).

Judy Salpeter, writing in Technology & Learning (1998), cites a recently released report, Technology and the New Professional Teacher: Preparing for the 21st Century Classroom, that warns that teacher education graduates are not fully prepared to use technology. Commissioned by the National Council for Accreditation of Teacher Education (NCATE), a Washington, D.C.-based coalition of 30 professional organizations that sets teacher education standards and accredits some 500 institutions, the independent report concludes that it is still possible for teachers to become certified without showing much proficiency in the use of technology (Salpeter, 1998).

Salpeter goes on to report that the researchers found that technology is too often treated as an add-on to the teacher education curriculum, and encouraged NCATE to require that technology be fully integrated across entire teacher preparation programs. The report concludes that since the nation's schools expect to hire approximately two million new teachers in the next 10 years, failure to prepare teacher education graduates to use technology effectively and wisely will cause billions of dollars invested in education technology initiatives to go to waste (Salpeter, 1998).

Many preservice teachers have had little exposure to the use of computers and calculators in the learning of mathematics (Trueblood 1986). Thus, because teachers tend to teach in the same manner in which they have been taught (Frank 1990), new teachers are unlikely to use such technology with their own students (Quinn, 1998).

Potentially powerful and stimulating, the computer is only an inert object that can never be a substitute for the personal touch of the classroom teacher (Davis & Shade, 1994). Most teachers can feel comfortable with technology, regardless of their experience, if they are involved in planning the program, receive initial training that respects their knowledge and experience, and receive plenty of help when things do not go well (Gilstrap, 1997). Senator Nancy Kasselbaum said in, Reinventing Schools: The Technology is Now (1995), a report published by the National Academy of Sciences in 1995, that "There can be infinite uses of the computer and new age technology, but if the teachers themselves are not able to bring it into the classroom and make it work, then it fails."

District Technology Plans

Without proper integration of computers into the curriculum, the benefits of technology to foster children's learning cannot be fully achieved, regardless of the creative potential of any software used (Davis & Shade, 1994). "A key thing is that schools need to select hardware and software based on the curriculum being offered," says Brent Frey, supervisor of technology and media services, West Shore School District, New Cumberland, Pa., in American School & University (1998). He suggests that districts first determine what they want to teach with the use of technology, then choose the software that will support that curriculum, and then choose the hardware that will support the software and curriculum. Frey claims that computers and the related equipment can last longer than three to five years and that even though it may not be the most up-to-date equipment, there are still benefits to equipment even 10 years old. He reports, "We have moved these machines into our classrooms and they can still provide

some instruction on them. The machines may not be able to handle the applications of today, but the applications on them are still worthwhile" (Frey, 1998).

It is better to have a school-wide plan for implementing technology that teachers have agreed upon, rather than purchasing equipment simply to keep up with other schools (Gilstrap, 1997). Only when computers are integrated into the curriculum as a vital element for instruction and are applied to real problems for a real purpose, will children gain the most valuable computer skill -- the ability to use computers as natural tools for learning (Shade & Watson, 1990).

Need for Technology

According to Martha Woodall (1997), the data contained in the STaR Report points to a continued gap in technology availability based on race and income. She claims that the good news on race is access at school is almost even, with 51 percent of black students having access, compared with 51 percent of Hispanic students and 63 percent of white students. However, she reports that home access is different. Thirty-six percent of white students have computer access, compared with 13 percent for black students and 12 percent for Hispanics (Woodall, 1997).

Woodall claims that the most pronounced home access difference is related to income since data showed that only 11 percent of those from households making $10,000 to $15,000 had access to a computer at home, while 56 percent of the $50,000 to $75,000 income level did. She cited Cheryl Lemke, executive director of the Milken Family Foundation's Exchange on Education Technology, who said "Poor children will only get these skills at school, not at home" (Woodall, 1997).

In his speech (1997), William Rodriguez referred to BellSouth Chairman John Clendenin who said at the 1996 National Education Summit, "we will be inadequate in our response to the competitive education challenge if we do not integrate technology into the classroom . The jobs we're hiring for are technology driven. If we don't apply technology during the school year, how can we expect our graduates to acclimate to the

jobs they aspire to hold?" He also cited Getting America's Students Ready for the Twenty-first Century, a report which states that by the next millennium, sixty percent of all jobs in the nation will require skills in computer or network use.

Rodriguez reports that every thirty minutes another network connects to the Internet, nearly eight million Americans now telecommute to work, and that by the year two thousand one, the number of Internet accounts will equal the total world population. He claims that in 1995 Americans spent more on computers than on televisions and that if our schools don't interact with that world, then they cannot prepare students to live and succeed in it. He also quoted President Clinton who has said, "Today, at the dawn of a new century, in the middle of an information and communications revolution, education depends upon computers" (Rodriguez, 1997).

Chapter Three

The Design of the Study

This chapter describes the development and design of the research instrument, data collection methods, a rationale for their selection, and the procedures for data analysis.

General Description of the Research Design

This study employed a qualitative research technique in the form of a questionnaire to arrive at a better understanding of the level of expertise of the teachers who are expected to utilize technology to improve instruction and whether the use of technology applications has actually improved instruction in Deptford Township. The content of the questionnaire underwent changes as it emerged that most teachers in the study's subject pool had only cursory hands-on experience with computers. Survey respondents should be competent in providing reliable information, and survey questions should be relevant to the participants' experience (McMillan & Schumacher, 1989).

Description of the Development and Design of the Research Instrument

The instrument was drafted for this study by the researcher. A questionnaire was believed to be the most effective and efficient method of collecting data from teachers distributed throughout Deptford Township. The questionnaire was developed to address the two grand tour research questions in this study and to accommodate a wide range of participants' experience, with some questions focusing on specific computer usage, and others on inherent beliefs regarding technology use and training. The questionnaire was organized in two parts, Section A and Section B, and included a combination of short-answer and Likert-scale questions in order to add variety. Section A included questions that pertain to how teachers have acquired knowledge to incorporate

technology into instruction. Section B included questions that pertain to teachers' perception as to whether or not the availability of computers has improved instruction, software programs utilized in their individual classrooms, and demographic information regarding teaching experience.

Description of the Sample and Sampling Technique Used in the Study

The study included 100 K-6 grade teachers in Good Intent School (21), Lake Tract School (23), Oak Valley School (19), Shady Lane School (20), Pine Acres School (11), and Central School (6), all K-6 elementary schools in Deptford Township, a K-12 district. Demographic data, such as the length of time participants have taught at their grade level and length of time participants have taught, was gathered in the instrument.

The sample size was limited to the elementary classroom teachers in Deptford Township because of the many variables in studying junior high and high school teachers at the same time as elementary teachers. Additionally, the high school has had an extensive computer system and technology courses have been offered to students for several years.

Description of the Data Collection Approach

A questionnaire was distributed to each elementary school teacher to determine the level of expertise of the teachers who are expected to utilize technology to improve instruction and whether the use of technology applications has actually improved instruction (See Appendix A).

The questionnaire was distributed by the Curriculum Coordinator at a Principal's meeting. The principals were asked to have their teachers complete the survey and return it via interdepartmental mail to the writer. A cover letter explaining the rationale of the questionnaire followed distribution of the questionnaire (See Appendix B) wherein teachers were informed that participation in the study was voluntary. They were also made aware that the instruments would be used for a master's degree thesis.

Description of the Data Analysis Plan

A narrative report was written describing the results of the questionnaire. In Section A of the questionnaire, Question 1 was included to determine the number of computers in each classroom. For Questions 2-8, percentages were mathematically calculated for each of the five responses to each question to determine the level of training provided by the district. Percentages were mathematically calculated for each of the five responses to Question 9 to determine how often the Internet is used in classrooms by teachers for research purposes. Percentages were mathematically calculated for each of the five responses to Question 10 to indicate how often the Internet is used in classrooms to access curriculum materials. Percentages were mathematically calculated for each of the five responses to Question 11 to indicate how often the Internet is used in classrooms by students for research purposes. Percentages were mathematically calculated for each of the seven responses to Question 12 to determine where each teacher received his or her training. Percentages were mathematically calculated for each of the four responses to Question 13 to determine the computer-literacy level of each teacher. Percentages were mathematically calculated for each of the five responses to Question 14 to determine where teachers perceive the district's priority to provide technology training lies. For Question 15 and its six sub-questions, percentages were mathematically calculated for each of the five responses to each question to determine the conditions under which teachers would be more apt to use computers to provide instruction in their classrooms. Percentages were mathematically calculated for each of the five responses to Question 16 to determine whether teachers would mentor other teachers in integrating technology into their teaching once they received adequate training and achieved a comfort level with technology.

In Section B of the questionnaire, for Question 1, percentages were calculated to determine whether teachers believe that technology can improve instruction. For Question 2, an average time was mathematically calculated to determine how much time

is devoted for each student to use the computer in individual classrooms on a weekly basis. For Question 3, percentages were mathematically calculated to determine whether teachers use a system to their classrooms to assure student use of computers. For Question 4, a list of systems used to allow student use of computers was compiled. For Question 5, a list of software programs used by grade level was created. Grade level was determined by Question 6.

Chapter Four

This chapter addresses the first research question, "What is the level of expertise of the teachers who are expected to utilize technology to improve instruction?" and its sub-questions, 1) "Where did teachers receive training in integrating technology into the classroom?" 2) "What type of training in how to use new hardware and software has been provided by the district?" 3) "What type of demonstrations and advice on how to incorporate technology into instruction has been provided by the district?" 4) "What type of help has been provided by the district when software problems or hardware failures arise?" and 5) "What type of help in planning for technology uses and acquisitions has been provided by the district?"

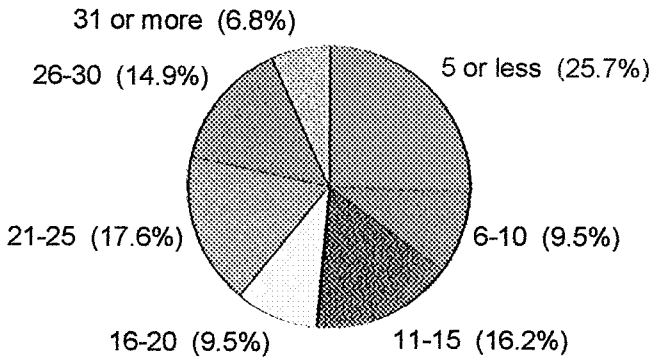
The chapter also addresses the second research question, "How has the use of technology applications actually improved instruction?" and its subquestions, 1) "Do teachers believe that technology can improve instruction?" 2) "How much time is devoted on average per week for each student to use the computer in the classroom?" 3) "Which software programs are used to enhance or improve instruction in the classroom?" 4) "How often is the Internet used in individual classrooms to enhance or improve instruction?" and 5) "How are computers used in individual classrooms?"

A total of 85 completed questionnaires (85%) were returned from the 100 questionnaires that were sent out. This return rate is considered high in circumstances where the subjects do not provide prior consent to receiving the questionnaire. However, in the present study, the questionnaires were sent to the teachers via the Curriculum Coordinator who asked the building principals to distribute and collect the questionnaires, leading to an expectation for a higher response rate.

The respondents represent a wide range in years of teaching experience as Chart 1 illustrates. As illustrated in Figure 1, the highest number of teachers surveyed have five or less years of teaching experience. Slightly more than half of the teachers surveyed have been teaching for 15 years or less.

Figure 1

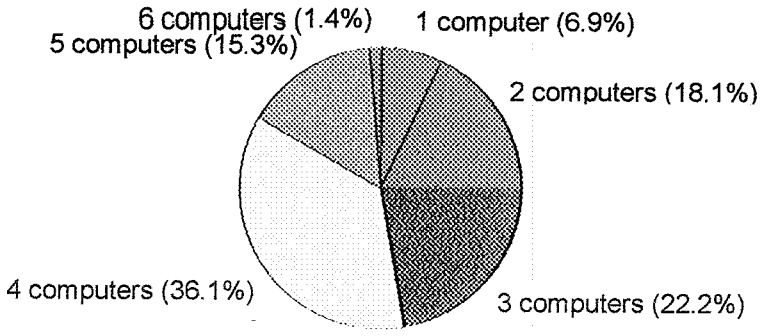
Years of Teaching Experience



As illustrated in Figure 2, there is an inequitable number of computers in individual classrooms, ranging from one computer to six computers. Most teachers surveyed indicated that they have four computer in their classroom.

Figure 2

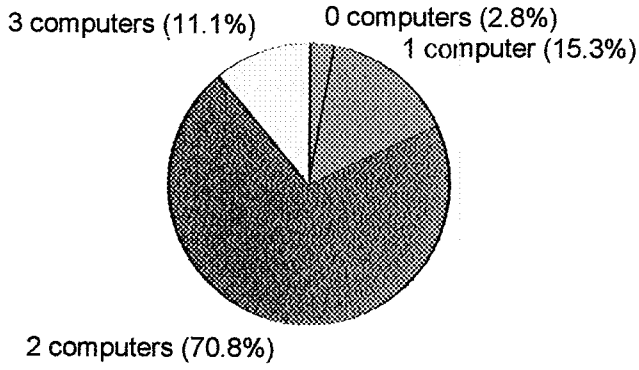
Number of Computers in Classroom



As illustrated in Figure 3, most of the teachers surveyed have two computers in their classroom with Internet access.

Figure 3

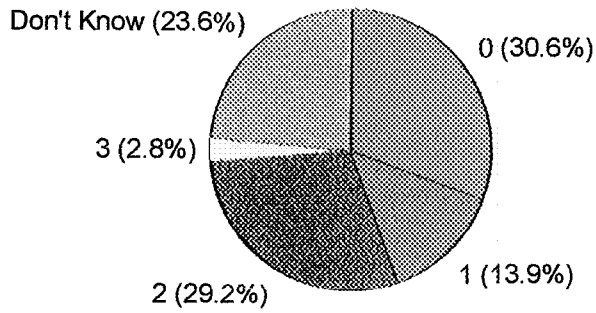
Computers with Internet Access



As illustrated in Figure 4, most teachers either have no computers in their classroom networked to the school's library or don't know if they have any computers in their classroom networked to the school's library.

Figure 4

Number of Networked Computers



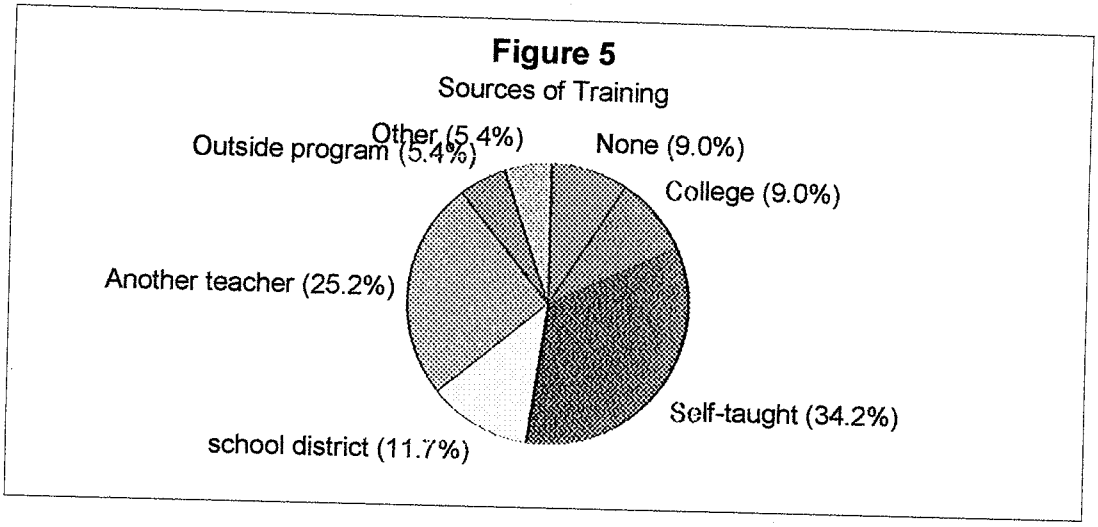
First Research Question and Subquestions

When asked to describe their level of expertise in technology, only 1% of the teachers surveyed consider themselves to be extremely computer literate and able to solve most problems themselves. Most of the teachers surveyed (53%) feel that they are able to manage as long as everything runs correctly, a good percentage feel that they need someone to guide them through new programs (41%), and some described themselves as "not having a clue" (4%).

The source of the teachers' training in technology is varied, as illustrated in Figure 5. Most of the teachers surveyed indicated that they learned how to integrate technology into the classroom on their own and were self-taught or trained by another teacher/colleague. 9% of the teachers surveyed indicated that they have received no training at all.

Figure 5

Sources of Training

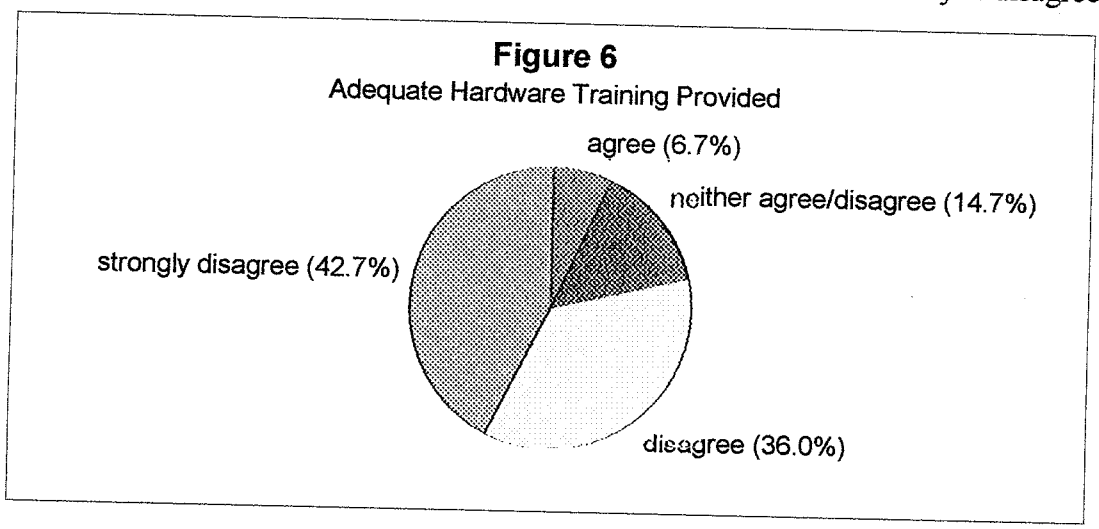


71% of the teachers surveyed indicated that they had a computer at home with Internet access, 2% had a computer but no Internet access, 4% planned to get a computer with Internet access, and 23% did not have a computer at all.

As indicated in Figure 6, when asked whether adequate training in how to use new hardware has been provided by the district, most of the teachers surveyed disagreed.

Figure 6

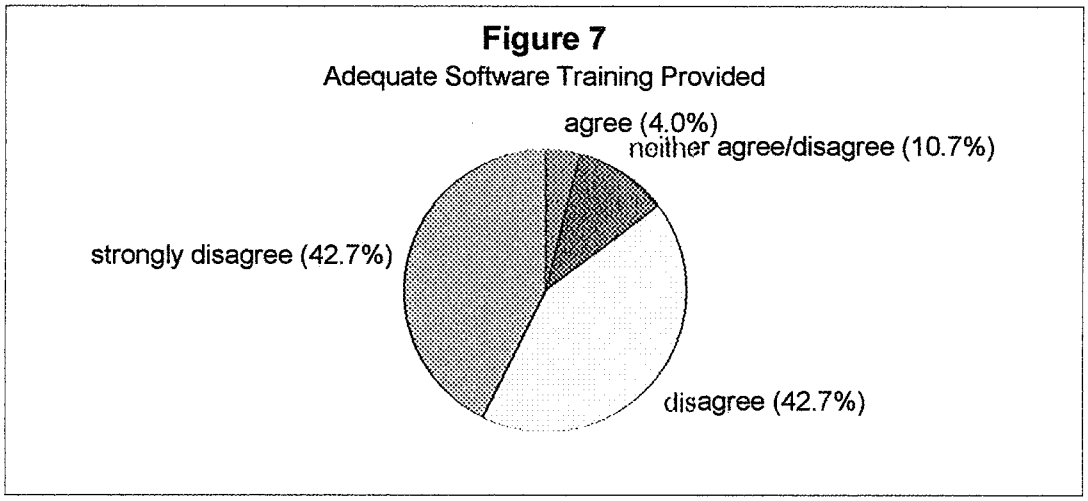
Adequate Hardware Training Provided



As illustrated in Figure 7, most of the teachers surveyed disagreed that adequate training in how to use new software has been provided by the district.

Figure 7

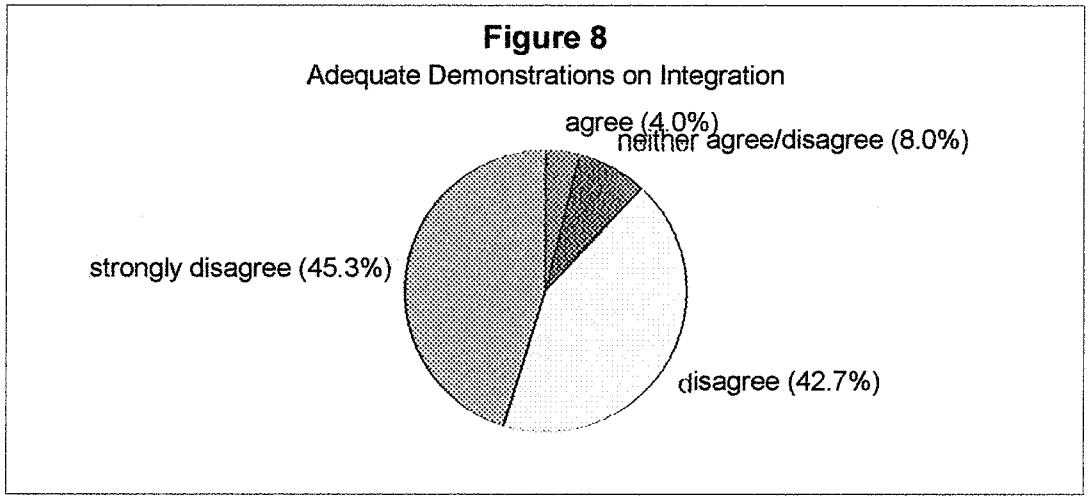
Adequate Software Training Provided



As illustrated in Figure 8, when asked whether adequate demonstrations on how to incorporate technology into instruction have been provided by the district, most teachers disagreed.

Figure 8

Adequate Demonstrations on Integration



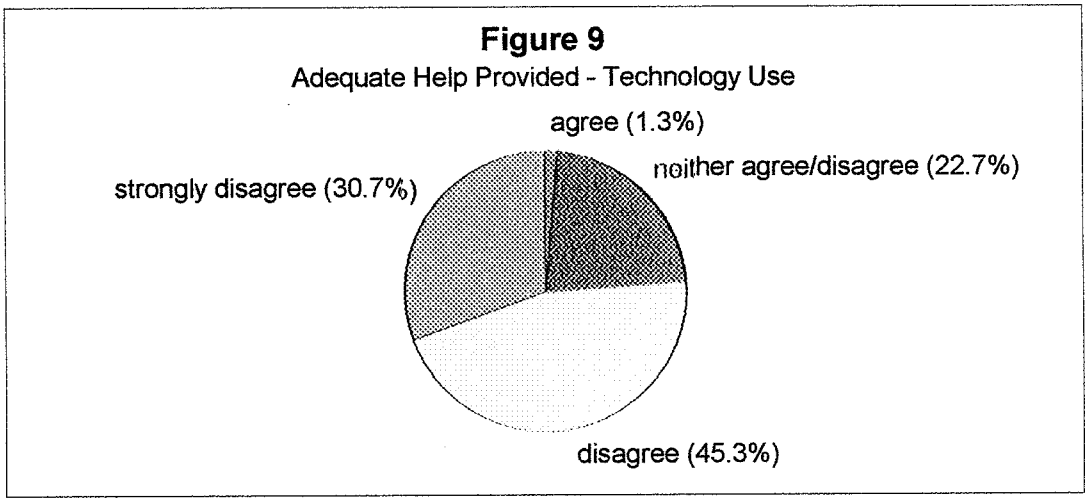
When asked whether adequate advice on how to incorporate technology into instruction has been provided by the district, most teachers surveyed (41%) strongly disagreed, 40% disagreed, 12% neither agreed nor disagreed, and 7% agreed.

When asked whether adequate help has been provided by the district when

hardware failures arise, most teachers surveyed (31%) disagreed, 25% strongly disagreed, 19% neither agreed nor disagreed, 23% agreed, and 3% strongly agreed.

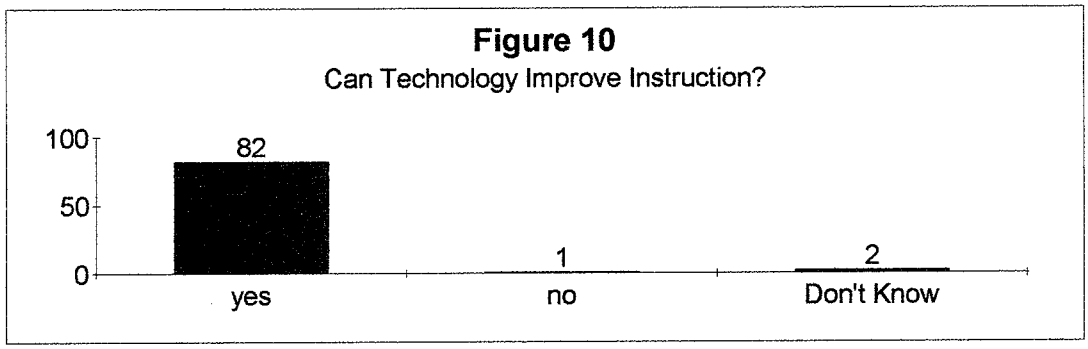
When asked whether adequate help has been provided by the district when software problems arise, most teachers surveyed (37%) disagreed, 21% strongly disagreed, 25% neither agreed nor disagreed, 15% agreed, and 1% strongly agreed.

As illustrated in Chart 9, when asked whether adequate help in planning for technology uses and acquisitions has been provided by the district, most teachers surveyed disagreed.



Second Research Question and Subquestions

As illustrated in Figure 10, an overwhelming majority of teachers surveyed indicated that they believe that technology can improve instruction.



When asked how much time was devoted on average per week for each student to use the computer in their classroom, teachers replies were varied, as indicated in Table 1.

Table 1	
Teachers	Time Allotted for Students to Use Computers
25%	It varies, depending on assignments
17%	30 minutes
12%	15 minutes
6%	Very little
6%	20 minutes
6%	N/A
4%	15 minutes every other week, if that
4%	60 minutes
4%	1-2 hours
2%	5 minutes
2%	10 minutes maximum, if that
2%	4 students per week for 15 minute session
2%	40 minutes
2%	50 minutes
2%	30-60 minutes
2%	2-3 hours
2%	3-4 hours

Many software programs that are used to enhance or improve instruction in the classroom were listed, along with an indication of whether or not the teachers feel that these programs have improved student learning, as illustrated in Table 2.

Table 2 - Kindergarten Software Programs			
Program	Skill Addressed	Grade Level	Has Improved Learning
Allies Activity Kit	reading and math	K-2	yes
BusyTown/Richard Scarry	basic reasoning	K	yes
Dr. Seuss	reading readiness	K	yes
Jump Start Math	math readiness	K	yes
JumpStart Kindergarten	basic reasoning & skills	K	yes
Kidsoft Select's Read with Me	letter, number, color and shape recognition; size relationships	K	yes
Reader Rabbit 1	letter recognition; rhyming; spelling; beginning/ending sounds	K	yes
Reader Rabbit Kindergarten	reading, math, early thinking skills	K	yes
Ready to Read with Pooh	reading readiness	K	yes
The Farm	social studies	K	yes

Programs that are being used in various first grades throughout the district, the skill each program addresses, and whether or not the teacher feels that student usage of the program has improved student learning are indicated in Table 3.

Table 3 - First Grade Software Programs

Program	Skill Addressed	Grade Level	Has Improved Learning
Addition & Subtraction	addition and subtraction	1	possibly
Allies Activity Kit	reading and math	K-2	yes
Arthur's Teacher Trouble	multi	LD1-4	yes
Body Park	health	LD1-4	yes
Bodyland	science/health	1	yes
Encarta 97	research	1	yes
Explorapedia	habitats	1-4	yes
Fine Artist Entertainment Pack	visual/motor	1-4	yes
Flexitutor Spelling	spelling	SE1-5	yes
Garfield	fun	LD1-4	no
Gus Goes to Cyperopolis	multiple skills	LD1-4	yes
Insects	various insects	1-4	yes
James Discovers Math	math skills	1	yes
Jill of the Jungle	fun	LD1-4	no
Jump Start 2nd grade	multiple skills	LD1-4	yes
JumpStart First Grade	various skills	1	yes
Kids Works	reading; language arts	1	yes
Kids Works Deluxe	reading	1	yes
Lenny's Time Machine	multiple skills	LD1-4	yes
Living Books (8)	reading	1	yes
MacMillan McGraw Hill	reading program	1	yes
Madeline 1st & 2nd Grade	reading, language, social studies	1	yes
Math Rabbit	math	1	yes
Montessori Math	math	1	yes
Mother Goose (Sierra)	reading	1	yes
My First Encyclopedia	research	1	yes
Phonics Fun	phonics	1	yes
Print Shop		K-6	yes
Puzzlemania	problem solving	1-4	yes
Reading Blaster	reading	1	possibly
Rex	fun	LD1-4	no
School House Rock 1st & 2nd Grade	math; science	1	yes
Soccer Dinosaurs	dinosaurs	1-4	no
Sticky Bear Math	math	K-2	yes
Sticky Bear Reading	phonics, letter recognition	LDI	yes
Talking Flashcards	counting, map skills, shapes, vocabulary, colors	LDI	yes
The Animals	reading	1	yes
Treehouse (Broderbund)	reading, math, science	1	yes
Word Rescue	reading	SE1-5	yes
Young Student Reference	library skills	1-4	yes

Programs that are being used in various second grades throughout the district, the skill each program addresses, and whether or not the teacher feels that student usage of the program has improved student learning are indicated in Table 4.

Table 4 - Second Grade Software Programs

Program	Skill Addressed	Grade Level	Has Improved Learning
Accelerated Reader	comprehension	2	yes
Allies Activity Kit	reading and math	K-2	yes
Arthur's Teacher Trouble	multiple skills	LD1-4	yes
Body Park	health	LD1-4	yes
Explorapedia	habitats	1-4	yes
Fine Artist Entertainment Pack	visual/motor	1-4	yes
Flexitutor Spelling	spelling	SE1-5	yes
Garfield	fun	LD1-4	no
Grammar Games	grammar	2-4 SE	yes
Gus Goes to Cyperopolis	multiple skills	LD1-4	yes
Insects	various insects	1-4	yes
Jill of the Jungle	fun	LD1-4	no
Jump Start 2nd grade	multiple skills	2	yes
Kid Phonics 2	phonics	2	don't know
Lenny's Time Machine	multiple skills	LD1-4	yes
Magic School Bus Dinosaurs	science - dinosaurs	2	no evidence
Math Workshop Deluxe	math skills	2	yes
Math Blaster	addition	2	no
Mathtown/MathSplash	math skills	2	no evidence
Puzzlemania	problem solving	1-4	yes
Read, Write, Type	keyboard skills	2	no evidence
Reader Rabbit's Interactive Reading Journ	reading/phonics	2	yes
Reading Blaster	reading/phonics	2	yes
Reading Journey 1	reading skills	2	no evidence
Rex	fun	LD1-4	no
Soccer Dinosaurs	dinosaurs	1-4	no
Spelling	spelling	2	no
Spelling Blizzard	spelling	2-4 SE	yes
Sticky Bear Math	math	K-2	yes
Sticky Bear Reading	reading	K-2	yes
Story Web	reading/phonics	2	yes
Storybook Weaver	reading/writing skills	2	no evidence
The Amazing Writing Machine	writing skills	2	no evidence
Treehouse	multiple skills	LD1-4	yes
Underwater Math Adventure	math facts	2	don't know
Underwater Reading Adventure	phonics	2	don't know
Word Rescue	reading	SE1-5	yes

Programs that are being used in various third grades throughout the district, the skill each program addresses, and whether or not the teacher feels that student usage of the program has improved student learning are indicated in Table 5.

Table 5 - Third Grade Software Programs

Program	Skill Addressed	Grade Level	Has Improved Learning
Animated Math	math facts	3	yes
Animated Words	reading/spelling	3	yes
Arthur's Teacher Trouble	multiple skills	LD1-4	yes
Big Math Attack	math facts/speed	3	yes
Bit Bot's math	multiplication	3	not sure
Body Park	health	LD1-4	yes
Brain Quest	general knowledge	3	yes
Country Fair Phonics	vowels and consonants	3	yes
Explorapedia	habitats	1-4	yes
Fashion Cave Math	money	3	yes
Fine Artist Entertainment Pack	visual/motor	1-4	yes
Flexi-Tutor Math	math skills	3	yes
Flexi-Tutor Spelling	spelling	3	yes
Football Rounding	rounding	3	yes
Garfield	fun	LD1-4	no
Geography	map skills	3	yes
Grammar Baseball	grammar	3	yes
Grammar Games	grammar	2-4 SE	yes
Gus Goes to Cyperopolis	multiple skills	LD1-4	yes
Insects	various insects	1-4	yes
Intergalactic Drill	multiplication and division	3	yes
Jill of the Jungle	fun	LD1-4	no
Jump Start 2nd grade	multiple skills	LD1-4	yes
Language Worksheets	grammar	3	yes
Leap Frog Math	Addition/subtraction facts	3	yes
Learning to Spell Speedway	Spelling	3	yes
Lenny's Time Machine	multiple skills	LD1-4	yes
Math Blaster	addition, subtraction	3	yes
Math for Real People	math skills	3-5	yes
Number Muncher	all operations	3	yes
Print Shop	desktop publishing	3-5	yes
Puzzlemania	problem Solving	1-4	yes
Reader Rabbit 1,2,3	reading/phonics	3	yes
Reading Blaster	reading	3-5	yes
Rex	fun	LD1-4	no
San Diego Zoo - The Animals	science	3	yes
Soccer Dinosaurs	dinosaurs	1-4	no
Spelling Blizzard	spelling	3	yes
Spellosaurus	spelling	3	yes
Storybook Weaver Deluxe	comprehension	2-4 SE	yes
Time, Money, Measurement	math skills	3	yes
Treehouse	multiple skills	LD1-4	yes
Underwater Reading Adventure	reading	3	yes
Word Munchers	grammar	3	not sure
Word Rescue	reading	SE1-5	yes
World Book	reference skills	3	yes
Young Student Reference	library skills	1-4	yes

Programs that are being used in various fourth grades throughout the district, the skill each program addresses, and whether or not the teacher feels that student usage of the program has improved student learning are indicated in Table 6.

Table 6 - Fourth Grade Software Programs

Program	Skill Addressed	Grade Level	Has Improved Learning
2-digit Subtraction	subtraction	4	no
Arthur's Teacher Trouble	multi	LD1-4	yes
Body Park	health	LD1-4	yes
Drawing Conclusions	reading	4	no
Explorapedia	habitats	1-4	yes
Fine Artist Entertainment Pack	visual/motor	1-4	yes
FlexiTutor Spelling	spelling	4	yes
Garfield	fun	LD1-4	no
Geo Safari	science	4	yes
Grammar Games	grammar	2-4 SE	yes
Gus Goes to Cyperopolis	multiple skills	LD1-4	yes
Insects	various insects	1-4	yes
Instructional Fair	spelling and reading	4	yes
Jill of the Jungle	fun	LD1-4	no
Jump Start 2nd Grade	multiple skills	LD1-4	yes
Lenny's Time Machine	multiple skills	LD1-4	yes
Math Blasters	math skills	4	yes
Math for Real People	math skills	3-5	yes
Multiplication	multiplication tables	4	yes
Oregon Trail	social studies	4	no
Print Shop	desktop publishing	3-5	yes
Punctuation	grammar	4	yes
Puzzlemania	problem Solving	1-4	yes
Reading Blaster	reading	4	don't know
Rex	fun	LD1-4	no
Science Discovery Works	science	4	yes
Soccer Dinosaurs	dinosaurs	1-4	no
Spelling Blizzard	spelling	2-4 SE	yes
Storybook Weaver Deluxe	comprehension	2-4 SE	yes
Treehouse	multiple skills	LD1-4	yes
Underwater Reading Adventure	reading	4	yes
Word Rescue	reading	SE1-5	yes
Young Student Reference	library skills	1-4	yes

Programs that are being used in various fifth grades throughout the district, the skill each program addresses, and whether or not the teacher feels that student usage of the program has improved student learning are indicated in Table 7.

Table 7 - Fifth Grade Software Programs			
Program	Skill Addressed	Grade Level	Has Improved Learning
Accelerated Reader	reading	5-6SE	yes
Challenge of Ancient Empires	thinking	5	some improvement
Electronic Jigsaw		5	some improvement
Flexitutor Spelling	spelling	SE1-5	yes
Fraction Attraction	fractions	5	some improvement
Jump Start 5th Grade	thinking	5	some improvement
Math Blaster	computation	5	some improvement
Math Blaster Mystery	problem solving	5	some improvement
Math for Real People	math	3-5	yes
Oregon Trail	social studies & thinking skills	5	some improvement
Print Shop	desktop publishing	3-5	yes
Programs for Math, English on the Internet		5	No data available
Reading Blaster	reading	3-5	yes
Sim City	thinking skills	5	some improvement
Spellbound	spelling	5	some improvement

Programs that are being used in various sixth grades throughout the district, the skill each program addresses, and whether or not the teacher feels that student usage of the program has improved student learning are indicated in Table 8.

Table 8 - Sixth Grade Software Programs			
Program	Skill Addressed	Grade Level	Has Improved Learning
Accelerated Reader	reading	5-6SE	yes
Africa Trail	social studies	6	yes
Amazon Trail	social studies	6	yes
Brain Quest	general knowlefge	6	yes
Math for the Real World	problem solving	6	yes
Math Munchers	math	6	yes
MS Word	word processing	6	yes
Science Processor	problem solving/ science application	6	yes
Word Munchers	grammar	6	yes

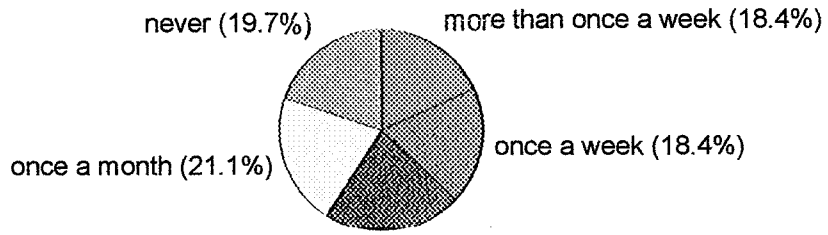
Programs that are being used in various kindergartens to sixth grades throughout the district, the skill each program addresses, and whether or not the teacher feels that student usage of the program has improved student learning are indicated in Table 9.

Table 9 - K-6 Software Programs			
Program	Skill Addressed	Grade Level	Has Improved Learning
Print Shop		K-6	yes
Reader Rabbit 1,2,3	reading/phonics	K-6	not significantly
Math Blaster	math skills	K-6	yes
Tackle English	grammar	K-6	yes
Ultimate Writing	writing/word processing	K-6	yes
Alpha Betty	readiness	K-6	yes
IBM Math	math facts and operations	K-6	yes
Treasure Math Storm	math skills	K-6	yes
Mario Teaches Typing	keyboarding	K-6	not significantly

As indicated in Figure 11, most teachers indicated that they used the Internet in their classroom for research purposes once a month or more than once a month.

Figure 11

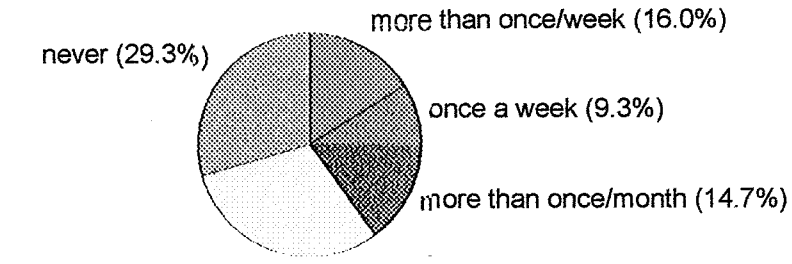
Teacher Use of Internet for Research



As indicated in Figure 12, when asked how often they use the Internet in their classroom to access curriculum materials, most teachers indicated that they use it once a month.

Figure 12

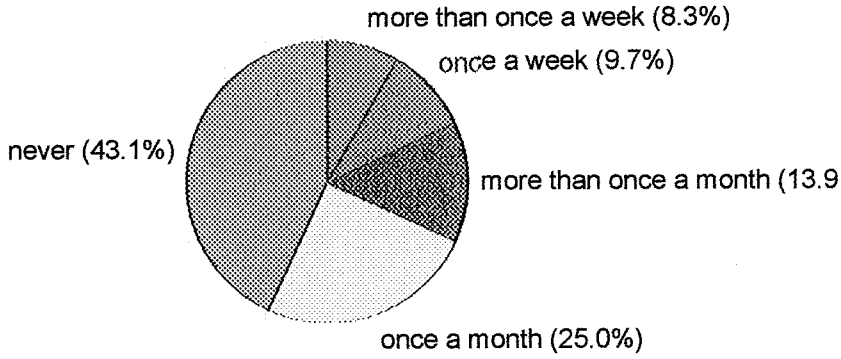
Teacher Use of Internet for Curriculum



As indicated by Figure 13, when asked how often their students use the Internet in their classroom for research purposes, most teachers indicated that their students never use the Internet in their classroom for research purposes.

Figure 13

Student Use of Internet for Research



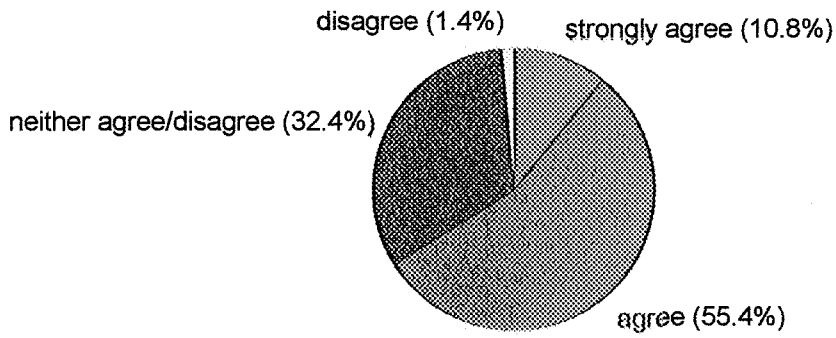
Most teachers (65%) indicated that they did have a system for allowing students to use computers in their individual classrooms. Various systems that are used are indicated in Table 10.

Table 10 - Systems for Student Computer Use
Students earn computer time for good behavior and completed work - also use as a math group once a week.
Each student has a computer day every other week where they can work on the computer during independent seatwork times.
Each column has a day to use the computer. This depends on their ability to complete assignments.
During our "off" library lesson week, we buddy with the 6th graders.
Weekly session in the Library/Media Center with 5th grade students - working 1 on 1 - limited use in classroom.
4 students per week for 15 minute session during "center time".
Students have a certain day they can use the computer whenever they have free time.
In a class of 25 students, 5 students per day can use the computer during free time.
A checklist - we rotate down the list and take turns. One person on each computer. Remaining students are involved in storytime with teacher.
Behavior management system allows students to choose the computer as a reward at 10-minute intervals throughout the day.
For speed drills on facts 3-5 minutes each. For writing reports 15 minutes per child.
In regular instances students are broken into regular groups and use computers on a given day. When researching we do it by need and take turns.
We use the computer for assignments and take turns; educational games in free time by rows.
We're in groups (small class of 13) and then rotate. We usually have 3 groups. This can work because I have a small class. We're doing more as the year progresses.
Students are assigned to a computer group- a different group gets to use the computer each day.
Every day different students are chosen to use the computer. It is theirs for the day.
Upon finishing classwork, students may choose to work on the computer. However, while working on certain skills (multiplication facts) allo students use the computer during math class.
Rotation of groups (Teacher-Aide-Computers-Centers-Independent Seatwork) Students rotate through these areas daily. They are also the most popular choice for earned free time.
Students are assigned a day to use the computer in the morning and during free time
When time is available, mostly before class starts.
It is one of the learning centers. During center time certain students are assigned each day,
Usually in the morning as a center on a rotating basis.
There is a rotating list of computers/students.
Students rotate by groups in the classroom - the computer is a station.
10-15 minutes in the morning if students get to school early.
Time is set aside daily to type/save to disk a journal. Also several afternoons they have to search (scavenger hunt) for a specific topic.
There is a computer schedule indicating time that each child can use the computer.
Group projects and drill work.
When there is time, I allow slower students - more organized, brighter students who finish work quicker probably get more time - unfair, but I feel basics must be understood and underway first.
Each student has an assigned day to use the computer for 15-20 minutes.
1-1 assistance when time allows. Not often.
Teacher working with computer students - others reading a book with a buddy. Friday morning after reading test is taken all have a chance to use a computer with a buddy - rotate groups.
Always when other work is completed. Used daily to reinforce spelling and math. Word processing used daily.
25 students in class - a group of 5 students use the computer on a specific day - rotate everyday. They are allowed to use Internet and preselected educational games.
All use them when a particular assignment is due. Otherwise, 15 minutes computer passes are earned.
2 students a day may use the computer. I have 26 students.
Daily by rows.
Monday - group 1; Tuesday - group 2; etc. Each group has about 5 students. They use the computer during their free time.
Students use word processor to compose messages and write stories. Each child works with a buddy for given amount of time (10-15 minutes).
Mainly used on as-need basis - word processing, drill of facts - when we research a topic on the Internet. Occasionally as reward for finished work.
Behavior mod program and, when seatwork is complete - center area time is allowed.

As indicated in Figure 14, most teachers agreed that they would be more apt to use technology in their teaching if they could find and collaborate with colleagues who teach on their grade level.

Figure 14

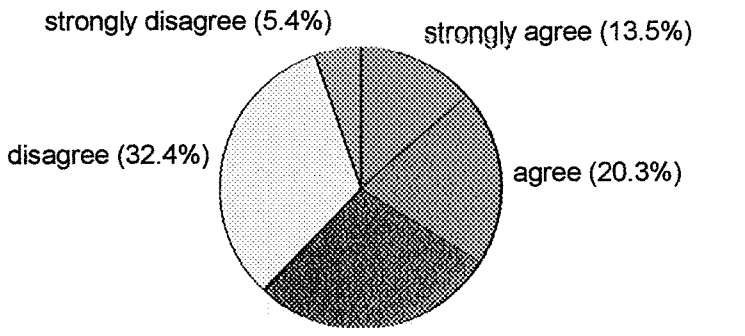
Collaboration with Grade-level Teachers



As indicated in Figure 15, most of the teachers surveyed disagreed that they would be more apt to use technology in their teaching if they had more computers in their classrooms.

Figure 15

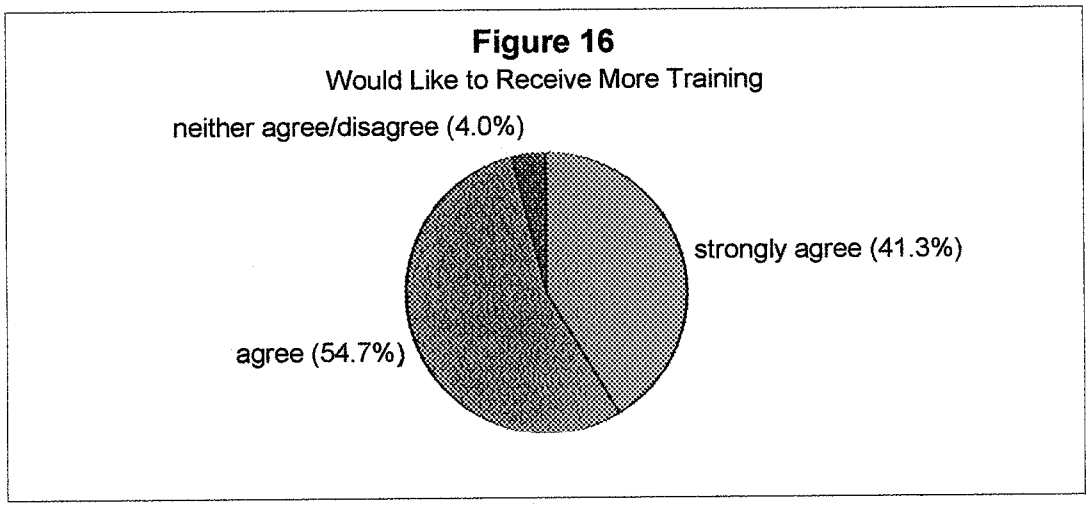
More Computers in Classroom



As indicated in Figure 16, most of the teachers surveyed agreed that they would be more apt to use technology in their teaching if they received more technology training.

Figure 16

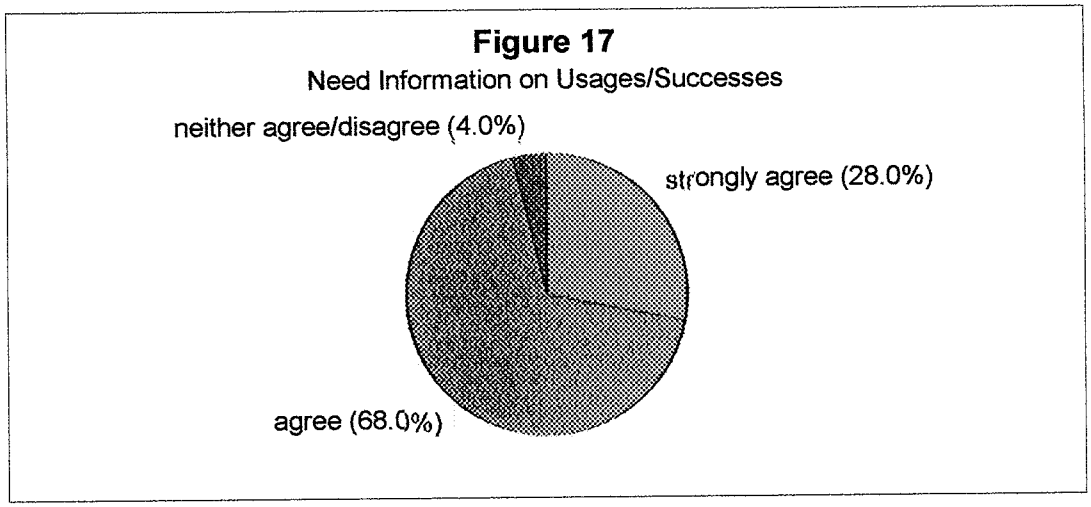
Would Like to Receive More Training



As indicated in Figure 17, most of the teachers surveyed agreed that they would be more apt to use technology in their teaching if they had information on best usages and/or successes of technology integration into instruction.

Figure 17

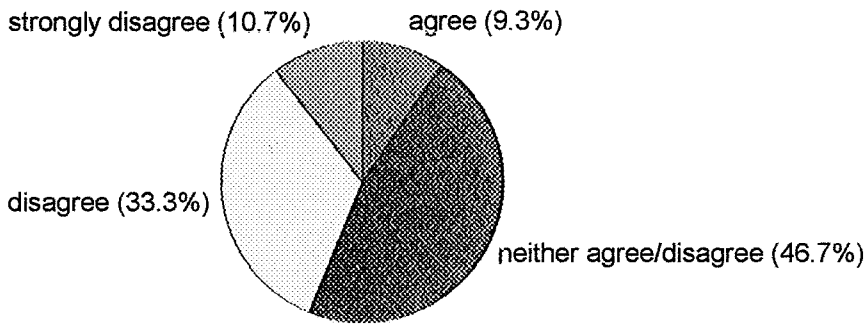
Need Information on Usages/Successes



As indicated in Figure 18, most of the teachers surveyed neither agreed nor disagreed that they would be more apt to use technology in their teaching if they received recognition and rewards for their technology work.

Figure 18

Need to Receive Recognition & Rewards

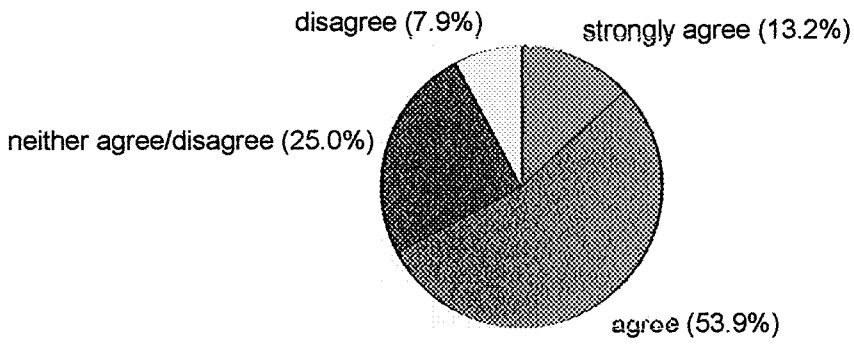


Most of the teachers surveyed (62%) agreed that they would be more apt to use technology in their teaching if they got more direct support from the technology experts in their school or district. 27% strongly agreed that they would be more apt to use technology in their teaching if they got more direct support from the technology experts in their school or district, and 9% neither agreed nor disagreed.

As indicated in Figure 19, most of the teachers surveyed agreed that once trained and having achieved a comfort level with technology, they would mentor other teachers in integrating technology into their teaching.

Figure 19

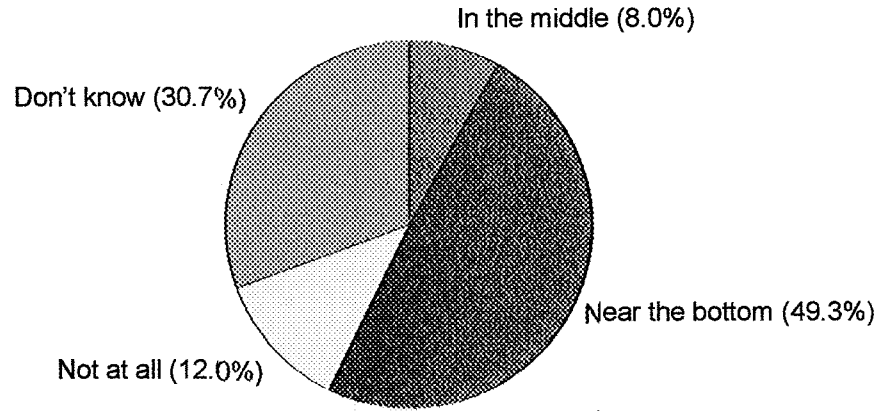
If Trained, Would Mentor



As indicated in Figure 20, most of the teachers surveyed indicated that their perception was that technology training for teachers was near the bottom in the school district's priorities. None of the teachers surveyed felt that technology training for teachers ranked near the top in the school district's priorities.

Figure 20

District's Priority for Tech. Training



Chapter Five

Conclusions

The research presented here was conducted to determine whether the computers that have been placed in elementary teachers' classrooms in Deptford Township have caused an improvement in instruction. It is important to understand the concerns that teachers feel as they begin using technology in their classrooms. The study examined two grand tour questions and their sub-questions. The following is discussion regarding the second grand-tour question and its subquestions.

> 1. What is the level of expertise of the teachers who are expected to utilize technology to improve instruction? Where did teachers receive training in integrating technology into the classroom? What type of training in how to use new hardware and software has been provided by the district? What type of demonstrations and advice on how to incorporate technology into instruction has been provided by the district? What type of help has been provided by the district when software problems or hardware failures arise? What type of help in planning for technology uses and acquisitions has been provided by the district?

The data collection reveals that the majority of elementary teachers surveyed described their level of expertise regarding technology as "able to manage as long as everything runs correctly" and/or "need someone to guide me through new programs".

It also reveals that the majority of elementary teachers in the district primarily learned how to use technology on their own or from another teacher or colleague.

The data collection also revealed that most teachers in this study, 73%, have invested in personal home computers. Whether the work involves a computer or not, it is very common for teachers to spend time on school work beyond the school day. Home access creates more opportunities for teachers to work on technology projects, learn new technology skills, or do teacher productivity chores at their convenience. Home access may account for the teachers' feeling that they primarily learned technology on their own, even though many teachers indicated that they had also taken college courses.

The data collection further reveals a high dissatisfaction with the type and amount of technology training and/or help that has been offered by the district. Since there were no records of technology inservices offered by the district, the researcher has attempted to reconstruct the inservices offered over the past five years from memory and interviews with teachers and the previous Supervisor of Curriculum and Instruction (K-12). During the 1998-99 school year, no inservices were offered in technology.

A three-credit graduate level course from Rowan University was offered by the district during the 1997 fall semester. Approximately 100 teachers enrolled in the course. Three separate classes were held after school from 3:30 to 7:00. Each class met once a week at the high school. The district paid for these courses and spent approximately $75,000.00. The courses focused on training teachers in computer awareness and lesson development using Microsoft Office.

During the 1996-97 school year, an inservice was held for the entire district. Dale Hicks, an educational technologist from Rowan University, ran the inservice. At the same time, an inservice was held at Good Intent School. Basic word processing skills were demonstrated and teachers were given hands-on experience in cutting and pasting in word processing documents, creating graphs and averaging in spreadsheets, using Microsoft Office.

During the 1995-96 school year, an inservice was held for elementary teachers on how to evaluate software programs. The presenter was from EIRC (Educational Information Resource Center) and distributed excerpts from magazines that rate software programs. Teachers were encouraged to take courses at EIRC for further training.

During the 1994-95 school year, the researcher held two workshops at Good Intent School for teachers who volunteered to attend. The focus of the workshops was on operating Windows 3.1 and word processing in Microsoft Works 3.0. During the 1993-94 school year, workshops on how to operate WordPerfect were offered at the high school on both a beginning and intermediate level.

The data collection further revealed that most teachers are dissatisfied with the help that they have received when they encounter software or hardware failures. Currently, the system for obtaining technical help when software problems or hardware failures arise is for the teacher to request a computer repair form from the principal during his or her prep time or lunch time, fill it out, have it approved by the principal, and mail it via departmental mail. Therefore, a simple problem might hold up a teacher for several days to several weeks because of the complexity of the current process.

Teachers have not been involved in the process of purchasing hardware but have been permitted to purchase software through their individual school budgets. Although building principals have recommended various software programs, teachers have had the freedom to order software that they feel will complement their curriculum. This has resulted in an extraordinary number of programs being used throughout the elementary schools in the district. Some of the programs that have been purchased are duplicates and some are not being used because they did not meet the expectations of the teacher.

The data collection revealed that half of the teachers surveyed felt that technology training for teachers was ranked near the bottom in the district's priorities and one-third of the teachers surveyed had no idea where it was ranked. None of the teachers surveyed felt that technology training for teachers was a top priority of the district.

The following is discussion regarding the second grand-tour question and its subquestions.

> 2. How has the use of technology applications actually improved instruction? Do teachers believe that technology can improve instruction? How much time is devoted on average per week for each student to use the computer in the classroom? Which software programs are used to enhance or improve instruction in the classroom? How often is the Internet used in individual classrooms to enhance or improve instruction? What would make teachers more apt to use technology in their teaching?

The data collection reveals that an overwhelming number of teachers, 96%, believe that technology can improve instruction. It also reveals that teachers are using the computers that have been placed in their classrooms. Although most teachers indicated that the time that students spend on computers in their classrooms varies, the average amount of time is 30 minutes per student per week. An extensive list of software programs was provided and broken down into grade-level tables. Most teachers are using the Internet for research purposes and to access curriculum materials, but 20% of the teachers surveyed never use it for research purposes and 29% never use it to access curriculum materials. Most teachers agreed that they would be more apt to use technology in their teaching if they were provided with information on web sites where they can access educational materials specific to their curriculum.

The data collection revealed various systems used in individual classrooms to allow student access to computers. The recurring theme in these systems is that students are using the computers when they have finished their other assignments or are rewarded for good behavior. Students are rotated by groups, rows, columns, etc. Unfortunately, with this type of system, slow-working students may not get to use the computers and

will not benefit from the remediation the software programs provide. Although most of the teachers surveyed indicated that their students do use the Internet for research purposes in the classroom, a high number, 43%, of students never use the Internet in their classrooms. If those students do not get time to use the Internet in their library classes, they will never have the experience of using the Internet in an educational setting.

The data collection also revealed an inequitable number of computers in elementary classrooms. Teachers have anywhere from one to three computers in their classrooms. Most teachers have two computers in their classrooms with Internet access, while some have three computers with Internet access and some have one with Internet access. A small percentage have no computer with Internet access. About one-third of the teachers surveyed have two computers networked to their school library, another one-third have no computer networked to their school library, and one-third don't know if they are networked to the school library.

The data collection revealed that most teachers would be more apt to use technology in instruction if they: 1) Could find and collaborate with colleagues who teach on their grade level; 2) Received more technology training; 3) Had information on best usages and/or successes related to technology; and 4) Got more direct support from the technology experts in their school or district. Most of the teachers surveyed agreed that, once trained and having achieved a comfort level with technology, they would mentor other teachers in integrating technology into their teaching. Becker (1994) found that exemplary computer-using teachers were more likely to be found where there was collegiality among the teachers using computers.

In summary, the researcher would conclude that technology has not improved instruction in Deptford Township to any measurable degree. It is evident that both teachers and students are using the computers that have been placed in the classrooms. Teachers overwhelmingly believe that technology can improve instruction and are incorporating computers into their classroom routines for research, remediation, and

reinforcement. However, student usage is very inconsistent from classroom to classroom and building to building. Students primarily use the computers when their classwork is finished. Additionally, the myriad number of software programs being used may or may not support the curriculum and are not used consistently across grade levels. An encouraging factor that emerged from the research is that most teachers are more than willing to receive training in technology uses and integration into instruction.

Implications

Since such a large majority of teachers believe that technology can improve instruction and indicate a strong desire to receive training so that they can effectively integrate technology into their curriculum, the researcher recommends several measures that could be adopted by the district.

Obtaining the services of an educational technologist would be advantageous for the district so that teachers could be provided with the amount and type of training that is needed while there is such a high desire among the teachers to receive such technology training. Teaching with technology requires teachers with specialized skills. The subject matter is inherently challenging, and because it is evolving and open-ended, it can never be totally mastered. Teachers who use technology in the classroom need to have some problem solving skills since there are an infinite number of technology problems, some small, some large, that can appear without notice at any given time. These problems make using computers in the classroom a stressful undertaking for teachers.

The computer has an operating system, which might be updated and changed, that the teacher should have some knowledge about in order to use the machine effectively and problem-solve small problems. There are individual applications, each requiring different knowledge and skills, running under the operating system. Since all computers in the district's elementary schools are, or are scheduled to be, connected to a network and/or LAN, another level of knowledge and skill is required to use the network

effectively and solve problems that occur as a result of problems with servers and systems.

Although computers are complex machines and require knowledge and skills to operate, knowing how to integrate them effectively into a teaching strategy or method requires an even higher skill level. New roles impose many challenges, too. The teacher must be able to launch and orchestrate multiple groups of students, intervene at critical points, diagnose individual learning problems, and provide feedback. There are classrooms in the district where teachers have risen to this challenge, but all classrooms need to consistently use technology in instruction if all students in the district are to benefit from it.

The process of acquiring computer skills occurs over a period of time and is evolutionary in nature (Becker, 1994). This type of training requires on-going sessions, weekly and/or monthly, depending on individual skill levels. The fact that teachers feel that the inservices to date have been inadequate reveals the flaws in providing district-wide inservices once or twice a year. An educational technologist could work with individuals or small groups, on an as-needed basis to bring all teachers up to a consistent level of expertise in integrating technology into instruction. Marcinkiewicz (1994) asserts that computer skills are acquired through a developmental process.

The latest study by the CEO Forum on Education and Technology reports that the number of computers in the nation's schools continues to rise, but also reports that most teachers still are not being trained in how to use them effectively. The report, "Professional Development: A Link to Better Learning," was released on February 21, 1999, at the American Association of School Administrators' national conference in New Orleans (Woodall, 1999). As discussed in Chapter Two, the report is the second in a series of four that the CEO Forum has planned as an assessment of how well the nation's schools are integrating technology to ensure students achieve higher academic standards and are equipped to meet the challenges of the 21st century. The report calls for

expanding technology training for veteran teachers and retooling college education departments to ensure they equip their graduates with the ability to integrate technology into lesson plans (Woodall, 1999).

Another benefit of training teachers in technology integration may result in students obtaining higher standardized test scores. A study released in January 1999 by Educational Testing Service, a research institute based in Princeton, New Jersey, documented a relationship between the use of technology and high scores on national standardized test. The researcher in that study, Harold Wenglinsky, found that when teachers received adequate training, they were much more likely to use computers for the higher-order thinking skills found to be most effective in the classroom (Trotter, 1998).

The level of understanding the teacher has about the technology resource itself is one factor in determining how well the teacher will be able to integrate it successfully into his or her teaching. Teachers need to have a personal comfort level using computers before they are likely to use them in the classroom. Determining the level of expertise of each individual teacher and taking the necessary steps to ensure that that teacher receives training to bring him or her to the expected level of all teachers in the district can be accomplished through the creation of individual technology plans. The educational technologist and the teacher could collaborate on the plan so that it is personal and relative to the teacher. This would eliminate a teacher not asking for help in a small or large group because of fear or embarrassment.

Additionally, an educational technologist could work with the curriculum coordinator to integrate technology into the curriculum to assure alignment with New Jersey Core Curriculum Content Standards. An educational technologist could also write sample technology lessons for teachers that correlate with the curriculum and provide teachers with web sites that complement their curriculum. Providing teachers with information on web sites where they can access educational materials specific to their curriculum could increase the percentage of teachers who use the Internet. Providing

teachers with information on web sites that complement their curriculum that are appropriate for student use could increase the number of students who use the Internet in the classrooms.

Deciding when technology is the best teaching tool to use is also important in the decision of when to integrate technology into teaching. Using technology appropriately is another important consideration that teachers must make when deciding whether to use technology as part of an instructional strategy. Providing teachers with specific lesson plans that utilize technology and support the curriculum would save time for teachers by eliminating the decision-making process for them and would also ensure that the technology is being used appropriately. The report from the CEO Forum study cautions that when technology is used inappropriately, it can have a negative effect on students (Crane, 1998). It concludes that the real strength of technology in education comes from using the right technology at the right time to meet the right objective.

Providing time is integral to any plan to train teachers to integrate technology into instruction. Planning technology lessons would be considered time-consuming for teachers because they are inexperienced in using computers in the classroom for instructional purposes. There are new classroom management issues to think through, web searches for sites and information to be found, projects to be developed, software to be loaded on machines, and problems to be solved in preparation for the lesson. All of these steps require more planning time and skills of the teacher than if they were using a traditional classroom lesson which they are more experienced in planning and teaching.

"Not enough time" is a universal constraint for all types of tasks. It is identified as a constraint in using technology by the teachers surveyed and adds complexity to the process of using and learning technology because teachers have to match their schedules to plan and develop new lessons, as well as get troubleshooting help when they are stuck. However, "not enough time" could be a contributing factor in forcing teachers to work at home or on personal time to learn or practice their technology skills.

Providing release time for teachers to receive one-on-one or small group instruction from an educational technologist would enable teachers to receive training in the skills they need to bring them to the expected level of expertise that the district desires. Offering after school workshops is another option in offering training. Since so many of the teachers surveyed indicated that they desire training, it would seem highly probable that they would attend after-school workshops . Many of the teachers surveyed attended the college course offered by the district which required three and one-half hours per week after school for a sixteen-week semester. Some teachers would require more training than others, but eventually an equitable schedule of training could be provided to all elementary teachers in the district. Applying these workshops to continuing education credits is a possibility worth exploring.

Educators around the country have told us that a lack of teacher training is the number one barrier to the effective use of technology in education. Teachers not only need access to technology, they also need to share their district's vision for using it. Involving teachers in the creation of a district technology plan would give teachers "ownership" of the need to integrate technology into instruction and would aid in creating enthusiasm for training sessions. Since most of the teachers surveyed indicated a strong desire for training, having a say in the type of training they could receive, and when it would occur, could create alignment in both the district's mission statement and the teachers' personal mission statements regarding technology.

It takes time and experience for a teacher to gain enough computer skills to be able to control all of the potential problems that could occur during a classroom technology lesson. The teachers may wait several days to get help with a technology problem or question, even if the technical support people have the same time available in the schedule as the teacher, due to the numerous impromptu problems that occur in the district during the school day. The need for technical support for teachers on-site has

been consistently identified as important to the success of integrating technology into instruction (Becker, 1994).

Teachers who are proficient in using technology for instruction and remediation and who are also proficient in solving minor hardware and software problems could be identified as "experts" in each building and given stipends to troubleshoot and/or solve on-site problems. Stipends can take the form of money, laptop computers, release time, etc., depending on finances available and expected work-load for the technology expert. On-site support could mean added cost for schools; however it appears to be an important component in the process of integrating computers into classrooms (Evans-Andris, 1996). An educational technologist could assist the district in offsetting these costs by applying for and obtaining some of the numerous grants that are available for technology training.

The district could implement a network management application that would let technical support people troubleshoot machines and systems from a remote location once they are hooked up to the network. Teachers might stop using technology when they encounter a problem that they are not able to solve. The time that the technical support is available needs to correspond with the teacher's planning time or personal time. The teacher might need help from a computer support person and the time for help has to be scheduled when both are available without students, parent meetings, or other duties that fall within the school day.

Additionally, an e-mail system can be developed wherein teachers e-mail plans to principals, thereby freeing the principal to view, approve, and/or comment on plans at times that are convenient to him or her.

The researcher proposes that teachers be supplied with a very few carefully chosen, open-ended software programs: a word processing/spreadsheet/database program; a multimedia authoring/Web publishing program; a math program that both reinforces skills and develops high-order cognitive thinking; a phonics program for primary grades to complement the reading series; a reading program that complements

the reading series; and programs that accompany the content-area texts that are used in the classrooms. When students use just a few computer tools, they have the opportunity to gain mastery and become more independent explorers and learners, building self-confidence along the way. The software programs chosen should be both remedial and able to develop higher-order thinking skills so that students of diverse abilities can use the same applications. In his study, Wenglinsky found that software applications that require students to address real-life situations are linked to higher standardized test scores (Trotter, 1998).

There are many DOS-based programs that can be utilized on older machines to remediate and reinforce basic skills. Also known as "drill and practice programs", these programs are valuable in reinforcement and remediation of basic skills. Additionally, many of these older programs are in the form of worksheets which can be used to test students' mastery of basic grammar and math skills. These computer-worksheets not only save teachers time (the computer grades them), they spark interest in the student and provide immediate remediation and practice in answering standardized-test formatted questions.

It is the researcher's hope that this study will help teachers, administrators, and other professionals working to integrate technology into instructional settings to understand the complex issues which accompany this process. As technology tools become more affordable and educational resources continue to be placed in digital formats, teachers will need to have command of technology tools as a part of the professional skills they bring to their classrooms.

As use of computers becomes routine, their support for and enrichment of the curriculum will increase. Simultaneously, a computer culture will be developed as both students and teachers turn to the computer as a tool. The focus will no longer be on the machines. While the curriculum is supported, computer literacy will be achieved. A better understanding of the needs of the teachers who are expected to incorporate

technology into their teaching will benefit not only the administrators who are able to provide for these needs, but ultimately the students who will be learning in technology-rich classrooms.

Recommendations for Further Research

Further research could investigate the effect of in-depth training on teachers' ability to incorporate technology into instruction. Efforts at utilizing technology for instruction could be compared to efforts utilized after receiving training at various intervals of time, from one training session to many, encompassing several months or years.

Another study could investigate whether students' standardized test scores have improved as a result of technology by comparing one teacher's effort to fully incorporate technology into instruction with another teacher who only marginally incorporates technology into instruction.

Another study could compare the differences in standardized test scores between students who use only drill and practice software programs to reinforce skills and students who use software programs that develop high-order cognitive skills.

Another study could investigate the reaction of students to using technology in the classroom. This may include an evaluation of the students' computer literacy, their initial and long-term responses to the variety of resources introduced in the classroom via the computer, and their interest in taking on leadership roles in the classroom as a result of the self-directed learning process.

References

Apple Computer, Inc., (1995). Changing the conversation about teaching, learning and technology: A Report on Ten Years of ACOT Research. Cupertino, CA.

Becker, H. J. (1994). How exemplary computer-using teachers differ from other teachers: Implications for realizing the potential of computers in schools. Journal of Research on Computing in Education, 26 (3), 291-321.

Clements, D. & Nastasi, B. (1993). Electronic media and early childhood education. Handbook of Research on the Education of Young Children, 51-275. New York: Macmillan.

Crane, T., (1999). Professional development: A link to better learning. Retrieved from the World Wide Web: http://www.ceoforum.org

Davis, B.C. & Shade, D.D. (1994). Integrate, don't isolate! Computers in the early childhood curriculum. ERIC Digest. Retrieved from the World Wide Web: http://www.ed.gov/databases/ERIC_Digests/ed376991.html

Evans-Andris, M. (1996). An apple for the teacher: Computers and work in elementary schools. Thousand Oaks, CA: Corwin Press, Inc.

Fischer, W. (ED.), (1997). Computer illiterate, are ya? NEA Today, 16, 3, 8.

Frank, M. L. (1990). What myths about mathematics are held and conveyed by teachers? Arithmetic Teacher 37, 5, 10-12.

Frey, B. (1998). One school makes it work. American School & University, 70, 6, T8.

Gatewood, T. E. & Conrad, S. H. (1997). Is your school's technology up-to-date? A practical guide for assessing technology in elementary schools. Childhood Education, Summer 1997, 73, 4, 249.

Gentile, C., Kuperstein, J., & Zwier, J. (1998, February). Technology roadmap. Retrieved from the World Wide Web: http://www.microsoft.com/education/k12/roadmap/chap1.asp

Gilstrap, R.L. (1997). The electrified classroom: using technology in the middle grades. Childhood Education, 73, 5, 297.

Harrington-Lueker, D. (1996). Coming to grips with staff development. Electronic Learning, 16, 1, 32-40.

Holland, H. (1996). Way past word processing. Electronic Learning, 15, 6, 22-28.

Kasselbaum, N. (1995). Reinventing Schools: The Technology is Now. Retrieved from the World Wide Web: http://www.nap.edu/readingroom/books/techgap/navigate.cgi

Marcinkiewicz, H. R. (1994). Computers and teachers: Factors influencing computer use in the classroom. Journal of Research on Computing in Education, 26 (2), 220-237.

McMillan, J., & Schumacher, S. (1989). Research in education: A conceptual introduction. London, England: Scott, Foresman and Company.

Means, B. & Olson, K. (1995). Restructuring schools with technology: challenges and strategies (Menlo Park, CA): SRI International. Vital Speeches, 63, 12, 375-379.

Moulton, A. (1997). Computers are available in schools, but many teachers lack proper training. Philadelphia Inquirer. [Newspaper, selected stories on line]. Retrieved from the World Wide Web: http://www.phillynews.com/newslibrary/newslib_pi.html

National Education Association. (1996). Software Selection. Retrieved from the World Wide Web: http;//www.nea.org/cet/BRIEFS/brief3.html

Plotnick, E. (1995). Trends in educational technology. ERIC Digest. Retrieved from the World Wide Web: http://www.ed.gov/databases/ERIC_Digests/ed398861.html

Quinn, R.J. (1998). Technology: preservice teachers' beliefs and the influence of a mathematics methods course. The Clearing House, 71, 6, 375-378.

Rodrigues, W. E. (1997). Raising the bar, lowering the barriers: improving learning through technology. Vital Speeches, 63, 12, 375-379.

Salpeter, J. (1998). Three recent reports present a snapshot of educational technology today. Technology & Learning, 18, 6, 68-70.

Salpeter, J. (Ed.) (1998). More teacher training urged. Technology & Learning, 18, 5, 29.

Sekston, A. (ed.), (1995). Transforming teaching, learning through computer technology. Focus On Education. Retrieved from the World Wide Web: http://www.ed.gov/Technology/Focus/toc.html

Sekston, A. (ed.), (1995). Computer technology helps teachers manage time, tasks at Hanstein. Focus On Education. Retrieved from the World Wide Web: http://www.ed.gov/Technology/Focus/edfocus1.html#Hanstein

Shade, D. (1996, September). Software Evaluation. Young Children, 51, 6, 17-21.

Shade, D.D., and J.A. Watson. (1990). Computers in early education: issues put to rest, theoretical links to sound practice, and the potential contribution of microwolds. Journal of Educational Computing Research, 6, 4, 375-392.

Snyder, T. (1997). Digest of Education Statistics. Retrieved from the World Wide Web: http://nces.ed.gov/pubs/digest97/d970007.html#technology

Software Publishers Association, (1996). The Effectiveness of Technology in Schools '95-'96. Retrieved from the World Wide Web: http://www.spa.org/project/edu_pub/summary.htm.

Trotter, A. (1998). Technology counts '98: Putting school technology to the test. Retrieved from the World Wide Web: http://www.edweek.org.reports/tc98/tchome.htm.

Trueblood, C. R. (1986). Hands on: help for teachers. Arithmetic Teacher 33, 6, 48-51.

U.S. Department of Education, (1998). President Clinton's call to action for American education in the 21st century: ensuring educational excellence in 1998 and beyond. Retrieved from the World Wide Web: http://www.ed.gov/updates/inits98/overview.html#7.

U.S. Department of Education (1998). White House Education Press Releases and Statements. Retrieved from the World Wide Web: http://www.ed.gov/PressReleases/08-1998/wh-0831.html

Woodall, M. (Nov. 10, 1997). Majority of PCs in schools outdated and inadequate, study finds. Philadelphia Inquirer. [Newspaper, selected stories on line]. Retrieved from the World Wide Web: http://www.phillynews.com/newslibrary/newslib_pi.html

Woodall, M. (Feb. 25, 1999). Training urged to prepaee schools for online age. Philadelphia Inquirer. [Newspaper, selected stories on line]. Retrieved from the World Wide Web: http://www.phillynews.com/newslibrary/newslib_pi.html

Appendix A

Research Instrument

Section A

1. How many computers are currently in your classroom? _____ How many of these computers have Internet access?_____ How many of these computers are networked to the library in your school?_____

2. Adequate training in how to use new hardware has been provided by the district.

_____	_____	_____	_____	_____
strongly agree	agree	neither agree nor disagree	disagree	strongly disagree

3. Adequate training in how to use new software has been provided by the district.

_____	_____	_____	_____	_____
strongly agree	agree	neither agree nor disagree	disagree	strongly disagree

4. Adequate demonstrations on how to incorporate technology into instruction have been provided by the district.

_____	_____	_____	_____	_____
strongly agree	agree	neither agree nor disagree	disagree	strongly disagree

5. Adequate advice on how to incorporate technology into instruction has been provided by the district.

_____	_____	_____	_____	_____
strongly agree	agree	neither agree or disagree	disagree	strongly disagree

6. Adequate help has been provided by the district when hardware failures arise.

_____	_____	_____	_____	_____
strongly agree	agree	neither agree nor disagree	disagree	strongly disagree

7. Adequate help has been provided by the district when software problems arise.

_____	_____	_____	_____	_____
strongly agree	agree	neither agree nor disagree	disagree	strongly disagree

8. Adequate help in planning for technology uses and acquisitions has been provided by the district.

_____	_____	_____	_____	_____
strongly agree	agree	neither agree nor disagree	disagree	strongly disagree

9. How often do you use the Internet in your classroom for research purposes?

_____	_____	_____	_____	_____
more than once a week	once a week	more than once a month	once a month	never

10. How often do you use the Internet in your classroom to access curriculum materials?

_____	_____	_____	_____	_____
more than once a week	once a week	more than once a month	once a month	never

11. How often do your students use the Internet in your classroom for research purposes?

_____	_____	_____	_____	_____
more than once a week	once a week	more than once a month	once a month	never

12. Where did you receive the most training in integrating technology into the classroom?

_____ Received no training

_____ College/university

_____ On my own, self-taught

_____ Other (please specify) _____

_____ My school/school district program

_____ From another teacher/colleague

_____ Outside training program

13. In general, I consider myself to be:

_____ Extremely computer literate - can solve problems myself

_____ Able to manage as long as everything runs correctly

_____ Need someone to guide me through new programs

_____ Don't have a clue

14. Where does technology training for teachers rank in our school district's priorities?

_____Near the top _____Not at all

_____In the middle _____Don't know

_____Near the bottom

15. I'd be more apt to use technology in my teaching, if I:

a. Could find and collaborate with colleagues who teach on my grade level.

_____	_____	_____	_____	_____
strongly agree	agree	neither agree nor disagree	disagree	strongly disagree

b. Had more computers in my classroom.

_____	_____	_____	_____	_____
strongly agree	agree	neither agree nor disagree	disagree	strongly disagree

c. Received more technology training

_____	_____	_____	_____	_____
strongly agree	agree	neither agree nor disagree	disagree	strongly disagree

d. Had information on best usages/successes.

_____	_____	_____	_____	_____
strongly agree	agree	neither agree nor disagree	disagree	strongly disagree

e. Received recognition and rewards for my technology work.

_____	_____	_____	_____	_____
strongly agree	agree	neither agree nor disagree	disagree	strongly disagree

f. Got more direct support from the technology experts in my school or district.

_____	_____	_____	_____	_____
strongly	agree	neither agree	disagree	strongly

agree nor disagree disagree

16. Once trained and having achieved a comfort level with technology, I would mentor other teachers in integrating technology into their teaching.

_____	_____	_____	_____	_____
strongly agree	agree	neither agree nor disagree	disagree	strongly disagree

Section B

1. Do you believe that technology can improve instruction? yes _____ no _____

2. How much time is devoted on average for each student to use the computer on a weekly basis? _____

3. Do you have a system for allowing students to use the computer? yes _____ no _____

4. If yes, briefly describe that system.

_____

_____

_____

5. Please list which software programs are used in your classroom, the skill each program addresses, and whether student use of the program has improved learning (use back if necessary).

Program	Skill Addressed	Has it Improved Student Learning (yes/no)

6. What grade level do you presently teach? _____

7. How long have you taught this grade level? _____

8. Years of teaching experience: 5 or less __, 6-10 __, 11-15 __, 16-20 __, 21-25 __,

26-30 __, 31 or more __

9. Do you have a computer with Internet access at your home? _____

If you would like to participate in an interview in order to build on your responses in this questionnaire, please contact me via e-mail at mcdermott.d@deptford.k12.nj.us. We can then arrange a mutually convenient date and time for the interview.

Thank you for your assistance! As a way of thanks, you will receive a detailed summary of the findings in this study.

Appendix B

Cover Letter

Denise McDermott
3rd Grade Teacher
Good Intent School
E-mail: mcdermott.d@deptford.k12.nj.us

March 5, 1999

Dear Colleague:

I am currently completing my graduate studies at Rowan University in the hopes of becoming a Technology Coordinator. I am conducting a research study to determine the level of expertise that exists among elementary teachers in our district regarding technology. This study could possibly aid in determining the amount and type of professional development that needs to be offered to teachers so that we can best utilize the computers that have been placed in our classrooms.

My survey was distributed by your building principal on March 3, 1999. I realize that another survey was distributed by the administration a week prior to mine and that you probably feel inundated with surveys. Hopefully, you will find my survey fairly simple to complete and will help me to accurately project our need for training not only on how to use appropriate software that enhances the curriculum and helps our students learn but also on how to use the computers to ease our bookkeeping tasks. Please be assured that your participation is strictly volunatry and your reply will be kept confidential. Please return the survey to me via interdepartmental mail at your earliest convenience.

Thank you in advance for your kind cooperation. If there is any way that I can help you with any technology questions you presently have, please do not hesitate to e-mail me.

Sincerely,

Denise McDermott

Biographical Data

Name	Denise A. McDermott
High School	Holy Spirit High School Absecon, New Jersey
Undergraduate	Associate in Arts Atlantic Community College Mays Landing, NJ
	Bachelor of Arts Elementary Education Glassboro State College Glassboro, NJ
Graduate	Master of Arts School Administration Rowan University Glassboro, NJ
Present Occupation	3rd Grade Teacher Good Intent Elementary School Deptford, NJ