Factors Related to Computer Use by Teachers in Classroom Instruction

by

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Dissertation submitted to the Faculty of the Virginia Polytechnic Institute and State University in partial fulfillment of the requirements for the degree of

DOCTOR OF EDUCATION

in

Educational Administration

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March, 1998
Blacksburg, Virginia

Key Words: Computer, Use, Attitude, Access, Training, Support

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(ABSTRACT)

The purpose of this study was to determine the extent to which the following factors predict computer use by teachers in classroom instruction: attitudes of teachers toward computers in the classroom, access by teachers and students to computers, training of teachers in computer use, support of teachers in their use of computers, age of the teacher, grade level in which the teacher teaches, curriculum area in which the teacher teaches, gender of the teacher, and number of years the teacher is from retirement. Computer use was measured in five ways: over-all computer use and use in drill and practice, whole class instruction, student-directed learning, and computer skills instruction.

The design of the study was both quantitative and qualitative. The population of the study was the classroom teachers of Carroll County (Virginia) Public Schools. A survey instrument was designed to measure computer use and the factors related to use. The responses from the survey were analyzed with multiple regression techniques to determine which factors were predictors of

computer use by teachers in classroom instruction. The qualitative portion of the study consisted of five focus groups (5-7 teachers from grades PreK-2, 3-5, 6-7, 8-9, 10-12). The nominal group technique was used to create a prioritized list of strategies to improve teacher use of computers by focusing on the factors determined to be predictors.

Factors that predict computer use varied by grade level. Training was the most common predictor followed by attitude, support, access, and age of teacher. The prioritized lists of strategies from the focus groups included grade and curriculum specific computer training, technology "coaches" in every building, and computer labs in every building. A major implication of the study was that training must be specifically targeted to grade level and curriculum area to be effective.

Dedication

This dissertation is dedicated to my wife, Ruby T. Blankenship, and my son, Madison Lee Blankenship, whose absolute love and support have been the foundation for all my endeavors.

Acknowledgments

The completion of this study would not have been possible without the support and guidance of many individuals. I am especially indebted to my advisor, Dr. David J. Parks. His encouragement over the past seven years kept me focused and on task. Dr. Parks is a professor who literally practices the teaching methods he teaches. His commitment to excellence in education is unequaled. I am also grateful to Dr. Dianne Yardley for co-chairing my committee. Dr. Yardley was instrumental in guiding me through the intricacies of research. She provided resources and tutelage during the analysis of the data. Dr. Steve Parson was the educational technology specialist on the committee. His insight into the educational technology issues surrounding the study were invaluable during the process. Dr. Larry Harris has been the professor who always caused me to look deeper. He made me see things differently. He was always demanding and sometimes severe in his analysis, but he always inspired me to create a better product.

Dr. Oliver McBride, Dr. Raymond Leonard, Dr. Joseph Berry, and Dr. Patricia Golding are appreciated for their support and encouragement of the degree. Their faith in my ability to succeed in the process was a major factor in my beginning and completing the process.

Dr. Wayne Worner and Dr. David Parks reminded me of my love of learning through the Regional Program for the Preparation of Principals Masters Program.

The School Leaders Program faculty and cohort members, who became my second family for three years, were both colleagues and supporters. They helped me to grow personally and professionally. A special thanks is extended to Jeanne Thomas and Douglas Arnold, who became particularly dear friends and were instrumental in helping me find the strength to finish.

Debbie Goad, Lois Goad, Lanor Ward, and Ruby Blankenship spent many hours reading and rereading the document. My heartfelt thanks is extended to each of them.

A special thanks is also extended to the administrators and particularly the classroom teachers of Carroll County Public Schools for their participation in the study. Their efforts have resulted in a better understanding of computer use in the classroom and a list of strategies to improve computer use.

Finally, a special thanks goes to all my family. My wife Ruby, is appreciated for the opportunity and resources to pursue my dreams. Ruby is the reason I have achieved any success in life. She is a life partner who understands my love for education. Lee, my son, who never let my coffee cup run empty and never made me feel guilty for missing some important events, is one of my

greatest teachers. His love of exploration and inquiry reminds me daily of the importance of education. Thanks for the love and support of my parents, William and Francis Blankenship, who instilled in me the importance of education and the belief that I could accomplish anything. My brother, Dr. Samuel Blankenship, is recognized for being an inspiration to pursue this degree. And appreciation is extended to my sister, Billie Kaye Robinette, who has shown me that parenting is an art form closely related to teaching. She is a master teacher with regard to the subject.

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CHAPTER I

THE PROBLEM AND ITS CONTEXT

If the State religion of America is Progress, then surely technology provides its icons. It is largely through the production of ever-more marvelous machines that we redeem the promise of a better tomorrow, confirm the world's perfectibility, and resorb some to ourselves and to our institutions (Hodas, 1993, p. 6).

The pressures placed on our society as it changes from a manufacturing to an informational and technological economy are well documented. Industries and businesses are hard pressed to stay ahead of the learning curve with regard to staying competitive. Computers are one of the main tools driving this change to an information age. It is within this climate that teachers are asked to prepare students for the next century by training the next generation of information "hunters and gatherers." Nationally, the push to integrate computers into our classrooms comes from government, business, and industry. President Clinton, in his 1996 State of the Union Address, announced an initiative to provide children with access to modern computers, classrooms connected to each other and the world, software that is an integral part of the curriculum, and teachers trained and

ready to use and teach technology. Business and industrial leaders have expressed the need for computer-literate graduates ready to enter the workforce (U.S. Department of Labor, 1992). Even the report of the National Association of Secondary School Principals (1996), Breaking Ranks: Changing an American Institution, stated the need to integrate technology into all aspects of the educational program.

Government, business, industry and educational leaders at the state level are placing new pressures on teachers to teach children to be knowledgeable computer users. Virginia is requiring all eighth-grade students to pass a minimal technology skills test and has implemented requirements for minimal teacher technological skills. One of the main goals in the Six-Year Educational Technology Plan for Virginia is improving student and teacher access to technological resources in the classroom. The Virginia General Assembly has included monies for technology initiatives to buy computers for classrooms for the past three biennium budgets. In recent years, Virginia governmental and economic development leaders have been actively campaigning to relocate high-tech businesses and industries to Virginia. These businesses are asking questions about the ability of local schools to produce technologically proficient workers.

The Problem

Locally, every school district in the state of Virginia is required to have an approved technology plan. These technology plans, which are approved by the local school boards, focus on the integration of computers and technology into classroom curriculum. During every budget season, school board members across the United States make decisions about spending taxpayer monies in an effort to increase the use of computers by classroom teachers in the instruction of students. Hundreds of millions of dollars are spent acquiring computers and software, repairing computers, providing staff development for teachers, paying computer support personnel (e.g., technicians, specialists, trainers), providing telephone lines, and upgrading old equipment. The Congressional Office of Technology Assessment (OTA) (1995) reported the one-time installation costs could run between $80 million and $145 billion. Training, support, and normal operational costs were estimated by the OTA report at another $160 million to $11.28 billion. These decisions are often made with little or no understanding of the factors that influence increasing the use of computers by teachers in classroom instruction. If computers and technology were not such popular "buzz words," would school board members be less inclined to spend such massive amounts of money without

documentation of specific benefits that these outlays will provide?

Purchasing hardware and software can be justified to parents, school board members, superintendents, and funding agency staffs. These hardware items are tangible, high profile, politically correct, and in vogue. Many superintendents, school board members, and funding agency staffs will approve budget expenditures for computers and technology without understanding the uses, needs, or staff issues related to these expenditures. If parents and taxpayers can *see* computers in classrooms, whether up-to-date or not, they feel as though the children are getting the "technology" they need. For school systems to enter the "computer age," they have to purchase the computers and such concomitant equipment as servers, wiring, hubs, routers, modems, scanners, and printers. However, the OTA report stated that many of the older machines do not have the capability to run current software, and many other needed technologies such as computer networks, CD-ROM's, and Internet access are not nearly as plentiful.

Purpose of the Study

The purpose of the study is to provide the Carroll County School Board members and Carroll County Public School administrators with the data and analysis to identify what factors determine computer use by teachers in classroom

instruction. The study will also provide a list of strategies and recommendations to improve computer use by Carroll County Public School teachers in classroom instruction.

Theoretical Context of the Study

It is within this context that school system administrators and teachers are expected to go about the task of educating children. Purchasing computers and hardware is a major problem facing school board members who have to contend with limited financial resources. Human factors dealing with technology are often just as important. What causes one teacher to embrace the use of computers for instruction while another teacher resists any introduction of computers? The answers may be grounded in three areas of research: school change, diffusion of innovations, and behavioral psychology. The study of change and its implementation, particularly in public school settings, will give educators a historical reference with which to compare and contrast successful versus failing change efforts. Infusing computers into classroom instruction is a major change. Does the literature on the implementation of change give any insight into the factors related to computer use in classroom instruction? A study of the research on the diffusion of innovations may offer some help in understanding the diffusion

of computers in the classroom. Is the diffusion of innovations in general an adequate model for the diffusion of computers into classroom instruction? Behavioral psychology helps researchers understand how personality interacting with environment affects behavior. Is there something about the environment of schools and the personalities of people who enter the teaching profession that helps explain the degree to which computers have been infused into classroom instruction? What follows is a brief discussion of each of these three areas of research.

School Change

School change is a popular topic of conversation and research within educational and political circles. Goodlad (1984) and Fullan (1991) suggested that while the impetus for change may be an external factor such as the national, state, and local initiatives mentioned previously in the introduction, real change must be internal and must be examined at the school and individual teacher level. Fullan (1991) described change as "... moving from an old, unsuccessful way of managing change to a new mind-set" (p. 347). This does not mean that school districts, state and federal departments of education, and political bodies cannot make major differences in the reform movement.

Means (1993) suggested that the components of educational reform are

divided into three areas: district, state, and federal; school; and classroom (individual teacher). The role of the district, state, and federal component (external) is to provide support and resources. The school provides the learning culture and the goals, but it is the individual teacher who changes the way students will learn (i.e., interactive instruction, student exploration, collaborative learning).

Means makes it clear that schools and classroom instruction are not instantly reformed with the infusion of technology. Technology is not, by itself, the savior of modern education. It is an innovation that, when infused properly within the school culture, can make a difference in the way teaching and learning are approached by both teachers and students (Bangert-Drowns, 1985).

Diffusion of Innovations

Diffusion research has as its premise the study of the infusion of an innovation into a culture. The computer is an innovation that is being diffused throughout the school culture with mixed results. Rogers (1995) depicted the beginnings of diffusion research as describing the rate at which people adopted an innovation. Later researchers began to look at reasons people adopted or refused an innovation. Reasons for refusal were often ignored in the research due to a pro-innovation bias. Many studies were funded by companies or organizations that had either financial or perceived humanitarian reasons to implement the

innovation. As reasons for refusal of an innovation became a topic of study, refusal was often found to be the result of cultural or environmental conditions. Is there a pro-technology bias in public education? This researcher comes to the study of computer use in classroom instruction with a pro-computer bias.

Another phenomenon noted by Rogers (1995) was the idea of individual-blame. Often the refusal to adopt an innovation was believed to be the refusal of individuals to accept or understand the need for the innovation. In many cases, further research determined that system-blame was, at least, a portion of the problem. The inability of the system to recognize systemic problems or cultural differences is an example of system-blame. Teachers are often blamed for the lack of innovation in schools. Hodas (1993) noted that school workers have their "... means, ends, and abilities ... regularly called into question by parents, politicians, social scientists, the business community, and any other group with an axe to grind..." (p. 4). Is there something that the system has not done that could help with the diffusion of computers into the classroom?

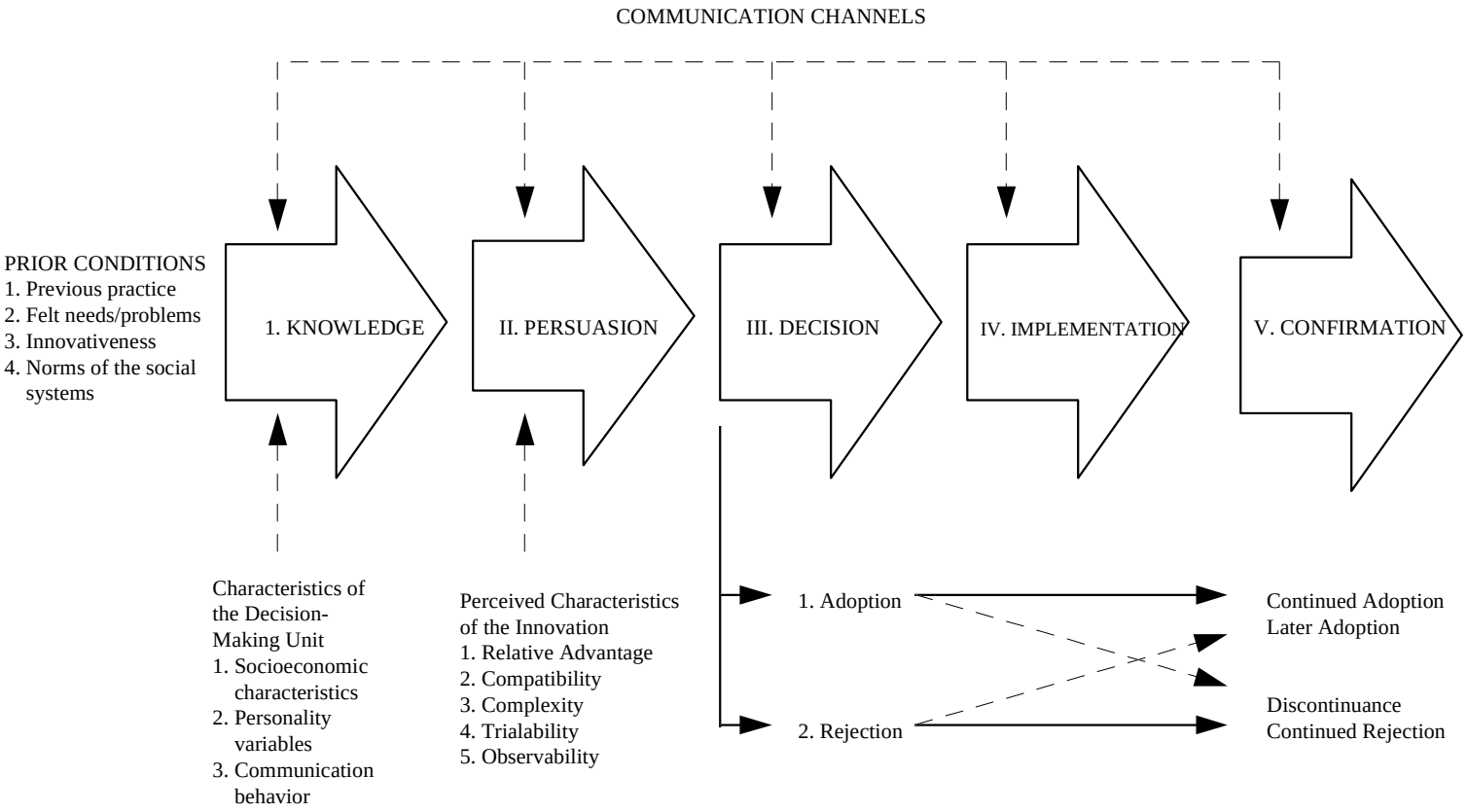
Hodas (1993) also reported that no technology is value-free, and for a new technology to be placed into an organizational culture, there must be a match of organizational and technology values. Conversely stated, if there is a lack of use by teachers of computers in classroom instruction, there must be a mismatch of

values between the organizational culture of schools and the technology. Is the environment, i.e., school culture, helping or hindering the use of computers in the classroom? Are the uses of computers as tools for instruction being communicated through staff development and support in a fashion that makes sense to teachers?

In his Model of Stages in the Innovation-Decision Process (Figure 1), Rogers (1995) displays the process through which an individual passes from first knowledge to confirmation. Rogers reinforces the idea that the decision to implement an innovation or change a behavior is a personal decision. Goodlad (1984), Fullan (1991), Means (1993), and Rogers (1995) all conclude that the decision to change must take place at the individual level. Individual behavioral change is at the root of integrating computers into classroom instruction.

Behavioral Psychology

Kurt Lewin (1935), in what later became known as field theory, suggested that behavior is a function of personality interacting with environment: B = *f*(PE).



<u>Figure 1.</u> A model of stages in the innovation-decision process (Rogers, 1995, p. 163)

> ... to understand or predict the psychological behavior (B) one has to determine for every kind of psychological event (actions, emotions, expressions, etc.) the momentary whole situation, that is, the momentary structure and the state of the person (P) and the psychological environment (E). (p.79)

Confer (1985) and Kimble (1985) explained that Lewin, who was strongly influenced by the Gestalt school of psychology, felt the psychological environment was the way in which the individual perceived the world. The behavior of the individual was a response to this perceived world and the individual's personality. Kimble (1985) stated that Lewin was the first to associate the two components, person and environment, with behavior and that these components could not be dealt with separately.

Matarazzo (1985) explained Lewin's theory further, "... behavior is a function of all positive and negative forces ...operating upon the individual at a given time, as well as the person's perception of those forces" (p. 353). This further supports the conclusions by Goodlad (1984), Fullan (1991), Means (1993), and Rogers (1995) that the decision to change a behavior is an individual decision. Lewin considered his model as both explanatory and predictive of behavior. Is there something about the interaction of teachers' personalities with

the environments or cultures of schools that creates behaviors hostile or friendly toward the integration of computers into classroom instruction? What is the perceived environment of schools? Is there some way to predict the behavior of a teacher toward computers by studying the factors that make up the environment?

Factors Related to Computer Use:

A Review of the Literature

What are the most influential factors that are related to the use of computers by teachers in classroom instruction? Understanding and defining computer use is the first and most important requirement of the study. Understanding and defining the factors related to computer use, as found in the literature, is the next charge. A search of the literature about computer use suggests some major factors are attitudes, access, training, support, and characteristic of individuals. The review will consist of six areas of discussion: computer use, attitudes, access, training, support, and characteristics of teachers.

Computer Use

Defining computer use in classroom instruction is a relatively difficult task. A search of the literature regarding computer use reveals a wide variety of definitions and three main components involved with the definition of computer

use in classroom instruction: frequency of use, amount of time used, and purpose.

Use is often defined as a frequency of use, shown as either actual number of occurrences or percentage of use. Askov (1993), Henderson (1994) , and the researchers at the Florida State Department of Education (1993) all reported the frequency of use by machine or software package.

Use can also be measured as an amount of time. Field Research Corporation (1995) researchers measured use as a percentage of time (hours) computers were used in a typical week. The research staff at the Center of Excellence for Computer Applications (CECA) (1988) used the number of hours per student per semester as a measure of computer use at the college level. The amount of time computers were used in a curriculum area (i.e., math, social studies) was utilized as a use measure in Field Research Corporation (1995), CECA (1988), and Kirby (1988).

The greatest variation of measurement of use is the purpose of the use. Field Research Corporation (1995) researchers utilized the following concepts to explain use in the classroom: direct instruction, student monitoring, and other school activities.

Very few studies relate to the method of instruction into which computers are integrated. Wirthlin Group (1989) researchers and Askov (1993) created a

very broad category called instruction. In the CECA (1988) study, researchers used such precise categories as simulation, computer-aided instruction, problem solving, data analysis graphics, multi-use, word processing, report writing, others, and not stated.

In the only K-12 study, Kirby (1988) broke instruction into the following areas: drill and practice, instructional games, reward or leisure activity, teaching content, teaching computer operation, teaching problem solving, teaching word processing, running simulations, programming, computer history, role and impact of the computer in society, data processing, and computer careers. As the previous discussion illustrates, most of the researchers utilized multiple ways of measuring use. This researcher will look at use as a measure of frequency of use and number of minutes in use with regard to four categories of instruction: drill and practice, whole-class instruction, student-directed instruction, and computer skills instruction. This narrows the scope from Kirby (1988) and the CECA (1988) studies and separates the broad category of instruction. The intent is to analyze the uses of computers by teachers in classroom instruction.

Attitudes and Computer Use

If I had my druthers, I don't think I would ever look at a computer again. -- John Erickson, High School Teacher

...Although John brought years of teaching experience to his job, John felt like a novice again. (Sandhotz, 1996, p. 281)

Teachers generally accept computers as valid educational tools, while they also experience an anxiety about personal use of the machines (Russek, 1991). Researchers at Field Research Corporation (1995) surveyed 1,000 elementary teachers in the United States and determined that most teachers surveyed had favorable attitudes toward computers.

In the 1995 Tenth Planet Survey of 1,000 Elementary School Teachers,

- 94% agreed that computers and computer technology are powerful motivators for getting today's students more interested in their classwork and assignments.
- 76% disagreed that computers are not helpful as a teaching aid.
- 59% agree that teachers who integrate PC's into the classroom are considered more successful.
- 61% agreed that students in their classes are ready to use computers.

(Field Research Corporation,1995, pp. 1-2)

Attitude determines whether a person is willing to try a new innovation (Rogers, 1995). So while most teachers appear to have a favorable attitude toward computers and recognize the need for them in the classroom, there is, at the same time, an anxiety about them. Attitude appears to be a related factor

in teacher use of computers in classroom instruction.

Access and Computer Use

The definition of access to technology, as defined in the OTA report, has multiple connotations: computers in the classroom, ratio of students to computers, computers at home, current hardware and software, and location of computers. Reilly (1996) stated, "There are enough computers in schools in the United States to provide at least one for each classroom, but the reality is that the technology is not evenly distributed and much is already old" (p. 215). The researchers of Field Research Corporation (1995, pp. 3-11) surveyed 1,000 elementary (K-6) teachers in the United States and found access to computers to be distributed unequally. Many teachers (76%) have one computer in their classroom, but the number of teachers with more than one computer (36%) per classroom drops drastically. The findings are subject to sampling error estimates of plus or minus 3 percentage points at the 95%

Data from the 1995 Tenth Planet Survey of teachers indicate that:

- 76% had at least one computer in the classroom.
- 36% had two or more computers in the classroom.
- 14% had four or more computers in the classroom.
- 26% had computers at school so out-of-date they could not run current software.
- 73% had computers at home.
- 78% used computers for teaching in the classroom.
- 64% used computers for teaching in a lab.
- 34% used computers for teaching in the library/media center.
- 53% of those teachers who did not use computers for teaching did not have access to computers.

(Field Research Corporation,1995, pp.3-5)

confidence level. Obviously, for teachers to use computers in classroom instruction, they must have access to computers.

While great strides have been made in placing computers in classrooms, there are still some great inequalities of access. Russek (1991) found a barrier that affected implementation of computers in classroom instruction to be the "difficulties with the whole-class demonstration format" (p. 28). This barrier is often related to teaching in a one-computer classroom. Many computers are too old to use current software, but, politically, it is not wise to throw out something that looks like a computer.

The type of access is an issue because teachers find signing up for the use of a lab cumbersome and inconvenient. Teachable moments do not often allow the luxury of signing up for the computer lab. The researchers at the Center for Applied Special Technology (1996) pointed out that schools are rapidly acquiring computers and networks, but that acquisition (access) is only the beginning.

Training and Computer Use

Continuous training, which David (1996) calls "spreading accomplished practice," is a factor in the use of computers by teachers. (pp. 240-242) Training can be divided into two major categories: mechanics and application. Much of today's educational technology training tends to focus on the

mechanics of operating new machinery, with little about integrating technology into specific subjects, how to choose software, and how to organize classes, e.g., to use four computer workstations or a single computer with a modem (U.S. Congress, Office of Technology Assessment, 1995, p. 22). Russek (1991) described some barriers to implementation as a person's knowledge of necessary, but technical and mundane, issues such as the operating system the computer uses, the cables the computer needs to connect with other equipment, and the operation of other equipment, such as printers. Researchers at Field Research Corporation (1995), in a survey of 1,000 elementary teachers, found that many teachers (40%) are self-taught with regard to using computers, but 64% of the teachers surveyed considered themselves comfortable or sophisticated users. The Office of Technology Assessment (1995) report added, "Currently schools spend much more on hardware (55

In the 1995 Tenth Planet Survey of Elementary Teachers,

- 9% considered themselves as sophisticated users.
- 55% considered themselves as comfortable computer users.
- 32% considered themselves as beginner computer users.
- 5% considered themselves as non-users.
- 70% worried about keeping up with all the latest computer developments.
- 63% were familiar with different types of computer-related courseware and how they can be used.
- 42% received NO formal training.
- 43% believed their school provided enough training and support to integrate PC's into curriculum.

(Field Research Corporation,1995, pp. 7-8)

percent) and software (30 percent) than they do on training (15 percent)" (p. 22). Training is unmistakably on the minds of teachers and is related to the way in which they integrate the computer into their classroom instruction.

Support and Computer Use

> *sup·port* ***4.*** *To keep (one's spirits, for example) from failing during stress; lend strength to.* (American Heritage Dictionary,1969, p. 1293)

This definition is a good description of what a teacher is looking for with regard to support of computers. Again, however, this support comes in many forms. It might be a technical person available on demand, a fellow teacher with some encouraging words, or a principal who believes in technology and commits to implementation (money, time, conferences, specific training). Russek (1991) described difficulties with equipment as a barrier to implementation. Is there a technician readily available to the teacher to help with these equipment difficulties? Office of Technology Assessment (1995) researchers reported:

> Only 6 percent of elementary and 3 percent of secondary schools have full-time school level computer coordinators; in nearly three-fifths of schools, no one had any portion of their workweek officially allocated to coordinating computer activities. (p.22)

Field Research Corporation (1995) researchers reported that eighteen percent of elementary teachers in the United States considered insufficient technical support to be a drawback to using computers in the classroom. Fifty-four percent believe the school does not provide enough training/support to integrate personal computers into curriculum.

The way in which teachers gather the knowledge necessary to make the decision to use computers in the classroom is an issue of support. Rogers (1995) suggested that individuals receive communication about innovations through mass media channels and interpersonal channels. Teachers receive mass media communication about computers through television, radio, newspapers, professional journals and magazines. Interpersonal communication about computers occur typically through staff development, workshops, contact with technicians, and teacher-to-teacher discussions. Rogers also stated: "*More effective communication occurs when two or more individuals are homophilous.* When they share common meanings, a mutual subcultural language, and are alike in personal and social characteristics" (p.19). Education should have somewhat of an advantage with respect to communicating the innovation (computers) to the individuals (teachers). Teachers, while having different personalities, do have a mutual subculture (education, school) and, generally speaking, have similar

personal and social characteristics. The ways in which computer use is communicated to teachers as being tools of teaching and learning are related to the use of computers by teachers in classroom instruction. A factor related to use is support.

Characteristics of Teachers and Computer Use

Do characteristics such as age, the number of years remaining until retirement, gender, and grade level relate to the use of computers by teachers in classroom instruction? A brief discussion of the research follows.

Age and Computer Use

Age is often assumed to be a factor related to computer use. There is no evidence to support this conclusion (Hayden, 1995). Hayden found that while seniors have other interests, more than fifty percent of those surveyed were interested in learning more about computers. Honeyman (1987) found no significant correlation between age and levels of anxiety in a study of school administrators and teachers. Comber (1997) found significant age differences in age in a study of students ranging in age from eleven to sixteen. This last study, which shows a significant difference, deals with a very small range of ages.

Number of Years Until Retirement and Computer Use

No studies were found that relate the number years a person remaining

before retirement to the degree of computer use. "I am only 2 years from retirement; I'm not going to learn computers now," was a comment overheard by this researcher in the office of a local public school. Similar statements in other schools prompted the researcher to ask the following questions: Is the number of years remaining before retirement an issue related to computer use in classroom instruction? Do teachers near retirement delay or completely refuse to learn the new technology?

Gender and Computer Use

The research literature is conflicting with regard to gender as a factor related to computer use. Hayden (1995) concluded that females tend to be more sensitive to how the technology will affect people, while males tend to view technology as a tool to help them accomplish a goal. Comber (1997) in a study of 278 school age children found the ANOVA for length of experience with computers for boys ($\underline{X}$ = 4.82) greater than girls ($\underline{X}$ = 4.43). Kay (1989), in a study of 383 students enrolled in the Faculty of Education at the University of Toronto, found that males ($\underline{M}$=105.9, $\underline{SD}$ = 43.3) tended to use computers more often than females ($\underline{M}$=82.6, $\underline{SD}$=5.0). Honeyman (1987) found no significant correlation between gender and computer anxiety in a study of 38 teachers and school administrators. No significant difference was found in computer use

between male and female vocational teachers in a study by Gordon (1993). Because of the variation in findings, gender will be included in this study.

Grade Level Taught and Computer Use

Is the grade level a teacher teaches related to his or her use of technology? No studies were found that directly related to the grade level taught by a teacher and computer use. Hoover (1997) found similarities in the technology staff development needs of elementary, middle school, and secondary teachers; however, the study recommended that staff development plans be customized for specific groups. The assumption was made that computer use and the factors related to computer use at the primary level and the secondary level were quite different. The grade level a teacher teaches became a focus of the data collection, data analysis, and discussions. Age, years remaining before retirement, gender, and grade level taught are all teacher characteristics to study.

Synthesis of Contextual and Research Background:

A Pre-Study Model

The context of school change, diffusion of innovation, and behavioral psychology give the theoretical and research background from which to begin a study of computer use by teachers in classroom instruction. Attitudes, access,

training, support, age, years remaining before retirement, gender, and grade level are factors that seem to be related to use of computers. Throughout the previous discussion, there is the recurring theme of the individual as the focus of change within an organization.

In keeping with Lewin's formula, B=*f*(PE) (Behavior is a function of personality and environment), the following definitions explain the interest in the factors and their relationship to use of computers in classroom instruction.

Behavior: the **use** of computers by teachers in classroom instruction: whole class instruction, student-directed learning, drill and practice, and computer skills instruction.

Personality: the **teacher characteristics**: age, years remaining before retirement, gender and grade level the teacher teaches and **attitudes** of teachers

Environment: **access** to computers, **training** opportunities provided to teachers, and **support** by administrators and technicians

What the person (a teacher) brings to a situation (demographics and attitudes) and that person's perception of their environment (access to computers, training opportunities, and support) are related to that person's behavior (computer use). This idea, when slightly restated, creates a researchable question: What are the

factors related to the use of computers by teachers in classroom instruction? A pre-study model of this question is illustrated in Figure 2.

Definitions of Computer Use and the Factors Related to Computer Use

The constitutive and operational definitions of computer use and the factors related to computer use: attitude, access, training, support, age, years remaining before retirement, and gender are located in Table 1.

Organization of the Study

The study is divided into four chapters. Chapter I includes a description of the following: the problem and its context, purpose of the study, a literature review of factors related to computer use, definitions, and the development of a pre-study Model.

The methodology of the study is the focus of Chapter II. The research questions, population, design, and procedures form the outline of the methodology chapter.

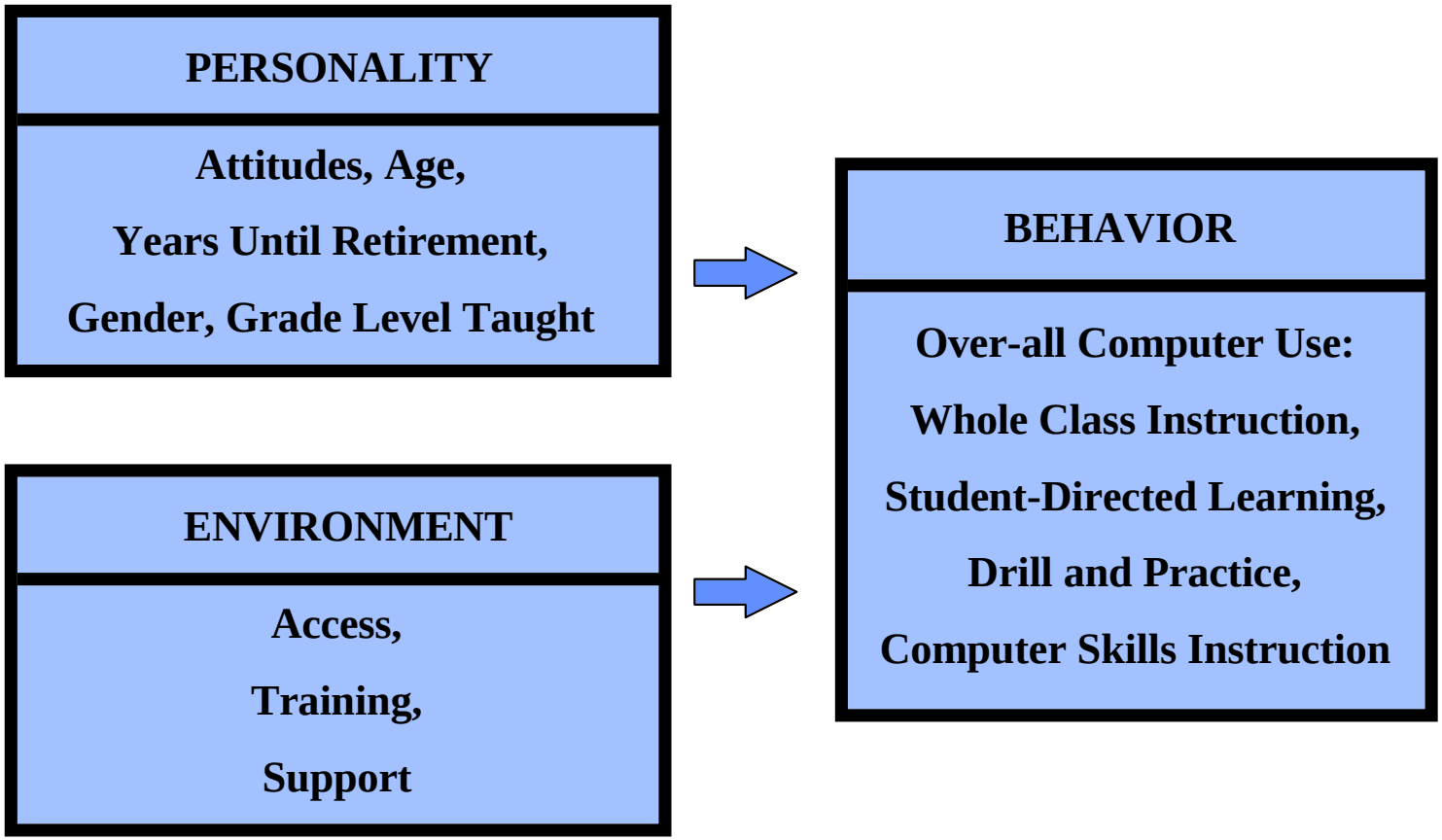


Figure 2. **A pre-study model. Factors related to computer use by teachers in classroom instruction.**

Table 1

Constitutive and Operational Definitions of Variables in the Study

DEFINITION		
VARIABLE	**CONSTITUTIVE**	**OPERATIONAL**
USE	**The frequency, amount of time, and ways in which teachers work with computers in the instruction of their students.**	Four types of use were measured: 1. Whole class instruction 2. Student-directed learning 3. Drill and practice 4. Computer skills instruction.
		Teacher use of the computer for **whole class instruction** (i.e., using the computer with a television or overhead adapter). **Whole Class Instruction Mean Score** = [Σ (z score of question 1A + z score of question 1B)] ÷ N
		Students use of the computer to search electronic encyclopedias or the Internet, presentation production, etc. (**student-directed learning**). **Student-Directed Learning Mean Score** = [Σ (z score of question 2A + z score of question 2B)] ÷ N
		Student assigned use of the computer for **drill and practice** (i.e., addition problems, multiplication problems, verb usage) during classroom time. **Drill & Practice Mean Score** = [Σ (z score of question 3A + z score of question 3B)] ÷ N
		Student use of the computer for the development of student **computer skills instruction** **Computer Skills Instruction Mean Score** = [Σ (z score of question 4A + z score of question 4B)] ÷ N
		Over-all Computer Use Mean Score = [Σ (z score of question 1A + z score of question 1B +z score of question 2A + z score of question 2B + z score of question 3A + z score of question 3B +z score of question 4A + z score of question 4B)] ÷ N (Where: Σ = the sum, z score = the standardized score, N = the total number of data rows).

Note. Specific items on the questionnaire are in Appendix A. (*table continues*)

Table 1 (*continued)*

DEFINITION		
VARIABLE	**CONSTITUTIVE**	**OPERATIONAL**
ATTITUDE	The evaluation of teacher feelings about computers and computer use in the classroom.	Semantic Differential Section (Items 5-11).
		Teachers believe students like to use computers (Item 12).
		Teachers believe teacher use of computers is considered to be desirable skill (Item 13).
		Teachers believe their principal thinks teachers who use computers in the classroom are better teachers (Item 14).
		Would the teacher use a piece of software if it were proven to improve student achievement (Item 15).
		Attitude Mean Score = [Σ (z score of question 5 + z score of question 6 + z score of question 7 + z score of question 8 + z score of question 9 + z score of question 10 + z score of question 11 + z score of question 12 + z score of question 13 + z score of question 14 + z score of question 15)] ÷ N (Where: Σ = the sum, z score = the standardized score, N = the total number of data rows).

Note. Specific items on the questionnaire are in Appendix A.

(*table continues*)

Table 1 (*continued*)

DEFINITION		
VARIABLE	**CONSTITUTIVE**	**OPERATIONAL**
ACCESS	The numbers, location, availability, and usability of computers in the classroom.	Number of computers in a teacher's classroom (Item 16A).
		The greatest number of students in the classroom during the day (Item 16B).
		The ratio of computers to students (Computed value = Item 16A ÷ 16B).
		Availability of a computer lab in the school (Item 17).
		Equipment and software necessary to use the computer for **whole class instruction** is available to teachers (Item 18).
		Equipment and software necessary to use the computer for **student-directed learning** (search electronic encyclopedia and Internet, presentation production, etc.) is available to teachers (Item 19).
		Equipment and software necessary to use the computer for **drill and practice** is available to teachers (Item 20).
		Equipment and software necessary to use the computer to teach **computer skills instruction** is available to teachers (Item 21).
		Teacher ownership of computer at home (Item 22).
		Access Mean Score = [Σ (z score of (question 16A/question 16B) + z score of question 17 + z score of question 18 + z score of question 19 + z score of question 20 + z score of question 21 + z score of question 22)] ÷ N (Where: Σ = the sum, z score = the standardized score, N = the total number of data rows).

Note. Specific items on the questionnaire are in Appendix A.

(*table continues*)

Table 1 (*continued*)

DEFINITION		
VARIABLE	**CONSTITUTIVE**	**OPERATIONAL**
TRAINING	The ways in which teachers learn how to use computers.	Number of hours of computer in-service the teacher has attended (Item 23).
		Number of computer related classes the teacher has attended (Item 24).
		The school system offers training for teachers (Item 25).
		Type of training the teacher has attended: no training, computer operation and basics, word processing, presentation software, spreadsheeting, database management, and other (Item 26).
		Degree to which teacher training offered by the school system has helped teachers use computers in classroom instruction (Item 27).
		Teacher classification of their computer training (Item 28).
		Teacher suggested training opportunities (Item 29).
		Training Mean Score = [Σ (z score of question 23 + z score of question 24 + z score of question 25 + z score of question 27 + z score of question 28)] ÷ N (Where: Σ = the sum, z score = the standardized score, N = the total number of data rows).
Computer Training Received		The number of teachers who have participated in the different type of computer training listed in Item 26 will be tallied to determine the types of training received and needed.
Training Suggestions		Suggested training opportunities in response to Item 29 will be listed and prioritized in order of frequency of response.

Note. Specific items on the questionnaire are in Appendix A.

(*table continues*)

Table 1 (*continued*)

DEFINITION		
VARIABLE	**CONSTITUTIVE**	**OPERATIONAL**
SUPPORT	The assistance available to teachers in the use of computers in the classroom.	The school system has a computer technician (Item 30).
		A person in the building has enough computer expertise to answer computer-related questions (Item 31).
		Adequacy of response time by computer technicians to technical problems and questions (Item 32).
		The principal is supportive of computers in classroom instruction (Item 33).
		The central administration is supportive of computers in classroom instruction (Item 34).
		The School Board is supportive of computers in classroom instruction (Item 35).
		Parents are supportive of computers in classroom instruction (Item 36).
		Support Mean Score = [Σ (z score of question 30 +z score of question 31 + z score of question 32 + z score of question 33 + z score of question 34 + z score of question 35 + z score of question 36)] ÷ N (Where: Σ = the sum, z score = the standardized score, N = the total number of data rows).

Note. Specific items on the questionnaire are in Appendix A.

(*table continues*)

Table 1 (*continued*)

DEFINITION		
VARIABLE	**CONSTITUTIVE**	**OPERATIONAL**
TEACHER CHARACTERISTICS	The personal characteristics of teachers.	
AGE		Age of the teacher (Item 37).
		Open ended numeric question, Min. - 21 , Max - ~
GRADE LEVEL		Grade level the teacher teaches (Item 38).
		Open ended numeric question, K=0, 1-12
CURRICULUM AREA		The curriculum area in which they teach (Item 39).
		Open ended text question.
GENDER		Gender of the teacher (Item 40).
		Male = 1, Female = 2
YEARS UNTIL RETIREMENT		Number of years the teacher is from retirement (Item 41).
		1 = 1-3 Years, 2 = 4-6 Years, 3 = 7-9 Years, 4 = 10-12 Years, 5 = More than 12 Years
BARRIERS TO COMPUTER USAGE IN THE CLASSROOM		List of things that are barriers to using computers in the classroom (Item 42).
		Responses to Question 42 will be listed and prioritized in order of frequency of response. A list of barriers to computer usage in classroom instruction.

Note. Specific items on the questionnaire are in Appendix A.

Chapter III contains the data analysis of the study. Discussions of the descriptive statistics, regression analysis, teacher recommended training opportunities, teacher determined barriers to computer use, and teacher recommended strategies for improvement of computer use in classroom instruction are included in Chapter III.

Finally, Chapter IV is a description of the conclusions and discussions of the study. Chapter IV is divided into conclusions, discussions, implications for the school system, and implications for further study.

CHAPTER II

METHODOLOGY

This chapter is a description of the methodology of the study and includes a list of the research questions, a description of the population, and an explanation of both the quantitative and qualitative phases of the research. Each research phase is divided into a discussion of data collection and data analysis.

Research Questions

The literature review helped to define the factors related to computer use: attitudes, access, training, support, and demographics. The researcher attempted to answer the following questions:

1. Which of the following factors predict computer use in classroom instruction?
    A. Attitudes of teachers toward computers in the classroom
    B. Access by teachers and students to computers
    C. Training of teachers in computer use
    D. Support of teachers in their use of computers
    E. Age of the teacher
    F. Grade level in which the teacher teaches

G. Gender of the teacher

H. Number of years remaining before retirement

2. What do teachers believe are the barriers to computer use in classroom instruction?
3. What staff-development or training opportunities would teachers like to see offered by the school system?
4. What are some teacher-suggested strategies to improve the use of computers in classroom instruction?

Population

Factors that determine use of computers by teachers in classroom instruction will vary from one school system to another, as not all school systems will be at the same stage of computer use. School systems will be at different stages of computer acquisition. And, school systems have their own unique cultures, technology needs and solutions. Therefore, this study was limited to Carroll County Public Schools, a small, rural school system in Southwest Virginia with a total school population of approximately 3,800 students. There are ten schools in the district: six K-5 elementary schools, two K-7 elementary schools, one 8-9 intermediate school, and one 10-12 high school. A stratified technique was used, dividing the population into grade levels (PreK-2, 3-5, 6-7, 8-9, 10-12), the

assumption being that at different levels of teaching there may be different factors that determine use of computers in the classroom. These particular grade level groups were chosen because they parallel the grade level group designation within the system: preschool through grade 2 are designated as the primary grades, grades 3 through 5 are considered to be lower elementary, grades 6 and 7 are upper elementary grades, grades 8 and 9 are the intermediate grades, and grades 10 through 12 are labeled secondary. The population of the study was limited to the classroom teachers of Carroll County Public Schools.

The total population of classroom teachers was surveyed (see Table 2). The instrument was administered to 241 teachers during faculty meetings at each school. Of the 241 surveys distributed to teachers, eight were returned without any responses, giving a total response of 233 surveys. The respondents in preschool through grade 7 were almost exclusively female, while almost 45% of the respondents teaching grades 8 through 12 were male. Carroll County Public Schools has an aging teaching staff. The mean age of the classroom teachers surveyed is 40 and median age is 42. The age ranking by grade level grouping

Table 2

Characteristics of Carroll County Public School Classroom Teacher Participants

	Age						Gender				Years Until Retirement					
	N	Median	Min	Max	Mean	SD	N	M	F	Median [e]	N	1-3	4-6	7-9	10-12	More Than 12
Preschool - Grade 2	47	44.00	22	55	41.02	9.62	47	1	46	1.99	47	1	0	6	9	31
Grade 3 - Grade 5	32	46.00	22	58	43.97	10.34	34	3	31	1.91	34	3	6	6	6	13
Grade 6 - Grade 7	23	41.00	22	49	37.65	8.63	29	1	28	1.97	26	1	2	1	3	19
Grade 8 - Grade 9	31	34.00	22	62	34.84	10.01	32	13	19	1.59	34	2	3	0	4	25
Grade 10 - Grade 12	54	47.50	23	64	43.39	10.94	54	26	28	1.52	54	8	10	8	2	26
Cross Grade Level [a]	23	38.00	23	56	38.30	9.13	25	7	18	1.72	23	0	2	2	1	18
Undeclared [b]	3	39.00	24	44	35.67	10.41	7	0	7	2.00	6	0	0	1	1	4
All Classroom Teachers	213	42.00	22	64	40.45	10.36	228	51	177	1.78	224	15	23	24	26	136
Missing Data [c]	20						5				9					
Total Surveys Returned	233						233				233					
Blank Surveys [d]	8						8				8					
Total Surveys Distributed	241						241				241					

[a] Responses to grade level ranged across grade-level groups (example K-5).
[b] Responses to grade level blank.
[c] Responses to age, gender, or years until retirement blank
[d] Surveys returned unanswered
[e] Male = 1, Female = 2

from oldest to youngest was grades 3-5, grades 10-12, grades preschool-2, grades 6-7, and grades 8-9. The school system can expect a large turnover of staff within the next few years. Thirty-nine percent of the classroom teachers will be eligible to retire within the next 12 years. However, certain grade level groupings may have greater levels of retirement. Of the grade 10-grade 12 respondents, 15% may retire within the next 3 years, 33% within the next 6 years, 48% within 9 years, and 52% may retire by 2009-2010. By the school year 2009-2010, 62% of the classroom teachers in grades 3-5 may retire.

Approval to proceed with the survey was granted by the Virginia Polytechnic Institute and State University Institutional Review Board after completing an Application for Approval of Research Involving Human Subjects. A formal letter of approval was received from the superintendent granting permission to do the study in the Carroll County Public School system.

Design and Procedures

The study is divided into a quantitative and a qualitative phase. Each phase is examined through a discussion of the data collection and the methods of data analysis.

Phase I: The Survey

Data Collection

A survey instrument was developed (Appendix A) using the methods discussed in Dillman (1978), Kerlinger (1973), and Osgood (1965). Survey questions attempted to quantify a teacher's level of over-all computer use in the categories of drill and practice, whole class instruction, student-directed learning, and computer skills instruction. The survey instrument was designed to numerically assess teacher attitudes toward computer use, teacher and student access to computers, computer training of teachers, support of teachers in the use of computers, age of the teacher, grade level the teacher teaches, and the number of remaining until retirement.

The survey instrument was pilot tested three times by various individuals (fellow doctoral students and colleagues). The first two pilot tests were adiministered to five to six members of the School Leaders Program, a doctoral cohort at Virginia Polytechnic Institute and State University. The largest pilot test was by classroom teachers in the Galax City School System during their pre-school workdays in August 1997. Five teachers from each of the three schools (Galax Elementary School, Galax Middle School, and Galax High School) were asked to participate. The pilot test participants were presented the survey in

exactly the same manner as it was to be presented to the study participants. An instrument was developed (Appendix B) to document the responses to the content validity and concerns of the participants. The pilot test participants were briefed on the purpose of the survey: measurement of computer use, attitude, access, training, support, age, gender, grade level, and years remaining until retirement. The questions on the instrument were arranged by factors, and participants were aware of the questions being used to measure each factor. Participants were specifically asked if they thought each question was measuring the factor with which it was associated. In one of the early pilot tests, it was discovered that the units of measure (hours) were not sufficiently sensitive to measure the amount of time computers are used in classroom instruction. The survey instrument was revised to use minutes as the measure of computer use. Participants were asked to express any concerns they had with the survey.

The researcher attended the Carroll County Public School Pre-School Administrative Workshop in August 1997 to explain the purpose and the method for administering the instrument. This allowed the researcher to schedule with the building principals a time during the regularly scheduled October or November faculty meeting of each school in the district. The survey was personally administered by the researcher during the faculty meetings. Teachers were told

that participation in the study was optional (Appendix C). The researcher explained that the purpose of the study was to identify what factors determine use of computers in classroom instruction. Each school would be sent two copies of the results of the survey to be posted both in the office and in the teachers' lounge, thus allowing all of the participants to see the results of the survey. The survey was completed privately by each teacher. The raw data from the survey were entered into a spreadsheet on the Minitab Statistical Software computer package. Each entry was verified by checking the computer spreadsheet entry against the original survey response. If a discrepancy was noted, the computer entry was changed to match the original survey response.

Analysis of Data

The responses of the participants were standardized using the Minitab Statistical Software. The standardized scores for each item were added together to determine a total score for each participant on each of the factors: use, attitude, access, training, and support. The mean score for each variable was determined by taking the mean of the totaled standardized scores for all participants (see definitions of variables for scoring schema). The maximum, mininum, mean, median, and standard deviation were computed using the raw data for each question on the survey. Multiple regression analyses help identify the factors that

have the strongest relationship to teacher use of computers in the classroom (Kerlinger, 1973b; & Thorndike, 1978). All statistical tests were run on the Minitab Statistical Software package (MINITAB, Inc., 1997).

The survey included two open-ended questions that were not part of the quantitative analysis; however, they provided important information. Item 33 asked for any suggested computer training opportunities the participants would like to see offered by the school system. These responses were listed and prioritized by frequency of response. Item 51 requested any comments or suggestions regarding barriers to the use of computers in classroom instruction. These responses were listed and categorized by purpose and common theme.

Phase II: The Focus Groups

Data Collection

The second phase of the study consisted of five focus groups (4-6 teachers in each group) comprised of teachers from each grade-level grouping. The participants were chosen purposefully by the school principals to optimize stakeholder representation (i.e., each school, non-user/user, gender, grade levels). The focus groups reviewed a condensed copy of the results of the quantitative analysis (Appendix E). The researcher explained that the purpose of the study was to determine the factors that have the greatest relationship to computer use. Via

the data the researcher determined one or two factors that appeared to have the greatest relationship to computer use in classroom instruction. The participants in the focus groups were asked to propose strategies, using the information from the study, that would increase the use of computers by teachers in classroom instruction.

The researcher used a Nominal Group Technique (NGT) to facilitate the focus group experience. The NGT has been shown to be an effective method of identifying issues (Van de Ven, 1974). The groups were given the results of the quantitative phase of the study and asked to write down as many strategies as possible. Then using a round-robin format, each member was asked to list one strategy. As the strategies were named, they were listed on a flip-chart. If an individual mentioned a strategy on someone else's list, she marked it off her list. This reduced duplication. If a person ran out of strategies, she passed when her turn arrived again. This round-robin procedure continued until all the strategies were discussed. The next step was to edit the list by asking for clarification, grouping similar strategies, and collapsing similar strategies into single concise statements. This was done as a group. Each member of the group was asked to list the top three strategies. They were then asked to rank the strategies in order with number one being the top choice and number three being the lowest. Each

participant was asked to hand in a prioritized list.

Analysis of the Data

The researcher tallied the numbers to determine the group ranking of strategies. The final product was a ranked list of strategies to improve the areas that have the greatest predictive ability for increasing computer use in classroom instruction. This qualitative portion of the study put the data and analysis in the hands of the teachers and made the study more powerful.

CHAPTER III

DATA ANALYSIS

The data for the study are presented in table format and organized around the research questions. Descriptive statistics for criterion (i.e., over-all computer use, whole class instruction, student-directed learning, drill and practice, and computer-skills instruction) and predictor variables (i.e., attitude, access, training, support, age, gender, and years remaining until retirement) are presented prior to the discussion of multiple regression analyses. Throughout the discussion the data are divided into the following grade-level groupings: preschool-grade 2 (p-2), grade 3-grade 5 (3-5), grade 6-grade 7 (6-7), grade 8-grade 9 (8-9), and grade 10-grade 12 (10-12). Where appropriate, three other groups are discussed: all classroom teachers (All Teachers), teachers who teach across these specific grade-level groupings (Cross Grade Level), and teachers who did not declare a grade level when responding to the survey (Undeclared). The multiple regression analyses were used to determine predictors of teacher use of computers in classroom instruction. Correlation analyses identified unusual relationships between criterion and predictor variables.

Possible training strategies and barriers to computer use are reported in matrices. Teacher-recommended strategies collected during the nominal group processes are reported as prioritized lists of strategies by grade-level groupings.

Computer Use by Teachers in Classroom Instruction

Computer use is a combination of the type of use, the number of times a computer was used, and the average number of minutes per use in a typical week of classroom instruction. Teachers were asked to report their use in four categories: whole class instruction, student-directed learning, drill and practice, and computer skills instruction. Further, they were asked to estimate the number of times they used a computer and the average number of minutes per use in each of the four categories of use. These data were to be estimated for the previous week of school (5 teaching days). Computer use is reported in Tables 3-7.

The major finding concerning computer use by classroom teachers in Carroll County is that computer use is low in all categories. The mean number of times the computer was used by the total population of classroom teachers during the selected week was less than three in every category, less than two in computer skills instruction, and less than one in whole class instruction. The more revealing statistic is the median of zero in every use category except for student-directed

Table 3

Teacher Use of Computers in Whole Class Instruction

Teacher Group	WHOLE CLASS INSTRUCTION (WCI)														
	TIMES							MINUTES							MEAN
	N	Med	Min	Max	Mean	SD	z [c]	N	Med	Min	Max	Mean	SD	z [c]	SCORE [d]
Preschool-Grade 2	45	.00	.00	5.00	.60	1.21	.11	45	.00	.00	60.00	.60	1.21	.03 #	.15
Grade 3-Grade 5	32	.00	.00	8.00	.63	1.70	.13	33	.00	.00	30.00	4.09	8.14	-.22 #	-.12
Grade 6-Grade 7	28	.00	.00	5.00	.36	1.10	-.10	27	.00	.00	85.00	6.30	19.69	-.08 #	-.34
Grade 8-Grade 9	35	.00	.00	5.00	.40	1.17	-.06	34	.00	.00	80.00	5.59	15.56	-.13 #	-.18
Grade 10-Grade 12	50	.00	.00	5.00	.64	1.16	.14	51	.00	.00	90.00	14.90	23.05	.43 #	.43
Cross Grade Level [a]	24	.00	.00	.00	.00	.00	-.40	25	.00	.00	15.00	.60	3.00	-.42 #	-.86
Undeclared [b]	9	.00	.00	1.00	.33	.50	-.12	9	.00	.00	40.00	9.44	15.50	.10 #	-.02
Total Population	223	.00	.00	8.00	.48	1.18	.00	224	.00	.00	90.00	7.70	16.77	.00 #	-.06

[a] Teachers who responded with a grade level that crossed grade-level groups (example K-5).

[b] Teachers who did **NOT** respond with a grade level

[c] $\underline{z}$ represents the mean z score for each item by teacher group. [(Σ individual z scores) $\div$ N]

[d] **Mean Score for Category** = [(Σ (individual z score for times + individual z score for minutes))] $\div$ N

Table 4

Teacher Use of Computers in Student-Directed Learning

Teacher Group	STUDENT-DIRECTED LEARNING (SDL)														
	TIMES							MINUTES							MEAN
	N	Med	Min	Max	Mean	SD	z [c]	N	Med	Min	Max	Mean	SD	z [c]	SCORE [d]
Preschool-Grade 2	44	.00	.00	20.00	2.52	5.46	-.03	45	.00	.00	60.00	5.62	11.42	-.44 #	-.58
Grade 3-Grade 5	33	3.00	.00	15.00	3.46	4.01	.18	33	15.00	.00	30.00	13.18	11.10	-.07 #	.11
Grade 6-Grade 7	28	1.00	.00	20.00	2.82	5.44	-.23	27	10.00	.00	100.00	17.15	25.09	.04 #	.15
Grade 8-Grade 9	35	.00	.00	15.00	1.83	3.21	-.18	34	.00	.00	100.00	13.09	23.19	-.07 #	-.27
Grade 10-Grade 12	54	2.50	.00	20.00	3.70	4.34	.16	50	27.50	.00	90.00	25.00	24.10	.51 #	.64
Cross Grade Level [a]	24	.00	.00	20.00	1.67	4.52	-.22	25	.00	.00	30.00	6.64	11.50	-.39 #	-.65
Undeclared [b]	8	1.00	.00	2.00	1.13	.84	-.34	8	17.50	.00	80.00	26.87	25.35	.60 #	.26
Total Population	226	1.00	.00	20.00	2.65	4.49	.00	222	10.00	.00	100.00	14.54	20.41	.00 #	-.04

[a] Teachers who responded with a grade level that crossed grade-level groups (example K-5)

[b] Teachers who did **NOT** respond with a grade level

[c] z represents the mean z score for each item by teacher group. [(Σ individual z scores) ÷ N]

[d] **Mean Score** = [(Σ (individual z score for times + individual z score for minutes))] ÷ N

Table 5

Teacher Use of Computers in Drill and Practice

Teacher Group	DRILL AND PRACTICE (D&P)														
	TIMES							MINUTES							MEAN
	N	Med	Min	Max	Mean	SD	z [c]	N	Med	Min	Max	Mean	SD	z [c]	SCORE [d]
Preschool-Grade 2	42	3.00	.00	20.00	5.19	5.70	.51	45	10.00	.00	60.00	12.40	12.76	.20 #	.61
Grade 3-Grade 5	28	1.00	.00	20.00	4.07	6.34	.28	31	10.00	.00	80.00	12.03	15.51	.17 #	.43
Grade 6-Grade 7	27	.00	.00	2.00	1.63	4.01	-.23	28	.00	.00	45.00	1.00	14.91	.04 #	-.24
Grade 8-Grade 9	35	.00	.00	15.00	1.23	3.20	-.31	35	.00	.00	30.00	4.57	8.86	-.33 #	-.64
Grade 10-Grade 12	53	2.50	.00	15.00	1.77	3.42	-.20	49	.00	.00	90.00	11.22	21.37	.12 #	-.12
Cross Grade Level [a]	24	.00	.00	16.00	2.54	4.78	-.04	25	.00	.00	30.00	4.80	8.60	-.31 #	-.42
Undeclared [b]	9	1.00	.00	18.00	2.67	5.81	-.02	8	3.50	.00	15.00	5.87	6.79	-.24 #	-.65
Total Population	218	.00	.00	20.00	2.74	4.82	.00	221	.00	.00	90.00	9.45	14.97	.00 #	-.06

[a] Teachers who responded with a grade level that crossed grade-level groups (example K-5)

[b] Teachers who did **NOT** respond with a grade level

[c] $\underline{z}$ represents the mean z score for each item by teacher group. [(Σ individual z scores) $\div$ N]

[d] **Mean Score for Category** = [(Σ (individual z score for times + individual z score for minutes))] $\div$ N

Table 6

Teacher Use of Computers in Computer Skills Instruction

Teacher Group	COMPUTER SKILLS INSTRUCTION (CSI)														
	TIMES							MINUTES							MEAN
	N	Med	Min	Max	Mean	SD	z [c]	N	Med	Min	Max	Mean	SD	z [c]	SCORE [d]
Preschool-Grade 2	45	.00	.00	20.00	2.09	4.04	.13	46	.00	.00	40.00	8.70	11.75	.04 #	.18
Grade 3-Grade 5	33	.00	.00	20.00	2.46	5.39	.23	33	.00	.00	40.00	6.36	11.20	-.11 #	.12
Grade 6-Grade 7	26	.00	.00	20.00	1.39	4.03	-.06	27	.00	.00	40.00	6.67	11.60	-.09 #	-.21
Grade 8-Grade 9	35	.00	.00	5.00	.31	1.02	-.35	34	.00	.00	90.00	4.71	16.37	-.22 #	-.57
Grade 10-Grade 12	53	.00	.00	15.00	2.00	3.67	.11	50	.00	.00	90.00	13.16	21.77	.33 #	.35
Cross Grade Level [a]	25	.00	.00	10.00	1.16	2.63	-.12	25	.00	.00	30.00	4.00	8.04	-.27 #	-.39
Undeclared [b]	9	.00	.00	5.00	.78	1.64	-.22	9	.00	.00	50.00	11.44	17.71	.22 #	-.01
Total Population	226	.00	.00	20.00	1.61	3.71	.00	224	.00	.00	90.00	8.08	15.30	.00 #	-.03

[a] Teachers who responded with a grade level that crossed grade-level groups (example K-5)

[b] Teachers who did **NOT** respond with a grade level

[c] z represents the mean z score for each item by teacher group [(Σ individual z scores) ÷ N]

[d] **Mean Score for Category** = [(Σ (individual z score for times + individual z score for minutes))] ÷ N

Table 7

Teacher Over-All Use of Computers

Teacher Group	OVER-ALL COMPUTER USE OVER-ALL MEAN SCORE[e]
Preschool-Grade 2	.20
Grade 3-Grade 5	.61
Grade 6-Grade 7	-1.30
Grade 8-Grade 9	-1.74
Grade 10-Grade 12	-.03
Cross Grade Level [a]	-2.86
Undeclared [b]	-.76
Total Population	-.71

[a] Teachers who responded with a grade level that crossed grade-level groups (example K-5)

[b] Teachers who did **NOT** respond with a grade level

[c] **Over-all Mean Score** = [Σ (individual z score for times of WCI + individual z score for minutes of WCI + individual z score for times of SDL + individual z score for minutes of SDL + individual z score for times of D&P + individual z score for minutes of D&P + individual z score for times of CSI + individual z score for minutes of CSI) $\div$ N

(Where WCI = whole class instruction, SDL = student-directed learning, D&P = drill and practice, and CSI = computer skills instruction)

learning which had a median of one. For all grade-level groups in whole class instruction and computer skills instruction, more than half of the teachers responded that computers were not used at all during the previous week. No matter what relative score is reported for use with any of the grade-level groups, the fact remains that computer use in classroom instruction is very low and for many respondents nonexistent. The raw data revealed that a few teachers (whole class instruction--0%, student-directed learning--10%, drill and practice--14%, computer skills instruction--8%) are heavy users (10 to 20 times per week) of computers, a slightly larger number of teachers (whole class instruction--21%, student-directed learning--42%, drill and practice--27%, computer skills instruction--25%) are moderate to low users (1 to 9 times per week), and the majority of teachers (whole class instruction--79%, student-directed learning--

RELATIVE RANK OF GRADE LEVEL GROUPS BY USE CATEGORY
(1 = highest)

Whole Class Instruction

Rank	Group
1.	10-12
2.	P-2
3.	3-5
4.	8-9
5.	6-7
6.	Cross Grade

Student-Directed Learning

Rank	Group
1.	10-12
2.	6-7
3.	3-5
4.	8-9
5.	P-2
6.	Cross Grade

Drill and Practice

Rank	Group
1.	P-2
2.	3-5
3.	10-12
4.	6-7
5.	Cross Grade
6.	8-9

Computer Skills Instruction

Rank	Group
1.	10-12
2.	P-2
3.	3-5
4.	6-7
5.	Cross Grade
6.	8-9

Over-all Computer Use

Rank	Group
1.	3-5
2.	P-2
3.	10-12
4.	6-7
5.	8-9
6.	Cross Grade

48%, drill and practice--59%, computer skills instruction--67%) are non-users (0 times per week).

Whole class instruction has the least amount of computer use of all the categories (Table 3). No grade-level group had a mean use greater than one time per week or a median number of uses greater than zero. Teachers in the 10-12 grade-level group had the highest use. The lowest mean score for whole class instruction was by the Cross Grade Level Group of teachers.

Computer use in the classroom for student-directed learning is the only bright spot with regard to use (Table 4). High school teachers (grades 10-12) are the highest users of computers for student-directed learning. It is somewhat unexpected that 6-7 and 3-5 grade-level teachers are fairly high student-directed learning users. The lowest users of student-directed learning were the P-2 and cross grade-level groups.

Teachers in grade-level groups P-2 and 3-5 reported the greatest use of computers for drill and practice activities (Table 5). Drill and practice use declines as the grade level increases with the exception of the 10-12 group, which scored a relative ranking of third. The lowest relative score was at the 8-9 grade level group.

Computer skills instruction is greatest at the high school (grades 10-12) (Table 6). Teachers in the P-2 grade-level group ranked second in reported use of computers for computer skills instruction. Once again, the lowest relative score was at the 8-9 grade level group.

Computer use as reported by the teachers on this survey is low in every category of use (Table 7). There are some positive areas to report, particularly in student-directed learning, but the over-all use of computers by teachers in classroom instruction appears to be very low. The over-all use mean score is a composite score that represents the sum of the standardized score of time and minutes in each use category, added together for each participant, and divided by the number of participants. Grade 3 through grade 5 teachers rank first in over-all computer use, while the Cross Grade Level group ranks last.

Attitude Toward Computer Use by Teachers

Teachers were asked to respond to a series of questions dealing with their attitudes about computers and the people who use them. Survey responses were overwhelmingly positive (Table 8) . Teachers characterized computers as good, beneficial, useful, important, and progressive, all very positive views. The majority of teachers believed that their students enjoyed using computers.

Table 8

Attitude Toward Computer Use by Teachers Grouped by Grade Level

ITEM [a]	Preschool - Grade 2							Grade 3 - Grade 5						
	N	Md	Min	Max	M	SD	z [d]	N	Md	Min	Max	M	SD	z [d]
5. Bad/good	47	7.00	2	8	6.98	1.36	.07	34	7.00	2	8	6.85	1.42	-.15
6. Compulsory/voluntary	47	6.00	1	8	5.68	1.72	.24	34	6.00	1	8	5.71	2.18	.25
7. Mystifying/understandable	47	5.00	1	8	4.94	2.00	-.20	34	5.50	1	8	5.24	1.89	-.04
8. Harmful/beneficial	47	7.00	4	8	6.96	1.27	.06	34	8.00	4	8	6.94	1.32	.05
9. Useless/useful	47	7.00	1	8	6.94	1.54	-.07	34	8.00	4	8	7.24	1.08	.15
10. Unimportant/important	47	7.00	1	8	6.87	1.70	.01	34	7.50	3	8	6.71	1.66	-.09
11. Regressive/progressive	46	7.00	1	8	7.09	1.35	.06	34	8.00	3	8	6.97	1.45	-.03
12. Students like to use computers	47	4.00	3	4	3.60	.50	.23	34	4.00	1	4	3.56	.99	.18
13. Teachers who use computers are better teachers	47	3.00	1	4	2.64	.74	.10	34	2.00	1	4	2.56	.75	.00
14. My principal thinks teachers who use computers are better teachers	46	3.00	1	4	2.85	.67	.06	33	3.00	1	4	2.79	.82	-.02
15. If I knew a piece of software had a positive effect, I would use it	46	2.00	2	2	2.00	.00	.07	34	2.00	2	2	2.00	.00	.07
ATTITUDE MEAN SCORE [e]	-.93							.41						

[a] Item scales are as follows:
Items 5 - 11: 1 - 8, Semantic differential scale
Items 12 -14 : 1-4, 1 = STRONGLY DISAGREE, 2 = DISAGREE, 3 = AGREE, 4 = STRONGLY AGREE
Item 15: 1 - 2, 1 = No, 2 = Yes

[b] Teachers who responded with a grade level that crossed grade-level groups (example K-5)

[c] Teachers who did **NOT** respond with a grade level

[d] $\underline{z}$ represents the mean z score for each item by teacher group [(Σ individual z scores) ÷ N]

[e] **Attitude Mean Score** = [Σ (z score of item 5 + z score of item 6 + z score of item 7 + z score of item 8 + z score of item 9 + z score of item 10 + z score of item 11 + z score of item 12 + z score of item 13 + z score of item 14 + z score of item 15)] ÷ N

(*table continues*)

Table 8 (*continued*)

ITEM [a]	Grade 6 - Grade 7							Grade 8 - Grade 9						
	N	Md	Min	Max	M	SD	z [d]	N	Md	Min	Max	M	SD	z [d]
5. Bad/good	28	7.00	5	8	6.79	1.07	-.06	35	7.00	1	8	6.57	1.56	-.21
6. Compulsory/voluntary	28	4.50	1	8	4.07	2.12	-.53	35	5.00	1	8	5.11	1.92	-.03
7. Mystifying/understandable	28	5.50	1	8	4.11	1.87	-.11	35	6.00	1	8	5.40	2.02	.05
8. Harmful/beneficial	28	7.00	1	8	6.54	1.80	-.24	35	7.00	1	8	6.49	1.74	-.28
9. Useless/useful	26	7.00	1	8	6.77	1.61	-.19	35	7.00	1	8	6.80	1.51	-.16
10. Unimportant/important	28	7.00	4	8	6.89	1.17	.03	35	7.00	2	8	6.60	1.82	-.16
11. Regressive/progressive	28	8.00	4	8	7.07	1.25	.05	35	7.00	2	8	6.77	1.56	-.19
12. Students like to use computers	29	4.00	2	4	3.62	.56	.26	34	3.00	1	4	3.27	.75	-.22
13. Teachers who use computers are better teachers	29	2.00	1	4	2.41	.95	-.18	35	2.00	1	7	2.26	.74	-.37
14. My principal thinks teachers who use computers are better teachers	27	3.00	2	4	2.74	.66	-.09	35	2.00	1	4	2.51	.78	-.40
15. If I knew a piece of software had a positive effect, I would use it	29	2.00	2	2	2.00	.00	.07	35	2.00	2	2	2.00	.00	.07
ATTITUDE MEAN SCORE [e]	-1.22							-1.93						

[a] Item scales are as follows:
Items 5 - 11: 1 - 8, Semantic differential scale
Items 12 -14 : 1-4, 1 = STRONGLY DISAGREE, 2 = DISAGREE, 3 = AGREE, 4 = STRONGLY AGREE
Item 15: 1 - 2, 1 = No, 2 = Yes

[b] Teachers who responded with a grade level that crossed grade-level groups (example K-5)

[c] Teachers who did **NOT** respond with a grade level

[d] **z** represents the mean z score for each item by teacher group [(Σ individual z scores) ÷ N]

[e] **Attitude Mean Score** = [Σ (z score of item 5 + z score of item 6 + z score of item 7 + z score of item 8 + z score of item 9 + z score of item 10 + z score of item 11 + z score of item 12 + z score of item 13 + z score of item 14 + z score of item 15)] ÷ N

(*table continues*)

Table 8 (*continued*)

ITEM [a]	Grade 10 - Grade 12							Cross Grade Level [b]						
	N	Md	Min	Max	M	SD	z [d]	N	Md	Min	Max	M	SD	z [d]
5. Bad/good	54	7.00	1	8	6.91	1.51	.02	24	8.00	2	8	7.42	1.35	.38
6. Compulsory/voluntary	53	5.00	1	8	4.91	2.27	-.13	23	6.00	1	8	5.52	2.15	.16
7. Mystifying/understandable	54	5.50	1	8	5.24	1.94	-.04	24	6.50	4	8	6.46	1.41	.60
8. Harmful/beneficial	54	7.00	3	8	6.87	1.17	.00	24	8.00	4	8	7.54	.93	.48
9. Useless/useful	54	7.00	1	8	7.04	1.39	.01	24	8.00	4	8	7.50	.89	.34
10. Unimportant/important	54	7.00	1	8	7.07	1.26	.14	24	7.50	1	8	7.00	1.79	.09
11. Regressive/progressive	54	7.00	3	8	6.89	1.22	-.10	24	8.00	6	8	7.58	.58	.44
12. Students like to use computers	54	3.00	1	4	3.20	.81	-.30	23	3.00	3	4	3.48	.51	.07
13. Teachers who use computers are better teachers	54	3.00	1	4	2.65	.78	.11	25	3.00	2	4	2.88	.78	.40
14. My principal thinks teachers who use computers are better teachers	52	3.00	2	4	2.98	.61	.24	25	3.00	2	4	2.96	.79	.21
15. If I knew a piece of software had a positive effect, I would use it	53	2.00	1	2	1.98	.14	-.22	24	2.00	2	2	2.00	.00	.07
ATTITUDE MEAN SCORE [e]	-.64							3.79						

[a] Item scales are as follows:
Items 5 - 11: 1 - 8, Semantic differential scale
Items 12 -14 : 1-4, 1 = STRONGLY DISAGREE, 2 = DISAGREE, 3 = AGREE, 4 = STRONGLY AGREE
Item 15: 1 - 2, 1 = No, 2 = Yes

[b] Teachers who responded with a grade level that crossed grade-level groups (example K-5)

[c] Teachers who did **NOT** respond with a grade level

[d] **z** represents the mean z score for each item by teacher group [(Σ individual z scores) ÷ N]

[e] **Attitude Mean Score** = [Σ (z score of item 5 + z score of item 6 + z score of item 7 + z score of item 8 + z score of item 9 + z score of item 10 + z score of item 11 + z score of item 12 + z score of item 13 + z score of item 14 + z score of item 15)] ÷ N

(*table continues*)

Table 8. (*continued*)

ITEM [a]	Undeclared [c]							Total Teacher Population						
	N	Md	Min	Max	M	SD	z [d]	N	Md	Min	Max	M	SD	z [d]
5. Bad/good	9	7.00	3	8	6.22	1.99	-.45	231	7.00	1	8	6.87	1.43	.00
6. Compulsory/voluntary	9	5.00	3	7	5.00	1.50	-.09	229	5.00	1	8	5.18	2.09	.00
7. Mystifying/understandable	9	6.00	2	8	5.22	1.92	-.05	231	6.00	1	8	5.31	1.92	.00
8. Harmful/beneficial	9	7.00	4	8	6.89	1.27	.01	231	7.00	1	8	6.87	1.39	.00
9. Useless/useful	9	7.00	5	8	7.00	1.23	-.02	229	7.00	1	8	7.03	1.38	.00
10. Unimportant/important	9	7.00	4	8	6.44	1.51	-.26	231	7.00	1	8	6.85	1.56	.00
11. Regressive/progressive	9	7.00	5	8	6.78	1.09	-.18	230	7.00	1	8	7.01	1.29	.00
12. Students like to use computers	8	3.50	1	4	3.25	1.04	-.24	229	4.00	1	4	3.43	.74	.00
13. Teachers who use computers are better teachers	9	2.00	1	4	2.33	1.00	-.28	233	3.00	1	4	2.56	.80	.00
14. My principal thinks teachers who use computers are better teachers	9	3.00	1	4	2.56	1.01	-.34	227	3.00	1	4	2.81	.73	.00
15. If I knew a piece of software had a positive effect, I would use it	9	2.00	2	2	2.00	.00	.07	230	2.00	1	2	2.00	.07	.00
ATTITUDE MEAN SCORE [e]	-2.04							-.04						

[a] Item scales are as follows:
Items 5 - 11: 1 - 8, Semantic differential scale
Items 12 -14 : 1-4, 1 = STRONGLY DISAGREE, 2 = DISAGREE, 3 = AGREE, 4 = STRONGLY AGREE
Item 15: 1 - 2, 1 = No, 2 = Yes

[b] Teachers who responded with a grade level that crossed grade-level groups (example K-5)

[c] Teachers who did **NOT** respond with a grade level

[d] **z** represents the mean z score for each item by teacher group [(Σ individual z scores) ÷ N]

[e] **Attitude Mean Score** = [Σ (z score of item 5 + z score of item 6 + z score of item 7 + z score of item 8 + z score of item 9 + z score of item 10 + z score of item 11 + z score of item 12 + z score of item 13 + z score of item 14 + z score of item 15)] ÷ N

And, when asked if they would use a piece of software if it could be proven that the software would increase student achievement, only one teacher out of 230 responded no (1=NO, 2=YES).

The only variance that teachers reported was in items 6, 7, and 13. The total group of respondents viewed computer use as being slightly more voluntary than compulsory (M = 5.18, Md = 5.00) and more understandable than mystifying (M = 5.31, Md = 6.00). However, the 6-7 grade-level group held a slightly more negative view, with computers being slightly more compulsory than voluntary (M = 4.07, Md = 4.5) and more mystifying than understandable (M = 4.11, Md = 5.50). By far the greatest variation in response was on item 13, which asked if teachers who used computers in classroom instruction were better teachers. The responses to this question were as follows: strongly disagree--9%, disagree--38%, agree--42%, and strongly agree--11%.The average response for the total population was almost neutral (M = 2.56, SD = .80, Md = 3.00, scale =1-4). Two grade-level groups--6-7 and 8-9--did not believe that teachers who use computers are better teachers. The relative rankings of these groups must be viewed in the total context that attitude about computers throughout the system is very high.

Relative Attitude Ranking by Grade-level Grouping (1 = highest)

Rank	Group
1.	Cross Grade
2.	3-5
3.	10-12
4.	P-2
5.	6-7
6.	8-9

Access to Computers by Teachers

Access is defined as the availability of computers and software. Teachers were asked how many computers were in their classrooms and the greatest number of students in the classroom during the day. A computer/student ratio was computed by dividing the number of computers by the number of students. Participants averaged 2.42 computers per classroom or 1 computer for every 8.57 students (Table 9). The number of computers per classroom by grade-level group ranges from .10 (1 computer for every 10 students) in the Cross Grade Level Group to .20 (1 computer for every 5 students) in the 10-12 grade-level group. In a classroom with a .20 computer/student ratio, if the computer is used 100 percent of classroom time by individual students, each student would only be allowed use of a computer 20 percent of the time. Of course, most computers in the school system are not used 100 percent of the time, so actual student use would be less. The number of computers per classroom gradually increases as the grade-level group increases (P-2 = 1.70 per classroom, 10-12 = 3.93 per classroom). In relative access ranking, the 10-12 group ranked first, P-2 ranked second, and the

Table 9

Access to Computers by Teachers Grouped by Grade Level

ITEM [a]	Preschool - Grade 2							Grade 3 - Grade 5						
	N	Md	Min	Max	M	SD	z [d]	N	Md	Min	Max	M	SD	z [d]
16A. Number of computers in the room in which you teach	47	1.00	0	5	1.70	1.06	-.17	32	1.00	0	22	2.19	3.77	-.06
16B. Number of students in the room in which you teach	46	19.00	1	28	17.87	5.73	-.31	33	23.00	16	30	22.06	3.47	.14
Computer to Student Ratio (Computed Value)	46	.09	.04	1	.13	.16	-.02	33	.05	0	.88	.11	.17	-.19
17. I have access to a computer lab	47	1.00	1	2	1.32	.47	-.41	33	1.00	1	2	1.33	.48	-.38
18. I have the equipment & software for whole class instruction	46	1.00	1	2	1.39	.49	.07	33	1.00	1	2	1.33	.48	-.05
19. I have the equipment & software for student-directed learning	46	1.00	1	2	1.48	.51	.05	33	2.00	1	2	1.52	.51	.12
20. I have the equipment & software for drill & practice	47	2.00	1	2	2.60	.50	.08	32	2.00	1	2	1.72	.46	.33
21. I have the equipment & software to teach computer skills	46	1.00	1	2	1.43	.50	-.13	32	2.00	1	2	1.53	.51	.06
22. I have a computer at home.	47	1.00	1	2	1.40	.50	-.02	33	1.00	1	2	1.30	.47	-.22
ACCESS MEAN SCORE [e]	-.24							-.29						

[a] Item scales are as follows:

Items 16A and 16B: Are open ended numerical questions

Computer to Student Ratio: The number of computers in the classroom divided by the greatest number of students in the room during the day.

Items 17 - 22: 1 - 2, 1 = No, 2 = Yes

[b] Teachers who responded with a grade level that crossed grade-level groups (example K-5)

[c] Teachers who did **NOT** respond with a grade level

[d] **z** represents the mean z score for each item by teacher group [(Σ individual z scores) ÷ N]

[e] **Access Mean Score** = [Σ (z score of the computer to student ratio + z score of item 17 + z score of item 18 + z score of item 19 + z score of item 20 + z score of item 21 + z score of item 22)] ÷ N

(*table continues*)

Table 9 (*continued*)

ITEM [a]	Grade 6 - Grade 7							Grade 8 - Grade 9						
	N	Md	Min	Max	M	SD	z [d]	N	Md	Min	Max	M	SD	z [d]
16A. Number of computers in the room in which you teach	29	1.00	0	24	2.35	4.46	-.02	35	2.00	0	25	2.86	4.37	.10
16B. Number of students in the room in which you teach	29	22.00	0	25	20.76	5.78	.00	35	24.00	6	72	23.26	10.42	.27
Computer to Student Ratio (Computed Value)	28	.05	.04	0.96	.12	.19	-.09	35	.11	0	1.09	.14	.20	.00
17. I have access to a computer lab	26	2.00	1	2	1.58	.50	.11	35	1.00	1	2	1.49	.51	-.07
18. I have the equipment & software for whole class instruction	29	1.00	1	2	1.21	.41	-.31	34	1.00	1	2	1.34	.47	-.07
19. I have the equipment & software for student-directed learning	29	1.00	1	2	1.41	.50	-.08	35	1.00	1	2	1.49	.51	.06
20. I have the equipment & software for drill & practice	29	1.00	1	2	1.48	.51	-.14	35	1.00	1	2	1.46	.51	-.19
21. I have the equipment & software to teach computer skills	29	1.00	1	2	1.34	.48	-.31	35	1.00	1	2	1.46	.51	-.09
22. I have a computer at home.	29	1.00	1	2	1.48	.51	.14	35	1.00	1	2	1.46	.51	.09
ACCESS MEAN SCORE [e]	-.41							-.37						

[a] Item scales are as follows:
Items 16A and 16B are open ended numerical questions
Computer to Student Ratio: The number of computers in the classroom divided by the the greatest number of students in the room during the day.
Items 17 - 22: 1 - 2, 1 = No, 2 = Yes

[b] Teachers who responded with a grade level that crossed grade-level groups (example K-5)

[c] Teacher who did **NOT** respond with a grade level

[d] **z** represents the mean z score for each item by teacher group [(Σ individual z scores) ÷ N]

[e] **Access Mean Score** = [Σ (z score of the computer to student ratio + z score of item 17 + z score of item 18 + z score of item 19 + z score of item 20 + z score of item 21 + z score of item 22)] ÷ N

(*table continues*)

Table 9 (*continued*)

ITEM [a]	Grade 10 - Grade 12							Cross Grade Level [b]						
	N	Md	Min	Max	M	SD	z [d]	N	Md	Min	Max	M	SD	z [d]
16A. Number of computers in the room in which you teach	53	1.00	1	25	3.93	6.33	.36	25	1.00	0	5	.88	1.01	-.37
16B. Number of students in the room in which you teach	53	23.00	6	35	20.08	7.59	-.07	24	21.00	0	75	23.92	19.26	.34
Computer to Student Ratio (Computed Value)	53	.08	.03	1.60	.20	.30	.31	23	.04	0	.63	.10	.14	-.20
17. I have access to a computer lab	53	2.00	1	2	1.89	.32	.73	25	1.00	1	2	1.40	.50	-.24
18. I have the equipment & software for whole class instruction	52	2.00	1	2	1.54	.50	.38	25	1.00	1	2	1.24	.44	-.02
19. I have the equipment & software for student-directed learning	53	1.00	1	2	1.38	.49	-.15	25	2.00	1	2	1.52	.51	.13
20. I have the equipment & software for drill & practice	53	2.00	1	2	1.57	.50	.02	25	1.00	1	2	1.48	.51	-.15
21. I have the equipment & software to teach computer skills	53	2.00	1	2	1.68	.47	.35	25	2.00	1	2	1.56	.51	.12
22. I have a computer at home.	53	1.00	1	2	1.42	.49	.00	25	1.00	1	2	1.32	.48	-.19
ACCESS MEAN SCORE [e]	1.56							-.51						

[a] Item scales are as follows:

Items 16A and 16B are open ended numerical questions

Computer to Student Ratio: The number of computers in the classroom divided by the the greatest number of students in the room during the day.

Items 17 - 22: 1 - 2, 1 = No, 2 = Yes

[b] Teachers who responded with a grade level that crossed grade-level groups (example K-5)

[c] Teachers who did **NOT** respond with a grade level

[d] **z** represents the mean z score for each item by teacher group [(Σ individual z scores) ÷ N]

[e] **Access Mean Score** = [Σ (z score of the computer to student ratio + z score of item 17 + z score of item 18 + z score of item 19 + z score of item 20 + z score of item 21 + z score of item 22)] ÷ N

(*table continues*)

Table 9 (*continued*)

ITEM [a]	Undeclared [c]							Total Teacher Population						
	N	Md	Min	Max	M	SD	z [d]	N	Md	Min	Max	M	SD	z [d]
16A. Number of computers in the room in which you teach	9	1.00	1	2	1.22	.44	-.29	231	1.00	0	25	2.42	4.19	.00
16B. Number of students in the room in which you teach	9	18.00	5	26	16.22	7.41	-.49	230	22.00	0	75	20.74	9.24	.00
Computer to Student Ratio (Computed Value)	9	.10	.04	.20	.09	.05	-.20	227	.07	0	1.6	.14	.21	.00
17. I have access to a computer lab	8	1.50	1	2	1.50	.54	-.04	228	2.00	1	2	1.52	.50	.00
18. I have the equipment & software for whole class instruction	9	1.00	1	2	1.22	.44	-.28	229	1.00	1	2	1.36	.48	.00
19. I have the equipment & software for student-directed learning	9	1.00	1	2	1.33	.50	-.24	231	1.00	1	2	1.45	.50	.00
20. I have the equipment & software for drill & practice	9	1.00	1	2	1.44	.53	-.22	231	2.00	1	2	1.55	.50	.00
21. I have the equipment & software to teach computer skills	8	1.00	1	2	1.25	.46	-.50	229	2.00	1	2	1.50	.50	.00
22. I have a computer at home.	9	2.00	1	2	1.67	.50	.51	232	1.00	1	2	1.41	.49	.00
ACCESS MEAN SCORE [e]	-1.32							.07						

[a] Item scales are as follows:

Items 16A and 16B are open-ended numerical questions

Computer to Student Ratio: The number of computers in the classroom divided by the the greatest number of students in the room during the day

Items 17 - 22: 1 - 2, 1 = No, 2 = Yes

[b] Teachers who responded with a grade level that crossed grade-level groups (example K-5)

[c] Teachers who did **NOT** respond with a grade level

[d] **z** represents the mean z score for each item by teacher group [(Σ individual z scores) ÷ N]

[e] **Access Mean Score** = [Σ (z score of the computer to student ratio + z score of item 17 + z score of item 18 + z score of item 19 + z score of item 20 + z score of item 21 + z score of item 22)] ÷ N

cross grade level group ranked last. Half of the teachers surveyed said they did not have access to a computer lab.

Relative Access Ranking by Grade-level Group (1 = highest)

Rank	Group
1.	10-12
2.	P-2
3.	3-5
4.	8-9
5.	6-7
6.	Cross Grade

When asked if they had the necessary equipment and software for whole class instruction, most teachers (64%) responded negatively -- 1 = NO, 2 = YES. Slightly more than half of the survey participants said they did not have the necessary equipment and software for student-directed learning. More teachers feel they have the necessary equipment for drill and practice activities, particularly teachers at the P-2 and 3-5 grade levels. About half of the teachers surveyed feel they have what they need to teach computer skills to their students.

Teachers were asked if they had a computer at home on which to work. The majority of teachers (59%) do not have a computer at home. Access is a mixed factor.

Training of Teachers to Use Computers

Teachers were positive about the training they had received in computer use (Table 10). Training is defined as the preparation of teachers to use computers

Table 10

Training to Use Computers by Teachers Grouped by Grade Level

ITEM [a]	Preschool - Grade 2							Grade 3 - Grade 5						
	N	Md	Min	Max	M	SD	z [d]	N	Md	Min	Max	M	SD	z [d]
23. Hours of computer-related in-service	42	2.50	0	90	10.29	17.65	-.14	31	3.00	0	75	9.94	16.27	-.09
24. Number of hours of computer-related college classes	45	2.00	0	25	2.36	1.30	-.12	33	3.00	0	8	2.76	2.00	-.07
25. School system offers computer training opportunities	47	2.00	2	2	2.00	.00	.09	34	2.00	1	2	1.97	.17	-.22
27. School system computer training has helped me use computers	43	3.00	1	4	2.84	.75	.31	27	3.00	2	4	3.04	.59	.13
28. I would classify myself as	43	4.00	1	4	3.23	.97	.10	30	4.00	1	4	3.30	.85	.17
TRAINING MEAN SCORE [e]	.16							-.17						

[a] Item scales are as follows:
Items 23 and 24 are open-ended numerical questions
Item 25: 1 - 2, 1 = No, 2 = Yes
Item 27: 1 - 4, 1 = STRONGLY DISAGREE, 2 = DISAGREE, 3 = AGREE, 4 = STRONGLY AGREE
Item 28: 1 - 4, 1 = A NON-USER, 2 = SELF TAUGHT, 3 = PEER TAUGHT, 4 = FORMALLY TRAINED (WORKSHOPS & COLLEGE CLASSES)

[b] Teachers who responded to grade level crossed grade-level groups (example K-5)

[c] Teachers who did **NOT** respond to grade level

[d] **z** represents the mean z score for each item by teacher group [(Σ individual z scores) ÷ N]

[e] **Training Mean Score** = [Σ (z score of item 23 + z score of item 24 + z score of item 25 + z score of item 26 + z score of item 27)] ÷ N

(*table continues*)

Table 10 (*continued*)

ITEM [a]	Grade 6 - Grade 7							Grade 8 - Grade 9						
	N	Md	Min	Max	M	SD	z [d]	N	Md	Min	Max	M	SD	z [d]
23. Hours of computer-related in-service	26	3.00	0	45	7.58	12.12	-.20	30	1.50	0	60	9.27	16.12	.18
24. Number of hours of computer-related college classes	28	3.00	0	7	2.89	1.91	-.04	33	2.00	0	6	2.39	1.48	.42
25. School system offers computer training opportunities	29	2.00	2	2	2.00	.00	.09	35	2.00	2	2	2.00	.00	.09
27. School system computer training has helped me use computers	24	3.00	1	4	2.88	.74	.11	22	3.00	1	4	2.68	.95	-.40
28. I would classify myself as	27	3.00	1	4	3.00	1.00	-.13	30	3.00	1	4	3.03	.93	-.10
TRAINING MEAN SCORE [e]	.11							.00						

[a] Item scales are as follows:
Items 23 and 24 are open-ended numerical questions
Item 25: 1 - 2, 1 = No, 2 = Yes
Item 27: 1 - 4, 1 = STRONGLEY DISAGREE, 2 = DISAGREE, 3 = AGREE, 4 = STRONGLY AGREE
Item 28: 1 - 4, 1 = A NON-USER, 2 = SELF TAUGHT, 3 = PEER TAUGHT, 4 = FORMALLY TRAINED (WORKSHOPS & COLLEGE CLASSES)

[b] Teachers who responded with a grade level that crossed grade-level groups (example K-5)

[c] Teachers who did **NOT** respond to grade level

[d] $\bar{z}$ represents the mean z score for each item by teacher group [(Σ individual z scores) ÷ N]

[e] **Training Mean Score** = [Σ (z score of item 23 + z score of item 24 + z score of item 25 + z score of item 26 + z score of item 27)] ÷ N

(*table continues*)

Table 10 (*continued*)

ITEM [a]	Grade 10 - Grade 12							Cross Grade Level [b]						
	N	Md	Min	Max	M	SD	z [d]	N	Md	Min	Max	M	SD	z [d]
23. Hours of computer-related in-service	51	4.00	0	90	12.20	19.61	-.02	20	1.00	0	90	11.95	21.48	.35
24. Number of hours of computer-related college classes	53	2.00	0	10	3.04	2.39	-.02	25	3.00	0	6	2.84	1.31	-.09
25. School system offers computer training opportunities	53	2.00	1	2	1.98	.14	-.11	25	2.00	2	2	2.00	.00	.09
27. School system computer training has helped me use computers	33	3.00	1	4	2.73	.91	-.39	21	3.00	1	4	3.05	.67	.40
28. I would classify myself as	50	3.00	1	4	2.88	1.08	-.25	23	4.00	1	4	3.48	.90	.35
TRAINING MEAN SCORE [e]	-.93							1.10						

[a] Item scales are as follows:
Items 23 and 24 are open-ended numerical questions
Item 25: 1 - 2, 1 = No, 2 = Yes
Item 27: 1 - 4, 1 = STRONGLY DISAGREE, 2 = DISAGREE, 3 = AGREE, 4 = STRONGLY DISAGREE
Item 28: 1 - 4, 1 = A NON-USER, 2 = SELF TAUGHT, 3 = PEER TAUGHT, 4 = FORMALLY TRAINED (WORKSHOPS & COLLEGE CLASSES)

[b] Teachers who responded with a grade level that crossed grade-level groups (example K-5)

[c] Teachers who did **NOT** respond with a grade level

[d] **z** represents the mean z score for each item by teacher group [(Σ individual z scores) ÷ N]

[e] **Training Mean Score** = [Σ (z score of item 23 + z score of item 24 + z score of item 25 + z score of item 26 + z score of item 27)] ÷ N

(*table continues*)

Table 10 (*continued*)

ITEM [a]	Undeclared [c]							Total Teacher Population						
	N	Md	Min	Max	M	SD	z [d]	N	Md	Min	Max	M	SD	z [d]
23. Hours of computer-related in-service	5	4.00	0	20	6.20	8.07	.18	205	3.00	0	90	10.28	17.26	.00
24. Number of hours of computer-related college classes	9	2.00	1	4	2.11	1.27	-.19	226	2.00	0	10	2.69	1.81	.00
25. School system offers computer training opportunities	9	2.00	2	2	2.00	.00	.09	232	2.00	1	2	1.99	.09	.00
27. School system computer training has helped me use computers	9	3.00	1	4	2.78	.83	.40	179	3.00	1	4	2.85	.78	.00
28. I would classify myself as	9	4.00	2	4	3.33	.87	.20	212	4.00	1	4	3.13	.99	.00
TRAINING MEAN SCORE [e]	.56							-.07						

[a] Item scales are as follows:
Items 23 and 24 are open-ended numerical questions
Item 25: 1 - 2, 1 = No, 2 = Yes
Item 27: 1 - 4, 1 = STRONGLY DISAGREE, 2 = AGREE, 3 = AGREE, 4 = STRONGLY AGREE
Item 28: 1 - 4, 1 = A NON-USER, 2 = SELF TAUGHT, 3 = PEER TAUGHT, 4 = FORMALLY TRAINED (WORKSHOPS & COLLEGE CLASSES)

[b] Teachers who responded with a grade level that crossed grade-level groups (example K-5)

[c] Teachers who did **NOT** respond with a grade level

[d] **z** represents the mean z score for each item by teacher group [(Σ individual z scores) ÷ N

[e] **Training Mean Score** = [Σ (z score of item 23 + z score of item 24 + z score of item 25 + z score of item 26 + z score of item 27)] ÷ N

in the classroom. The scores for training were universally high, so while the 10-12 grade level group had the lowest relative rank in training, it is still a fairly positive score. The total population of classroom teachers reported an average of 10.28 hours of computer-related inservice and 2.69 computer-related college classes. Grades 6-7 had the lowest amount of inservice (7.58 hours), while P-2 teachers reported the lowest average number of computer classes (2.36 classes). Only eight percent of the survey participants had received no training (Table 11).

Relative Training Ranking by Grade-level Group (1 = highest)

Rank	Group
1.	Cross Grade
2.	P-2
3.	8-9
4.	6-7
5.	3-5
6.	10-12

When the participants in the survey were asked to classify their computer expertise, only 6 % of the teachers classified themselves as non-users, 26% reported they were self-taught, 18 % responded as peer-taught, and 50% considered themselves to be formally trained. The training provided by the school system appears to have made some difference in both the self-perception of teachers and use of computers in classroom instruction by teachers.

Support of Teachers in the Use of Computers

Support is defined as the assistance needed to use computers in the classroom (i.e., computer technicians, computer literate coworkers, and

Table 11

Computer Training Received by Teachers Grouped by Grade Level

Type of Training	Preschool - Grade 2 *N = 47*	Grade 3 - Grade 5 *N = 34*	Grade 6 - Grade 7 *N = 29*	Grade 8 - Grade 9 *N = 35*	Grade 10 - Grade 12 *N = 53*	Cross Grade Level *N = 24*	Undeclared *N = 9*	Total Teacher Population *N = 231*
No Training	1	2	1	2	2	0	0	8
Computer Operation and Basics	43	26	26	28	41	24	8	196
Word Processing	22	15	15	19	39	14	3	129
Presentation Software	6	8	4	10	21	7	3	59
Spreadsheeting	9	9	6	12	18	9	2	65
Database Management	6	5	5	7	12	6	1	42
Other	14	13	7	8	9	1	1	53

Note. Numbers in the table are frequencies.

administrators/others who endorse computer use) (Table 12). Communications do not seem to be a problem with regard to computer technicians. When asked if the school system had a computer technician, whom they could call with computer-related questions, most teachers (89%) were aware that the school system employed technicians to repair computers. Almost every teacher (90%) has determined who in their building has some expertise about computers and considers them a resource for computer-related questions.

Teachers rated the speed with which computer-related questions were answered as adequate or fast (66%) and slow or nonexistent (34%). Most teachers are satisfied with rate of repair and technical support. The 8-9 and 10-12 grade level groups were less likely to rate the speed as adequate or fast.

All teachers felt a high degree of support for computer use in the classroom from their principal, the central office, the school board, and parents. Grades 6-7 had the highest relative ranking in support. The 8-9 group ranked last. Once again, the total support score was high, and a relative ranking of "last" does not indicate that teachers feel a lack of support.

Relative Support Ranking by Grade-level Group (1 = highest)

Rank	Group
1.	6-7
2.	3-5
3.	P-2
4.	Cross Grade
5.	10-12
6.	8-9

Table 12

Support in the Use of Computers by Teachers Grouped by Grade Level

ITEM [a]	Preschool - Grade 2							Grade 3 - Grade 5						
	N	Md	Min	Max	M	SD	z [d]	N	Md	Min	Max	M	SD	z [d]
30. The school system has a computer technician	47	2.00	1	2	1.89	.31	.02	33	2.00	1	2	1.91	.29	.07
31. There is a person in the building who can answer computer questions	45	2.00	1	2	1.93	.25	.12	34	2.00	1	2	1.82	.39	-.25
32. How fast do you get help with computer-related questions?	44	3.00	2	4	2.93	.63	.32	34	3.00	2	4	2.85	.70	.36
33. My principal is supportive of computers in the classroom	44	3.00	1	4	3.07	.70	-.12	30	4.00	3	4	3.57	.50	.23
34. The central administration is supportive of computers in the classroom	42	3.00	1	4	3.12	.74	-.04	32	4.00	1	4	3.50	.67	.34
35. The school board is supportive of computers in the classroom	39	3.00	1	4	3.08	.77	.01	28	3.00	3	4	3.43	.50	.20
36. Parents are supportive of computers in the classroom	42	3.00	1	4	3.24	.58	.15	30	3.00	3	4	3.47	.51	.28
SUPPORT MEAN SCORE [e]	.37							1.21						

[a] Item scales are as follows:
Items 30 and 31: 1 - 2, 1 = No, 2 = Yes
Items 32 - 36: 1 - 4, 1 = STRONGLY DISAGREE, 2 = DISAGREE, 3 = AGREE, 4 = STRONGLY AGREE

[b] Teachers who responded with a grade level that crossed grade-level groups (example K-5)

[c] Teachers who did **NOT** respond with a grade level

[d] **z** represents the mean z score for each item by teacher group [(Σ individual z scores) ÷ N

[e] **Support Mean Score** = [Σ (z score of Item 30 + z score of item 31 + z score of item 32 + z score of item 33 + z score of item 34 + z score of item 35 + z score of item 36)] ÷ N

(*table continues*)

Table 12 (*continued*)

ITEM [a]	Grade 6 - Grade 7							Grade 8 - Grade 9						
	N	Md	Min	Max	M	SD	z [d]	N	Md	Min	Max	M	SD	z [d]
30. The school system has a computer technician	29	2.00	1	2	1.86	.35	-.08	35	2.00	1	2	1.94	.24	.18
31. There is a person in the building who can answer computer questions	29	2.00	1	2	1.90	.31	-.01	34	2.00	1	2	1.91	.29	.04
32. How fast do you get help with computer-related questions?	29	3.00	1	4	2.86	.69	.37	29	3.00	1	4	2.59	.73	-.29
33. My principal is supportive of computers in the classroom	29	3.00	3	4	3.34	.48	.33	33	3.00	2	4	3.21	.48	.03
34. The central administration is supportive of computers in the classroom	28	3.00	3	4	3.39	.50	.33	28	3.00	1	4	3.11	.63	-.35
35. The school board is supportive of computers in the classroom	24	3.00	3	4	3.49	.51	.30	24	3.00	1	4	3.04	.62	-.32
36. Parents are supportive of computers in the classroom	27	3.00	2	4	3.30	.54	.37	23	3.00	3	4	3.13	.34	-.51
SUPPORT MEAN SCORE [e]	1.71							-1.24						

[a] Item scales are as follows:

Items 30 and 31: 1 - 2, 1 = No, 2 = Yes

Items 32 - 36: 1 - 4, 1 = STRONGLY DISAGREE, 2 = DISAGREE, 3 = AGREE, 4 = STRONGLY AGREE

[b] Teachers who responded with a grade level that crossed grade-level groups (example K-5)

[c] Teachers who did **NOT** respond with a grade level

[d] **z** represents the mean z score for each item by teacher group [(Σ individual z scores) ÷ N

[e] **Support Mean Score** = [Σ (z score of Item 30 + z score of item 31 + z score of item 32 + z score of item 33 + z score of item 34 + z score of item 35 + z score of item 36)] ÷ N

(*table continues*)

Table 12 (*continued*)

ITEM [a]	Grade 10 - Grade 12							Cross Grade Level [b]						
	N	Md	Min	Max	M	SD	z [d]	N	Md	Min	Max	M	SD	z [d]
30. The school system has a computer technician	52	2.00	1	2	1.81	.40	-.25	25	2.00	1	2	1.92	.28	.10
31. There is a person in the building who can answer computer questions	51	2.00	1	2	1.92	.27	.08	25	2.00	1	2	1.88	.33	-.06
32. How fast do you get help with computer-related questions?	40	3.00	1	4	2.65	.70	-.42	19	3.00	2	4	2.79	.54	-.23
33. My principal is supportive of computers in the classroom	44	3.00	3	4	3.23	.42	-.35	23	3.00	3	4	3.44	.51	.15
34. The central administration is supportive of computers in the classroom	45	3.00	1	4	3.13	.55	-.24	23	3.00	3	4	3.48	.51	.26
35. The school board is supportive of computers in the classroom	41	3.00	1	4	3.22	.57	-.07	19	3.00	3	4	3.26	.45	-.04
36. Parents are supportive of computers in the classroom	43	3.00	3	4	3.12	.32	-.18	22	3.00	2	4	3.09	.53	.01
SUPPORT MEAN SCORE [e]	-.93							.02						

[a] Item scales are as follows:

Items 30 and 31: 1 - 2, 1 = No, 2 = Yes

Items 32 - 36: 1 - 4, 1 = STRONGLY DISAGREE, 2 = DISAGREE, 3 = AGREE, 4 = STRONGLY AGREE

[b] Teachers who responded with a grade level that crossed grade-level groups (example K-5)

[c] Teachers who did **NOT** respond with a grade level

[d] **z** represents the mean z score for each item by teacher group [(Σ individual z scores) ÷ N

[e] **Support Mean Score** = [Σ (z score of Item 30 + z score of item 31 + z score of item 32 + z score of item 33 + z score of item 34 + z score of item 35 + z score of item 36)] ÷ N

(*table continues*)

Table 12 (*continued*)

ITEM [a]	Undeclared [c]							Total Teacher Population						
	N	Md	Min	Max	M	SD	z [d]	N	Md	Min	Max	M	SD	z [d]
30. The school system has a computer technician	9	2.00	2	2	2.00	.00	.10	230	2.00	1	2	1.89	.32	.00
31. There is a person in the building who can answer computer questions	8	2.00	1	2	1.88	.35	-.06	226	2.00	1	2	1.90	.30	.00
32. How fast do you get help with computer-related questions?	9	2.00	1	4	2.44	.88	-.23	204	3.00	1	4	2.77	.69	.00
33. My principal is supportive of computers in the classroom	9	3.00	3	4	3.33	.50	.15	212	3.00	1	4	3.28	.55	.00
34. The central administration is supportive of computers in the classroom	9	3.00	1	3	2.78	.67	.26	207	3.00	1	4	3.24	.64	.00
35. The school board is supportive of computers in the classroom	8	3.00	3	3	3.00	.00	-.04	183	3.00	1	4	3.22	.60	.00
36. Parents are supportive of computers in the classroom	8	3.00	3	4	3.13	.35	.01	195	3.00	1	4	3.22	.48	.00
SUPPORT MEAN SCORE [e]	.53							.09						

[a] Item scales are as follows:

Items 30 and 31: 1 - 2, 1 = No, 2 = Yes

Items 32 - 36: 1 - 4, 1 = STRONGLY DISAGREE, 2 = DISAGREE, 3 = AGREE, 4 = STRONGLY AGREE

[b] Teachers who responded with a grade level that crossed grade-level groups (example K-5)

[c] Teachers who did **NOT** respond with a grade level

[d] **z** represents the mean z score for each item by teacher group [(Σ individual z scores) ÷ N

[e] **Support Mean Score** = [Σ (z score of Item 30 + z score of item 31 + z score of item 32 + z score of item 33 + z score of item 34 + z score of item 35 + z score of item 36)] ÷ N

Prediction of Teacher Computer Use

Multiple regression analysis was used to determine which factors were the best predictors of computer use. Predictor variables were regressed on each criterion variable: whole class instruction, student-directed learning, drill and practice, computer skills instruction, and over-all computer use. This analysis was done for each grade-level group as well as all classroom teachers.

Grades P-2

Two significant predictors were identified from the regression analysis for grade level group P-2 in computer skills instruction (Table 13). Support and age were found to be predictors of computer skills instruction use. Age appears to be the best predictor of computer skills instruction use, and the relationship is negative. In other words, the older the teacher, the less amount of computer skills instruction has been received. The regression analyses to identify predictors of whole class instruction, student-directed learning, drill and practice, and over-all computer use produced no significant predictors (Tables D1 - D4, Appendix D).

Grades 3-5

Training and Support appear to be the significant predictors of over-all computer use for grade-level group 3-5 (Table 14). Training is highly predictive

Table 13

Prediction of Computer Use in Computer Skills Instruction for Preschool - Grade 2 Teachers, N = 33 [a]

Computer Skills Use = .12 - .02 Attitude + .05 Access + .16 Training + .15 Support - .72 Age - .38 Retirement [b]

R-Sq .31

Analysis of Variance

Source	df	SS	MS	F	p
Regression	6	18.81	3.14	1.91	.12
Error	26	42.62	1.64		
Total	32	61.42			

Regression Analysis

Predictor	β	SD	t	p
Constant	.12	.29	.42	.68
Attitude	-.02	.05	-.36	.72
Access	.05	.06	.71	.48
Training	.16	.17	.91	.37
Support	.15	.06	2.64	.01
Age	-.72	.33	-2.17	.04
Retirement	-.38	.53	-.72	.48

[a] Listwise deletion of subjects with missing data.

[b] Gender is (essentially) constant.

[b] Gender has been removed from the equation.

Table 14

Prediction of Over-All Computer Use for Grade 3 - Grade 5 Teachers, N = 20 [a]

Computer Use = 1.34 + .02 Attitude + .07 Access + .87 Training - 1.05 Support - .16 Age + .55 Gender - .05 Retirement

R-Sq .59

Analysis of Variance

Source	df	SS	MS	F	p
Regression	7	97.11	13.87	2.49	.08
Error	12	66.76	5.56		
Total	19	163.87			

Regression Analysis

Predictor	β	SD	t	p
Constant	1.34	.83	1.61	.13
Attitude	.02	.16	.12	.90
Access	.07	.18	.40	.69
Training	.87	.27	3.23	.01
Support	-1.05	.34	-3.07	.01
Age	-.16	.95	-.17	.87
Gender	.55	1.10	.50	.63
Retirement	-.05	1.07	-.05	.96

[a] Listwise deletion of subjects with missing data.

of over-all computer use in this grade-level group. This is a strong argument for training at the 3-5 level. Support is an unexplained but strongly negative predictor of over-all computer use. The greater the support, the less the prediction of use. The regression analyses to identify predictors of whole class instruction, student directed learning, drill and practice, and computer skills instruction use produced no significant predictors (Tables D5 - D8, Appendix D).

Grades 6-7

Training is a strong predictor of both whole class instruction (.78) and student-directed learning (.68) at the 6-7 level (Tables 15 &16). Attitude at the 6-7 grade-level group is a predictor (.16) of drill and practice use (Table 17). Training is obviously an area of concentration needed at this grade-level group. The regression analyses to identify predictors of computer skills instruction, and over-all computer use produced no significant predictors (Tables D9 - D10, Appendix D).

Grades 8-9

In grades 8 and 9, training is the best predictor of computer skills instruction (Table 18). This was the only significant predictor for the 8-9 group. For every standard deviation unit of change in training, a predicted .28 standard deviation

Table 15

Prediction of Computer Use in Whole Class Instruction for Grade 6 - Grade 7 Teachers, N = 15 [a]

Whole Class Instruction Use = -.70 + .08 Attitude - .06 Access + .78 Training + .13 Support - .45 Age + .59 Retirement [b]

R-Sq .68

Analysis of Variance

Source	df	SS	MS	F	p
Regression	6	32.92	5.49	2.79	.09
Error	8	15.72	1.97		
Total	14	48.65			

Regression Analysis

Predictor	β	SD	t	p
Constant	-.70	.59	-1.19	.27
Attitude	.08	.09	.93	.38
Access	-.06	.11	-.54	.61
Training	.78	.25	3.18	.01
Support	.13	.17	.80	.45
Age	-.45	.62	-.72	.49
Retirement	.59	.60	.98	.36

[a] Listwise deletion of subjects with missing data.

[b] Gender is (essentially) constant.

[b] Gender has been removed from the equation.

Table 16

Prediction of Computer Use in Student-Directed Learning for Grade 6 - Grade 7 Teachers, N = 14 [a]

Student-Directed Learning Use = -.40 - .01 Attitude + .06 Access + .68 Training + .01 Support - 1.37 Age - .17 Retirement [b]

R-Sq .67

Analysis of Variance

Source	df	SS	MS	F	p
Regression	6	16.72	2.79	2.34	.15
Error	7	8.34	1.19		
Total	13	25.06			

Regression Analysis

Predictor	β	SD	t	p
Constant	-.40	.42	-.95	.38
Attitude	-.01	.07	-.16	.88
Access	.06	.11	.55	.60
Training	.68	.26	2.57	.04
Support	.01	.14	.05	.96
Age	-1.37	.68	-2.01	.09
Retirement	-.17	.53	-.31	.76

[a] Listwise deletion of subjects with missing data.

[b] Gender is (essentially) constant.

[b] Gender has been removed from the equation.

Table 17

Prediction of Computer Use in Drill and Practice for Grade 6 - Grade 7 Teachers, N = 14 [a]

Drill and Practice Use = .84 + .16 Attitude - .20 Access - .03 Training - .23 Support + .24 Age - .47 Retirement [b]

R-Sq .76

Analysis of Variance

Source	df	SS	MS	F	p
Regression	6	21.08	3.51	3.61	.06
Error	7	6.82	.97		
Total	11	27.90			

Regression Analysis

Predictor	β	SD	t	p
Constant	.84	.40	2.11	.07
Attitude	.16	.06	2.61	.04
Access	-.20	.09	-2.16	.07
Training	-.03	.18	-.18	.86
Support	-.23	.11	-2.00	.09
Age	.24	.45	.53	.61
Retirement	-.47	.57	-.81	.44

[a] Listwise deletion of subjects with missing data.

[b] Gender is (essentially) constant.

[b] Gender has been removed from the equation.

Table 18

Prediction of Computer Use in Computer Skills Instruction for Grade 8 - Grade 9 Teachers, N = 20 [a]

Computer Skills Use = -.62 + .00 Attitude + .04 Access + .28 Training - .04 Support - .44 Age + .09 Gender - .14 Retirement

R-Sq .90

Analysis of Variance

Source	df	SS	MS	F	p
Regression	7	47.35	6.76	15.38	.00
Error	12	5.28	.44		
Total	19	52.62			

Regression Analysis

Predictor	β	SD	t	p
Constant	-.62	.21	-2.90	.01
Attitude	.00	.03	-.14	.89
Access	.04	.05	.71	.49
Training	.28	.04	6.37	.00
Support	-.04	.05	-.77	.46
Age	-.44	.32	-1.36	.20
Gender	.09	.14	.65	.53
Retirement	-.14	.28	-.52	.61

[a] Listwise deletion of subjects with missing data.

unit of use in computer skills instruction should occur. The regression analyses to identify predictors of whole class instruction, student directed learning, drill and practice, and over-all computer use produced no significant predictors (Tables D11 - D14, Appendix D).

Grades 10-12

At the 10-12 grade level, attitude is a fairly weak but significant predictor (.09) of student-directed learning (Table 19); access is a somewhat stronger predictor (.27) of computer skills instruction (Table 20). At this level more emphasis should be placed on attitude and access in order to improve computer use. The regression analyses to identify predictors of whole class instruction, drill and practice, and over-all computer use produced no significant predictors (Tables D15 - D17, Appendix D).

Cross Grade Level

The cross grade level group has three useful predictors for computer skills instruction use (Table 21); they are attitude (.16), access (.08), and gender (.27). The higher the attitude and access, the greater the prediction of computer skills instruction. Female teachers in this group were more likely to predict use in computer skills instruction. The difficulty with this group is targeting the teachers

Table 19

Prediction of Computer Use in Student-Directed Learning for Grade 10 - Grade 12 Teachers, N = 38 [a]

Student-Directed Learning Use = .47 + .09 Attitude + 12 Access - .08 Training + .01 Support + .50 Age + .07 Gender + .28 Retirement

R-Sq .34

Analysis of Variance

Source	df	SS	MS	F	p
Regression	7	21.84	3.12	2.20	.06
Error	30	42.47	1.42		
Total	37	64.31			

Regression Analysis

Predictor	β	SD	t	p
Constant	.47	.29	1.59	.12
Attitude	.09	.04	2.28	.03
Access	.12	.06	1.82	.08
Training	-.08	.07	-1.13	.27
Support	.01	.05	.16	.87
Age	.50	.41	1.23	.23
Gender	.07	.19	.40	.69
Retirement	.28	.34	.81	.43

[z] Listwise deletion of subjects with missing data.

Table 20

Prediction of Computer Use in Computer Skills Instruction for Grade 10 - Grade 12 Teachers, N = 38 [a]

Computer Skills Use = -.21 + .02 Attitude + .27 Access + .05 Training + .04 Support + .26 Age - .12 Gender + .06 Retirement

R-Sq .31

Analysis of Variance

Source	df	SS	MS	F	p
Regression	7	10.10	5.73	1.92	.10
Error	30	89.33	2.98		
Total	37	129.43			

Regression Analysis

Predictor	β	SD	t	p
Constant	-.21	.42	-.49	.63
Attitude	.02	.06	.27	.79
Access	.27	.09	3.03	.01
Training	.05	.10	.53	.60
Support	.04	.09	.44	.66
Age	.26	.59	.44	.66
Gender	-.12	.26	-.46	.65
Retirement	-.06	.48	-.12	.90

[a] Listwise deletion of subjects with missing data.

Table 21

Prediction of Computer Use in Computer Skills Instruction for Cross Grade Level Teachers, N = 17 [a]

Computer Skills Use = -1.08 + .16 Attitude + .08 Access - .05 Training + .03 Support + .33 Age + .27 Gender + .37 Retirement

R-Sq .85

Analysis of Variance

Source	df	SS	MS	F	p
Regression	7	8.75	1.25	6.99	.01
Error	9	1.61	.18		
Total	16	10.36			

Regression Analysis

Predictor	β	SD	t	p
Constant	-1.08	.18	-5.99	.00
Attitude	.16	.04	4.13	.00
Access	.08	.03	2.59	.03
Training	-.05	.06	-.83	.43
Support	.03	.04	.62	.55
Age	.33	.20	1.62	.14
Gender	.27	.11	2.42	.04
Retirement	.37	.22	1.67	.13

[a] Listwise deletion of subjects with missing data.

who comprise the group. It is a somewhat artificial grouping, although itinerant and specialty teachers would be members of this group. The regression analyses to identify predictors of whole class instruction, student-directed learning, drill and practice, and over-all computer use produced no significant predictors (Tables D18 - D21, Appendix D).

All Classroom Teachers

The regression analyses to identify predictors of computer use for all the classroom teachers who responded to the survey found four significant predictors. Gender (.39) is a good predictor of drill and practice use (Table 22). Access (.13) and training (.11) are moderate predictors of computer skills instruction use (Table 23). Gender (.80) is a very strong predictor of over-all computer use (Table 24). The regression analyses to identify predictors of whole class instruction and student-directed learning use produced no significant predictors (Tables D22 - D23, Appendix D).

Correlation of Criterion and Predictor Variables

All of the coefficients indicate moderate to very high correlations between over-all computer use and whole class instruction, student-directed learning, drill and practice, and computer skills instruction (Table 25). These correlations are

Table 22

Prediction of Computer Use in Drill and Practice for All Classroom Teachers, N = 144 [a]

Drill and Practice Use = .00 + .04 Attitude + .00 Access + .04 Training + .03 Support + .09 Age + .39 Gender + .00 Retirement

R-Sq .13

Analysis of Variance

Source	df	SS	MS	F	p
Regression	7	46.98	6.71	2.85	.01
Error	136	320.41	2.36		
Total	143	367.39			

Regression Analysis

Predictor	β	SD	t	p
Constant	.00	.13	.03	.98
Attitude	.04	.02	1.57	.12
Access	.00	.04	.13	.90
Training	.04	.05	.82	.42
Support	.03	.03	.95	.35
Age	.09	.20	.44	.66
Gender	.39	.13	2.98	.00
Retirement	.00	.21	.00	1.00

[a] Listwise deletion of subjects with missing data.

Table 23

Prediction of Computer Use in Computer Skills Instruction for All Classroom Teachers, N = 149 [a]

Computer Skills Use = -.11 + .01 Attitude + .13 Access + .11 Training + .06 Support - .25 Age + .09 Gender - .33 Retirement

R-Sq .20

Analysis of Variance

Source	df	SS	MS	F	p
Regression	7	75.48	10.78	5.01	.00
Error	141	303.20	2.15		
Total	148	378.68			

Regression Analysis

Predictor	β	SD	t	p
Constant	-.11	.12	-.87	.38
Attitude	.01	.02	.56	.58
Access	.13	.03	4.01	.00
Training	.11	.04	2.43	.02
Support	.06	.03	1.83	.07
Age	-.25	.19	-1.31	.19
Gender	.09	.12	.73	.47
Retirement	-.33	.19	-1.75	.08

[a] Listwise deletion of subjects with missing data.

Table 24

Prediction of Over-all Computer Use for All Classroom Teachers, N = 129 [a]

Computer Use = -.47 + .03 Attitude + .10 Access + .13 Training + .07 Support - .72 Age + .80 Gender - .84 Retirement

R-Sq .10

Analysis of Variance

Source	df	SS	MS	F	p
Regression	7	162.46	23.21	1.93	.07
Error	121	1457.51	12.05		
Total	128	1619.97			

Regression Analysis

Predictor	β	SD	t	p
Constant	-.47	.31	-1.53	.13
Attitude	.03	.06	.56	.57
Access	.10	.09	1.11	.27
Training	.13	.11	1.25	.21
Support	.07	.08	.79	.43
Age	-.72	.50	-1.42	.16
Gender	.80	.31	2.57	.01
Retirement	-.84	.50	-1.67	.10

[a] Listwise deletion of subjects with missing data.

Table 25

Pearson Coefficients for Relationships Among All Variables, All Classroom Teachers

	Over-all Use	Whole class instruction	Student-directed learning	Drill and practice	Computer skills instruction	Attitude	Access	Training	Support	Age	Gender
Whole Class Instruction	.67										
Student-Directed Learning	.62	.27									
Drill and Practice	.68	.16	.25								
Computer Skills Instruction	.72	.29	.27	.43							
Attitude	.22	.13	.09	.24	.20						
Access	.24	.23	.07	.19	.37	.24					
Training	.18	.14	-.04	.19	.27	.21	.13				
Support	.14	.01	.09	.19	.19	.18	.15	.22			
Age	.05	.00	.15	.12	.07	-.16	-.06	.18	.21		
Gender	.12	.06	-.01	.22	.05	.23	-.08	.12	.03	-.08	
Years Until Retirement	-.12	.02	-.16	-.11	-.14	.15	.08	-.02	-.09	-.70	.20

meaningless, however, since the over-all computer use score is a composite of the other four. Another correlation finding across all of the grade-level groups is a moderately negative to strongly negative correlation between age and years remaining until retirement. This finding is exactly opposite of expected results; however, it should be noted that in scaling years to retirement (1-5), the smallest value represents the teachers closest to retirement, with the largest value the teachers farthest from retirement. This coding of the years to retirement creates an impression that the farther a teacher is from retirement, the greater the age. In fact, the correlation shows a moderate to strong correlation of years remaining until retirement and age. To restate the correlation, the greater a person's age, the more likely she is to be close to retirement. This logic may explain the demographic data.

In the correlation analysis for all classroom teachers, the correlation coefficients were as follows: student-directed learning and whole class instruction (.27), drill and practice and whole class instruction (.25), computer skills instruction and whole class instruction (.29), computer skills instruction and drill and practice (.43), and drill and practice and whole class instruction (.16). These coefficients are all low but significant, with the exception of drill and practice and

whole class instruction, which is borderline low and negligible. Correlation analyses tables are in Appendix F.

Recommended Training Opportunities

Item 29 on the survey was an open-ended question that asked the participants to list computer training opportunities they would like to see offered by the school system. Table 26 is a matrix of the responses to item 29. The responses were categorized by major themes and subthemes. The frequency of response for each theme was tallied and recorded in the matrix. The responses were also sorted by grade-level grouping. All of the grade-level groups, except for 3-5 teachers, listed Internet training as the number one response. Teachers in grades 3-5 chose Internet training as their second choice. Their number one training concern dealt more with the logistics of the training, when and where training was offered. Training on ways to incorporate the Virginia Standards of Learning was the second choice of the P-2 teachers. Grade 6 and 7 teachers listed four topics with equal frequency response rates: classroom instruction training, application software training, classroom management training, and presentation software training. Classroom instructional training, such as training in application software and software exploration, tied for second place in the frequency of responses by grade 8

Table 26

Matrix of Suggested Training Opportunities by Teacher Groups

Major Themes	Subthemes	Total Responses N = 108	Pre-Gr 2 Responses N = 24	Gr 3 - Gr 5 Responses N = 18	Gr 6 - Gr 7 Responses N = 14	Gr 8 - Gr 9 Responses N = 13	Gr 10 - Gr 12 Responses N = 28	Cross Grade Level Responses N = 7
Internet		40	6	5	5	6	16	2
	Internet Use	34	4	5	4	5	14	2
	Internet Classroom Application	4	2			1	1	
	Web Page Production	1			1			
	e-mail Usage	1					1	
Standards of Learning		11	5	4			1	
	Integration of SOL's Across the Curriculum	9	3	4			1	
	Teaching SOL's with a Limited Number of Computers	2	2					
Classroom Instruction Training		11	4	1	2	2		1
	Instructional Needs	5			2	1		1
	Young Students	4	3	1				
	Reading	1				1		
	Whole Class Instruction	1	1					
Basic Skills		8	2		1	1	2	
Windows		8	1	1			6	
	Windows	2					2	
	Windows 95	6	1	1			4	
Software Discovery		7	2		2	2		1
	Software Experimentation	4	1			2		1
	List of Good Application Software	3	1		2			
Classroom Management		8	2		2	1	1	
	Management	4	1		2	1		
	Integration	1	1					
	Lessons	2					1	
	IEP's	1						
Presentation Software		4	1		2		1	
Word		3	1		1		1	
Math		3			1	1	1	
Excel		2		1	1			
Access		2		1	1			
Set-up & Fixing Computers		2	1					
Computer Aided Music		1						1
AutoCad Lt		1				1		
Science		1			1			
Social Studies		1			1			
Time		1			1			
Photos		1					1	
Mitchell On-Demand		1					1	
Network		1					1	

(*table continues*)

Table 26 (*continued*)

Major Themes	Subthemes	Total Responses N = 108	Pre-Gr 2 Responses N = 24	Gr 3 - Gr 5 Responses N = 18	Gr 6 - Gr 7 Responses N = 14	Gr 8 - Gr 9 Responses N = 13	Gr 10 - Gr 12 Responses N = 28	Cross Grade Level Responses N = 7
When, Where, or How Training Should be Conducted		10	2	6			3	
	When	4	1	2			1	
	Where	3		4				
	How	3	1				2	
No Specific Suggestion		13	2	4	1	1	3	2
	Any Help	4		2		1	1	
	None	2		1			1	
	Continue Current Classes	3		1	1			1
	Fun Uses of the Computer	1	1					
	Other	3	1				1	1

and 9 teachers. Teachers in grades 10-12 listed Windows training (Windows and Windows '95) as their second choice.

The group of all classroom teachers (all survey participants) chose the following training issues in order of frequency (most to least): Internet training, Standards of Learning training, classroom instruction training, basic skills training, Windows training, classroom management training, and training in software discovery. Teachers at all levels seemed to be concerned with staying current (Internet training), integration of the computer into regular classroom activities (SOL's, classroom instruction), basic computer operation (Windows, basic skills), and training in applications specific to their subject and grade level.

Barriers to Computer Use

Item 42 on the survey was an open-ended question which asked teachers to list barriers to computer use in the classroom. Table 27 is a list of responses by major themes and subthemes. The frequency of each response was tallied and recorded in the matrix by grade-level grouping. In every grade-level group, access to hardware was the number one barrier. Hardware access barriers included the high computer/student ratio, need for more computers, access to the Internet, quality of computers in the classrooms, and variety of computers found in

Table 27

Matrix of Barriers to Computer Use by Teacher Groups

Major Themes	Subthemes	Total Responses N = 206	Pre-Gr 2 Responses N = 46	Gr 3 - Gr 5 Responses N = 31	Gr 6 - Gr 7 Responses N=28	Gr 8 - Gr 9 Responses N = 27	Gr 10 - Gr 12 Responses N = 47	Cross Grade Level Responses N = 21
Access (Hardware)		184	36	26	33	27	41	17
	Student/Computer Ratio	61	11	10	6	13	16	3
	More Access	59	14	10	11	8	7	8
	Peripherals	27	4		10	2	7	3
	Internet Access	14	1	2	2	3	6	
	Quality of Computers	9	2	2	1		4	
	Computer Application	5	2	1			1	1
	Operation of Computers	3		1	1	1		
	Network	2			1			1
	Location of Computers	1	1					
	Laptop Access	1						1
Access (Software)		69	11	6	9	15	16	6
	Integration of Software Into Curriculum	36	4	2	5	12	8	3
	More Software	25	6	4	4	2	7	2
	Other	4	1			1		1
	Purchasing	3						
	Quality of Computers	1					1	
Training		41	9	9	2		17	
	Adequacy of Teacher Skills	20	4	4			10	
	Technology SOL Training	5	2	1			2	
	Need More Training	5	2	3				
	Classroom Application	5	1		1		2	
	Teacher Initiative to Take Training	4		1			2	
	Timing of Training	2			1		1	
Facilities		37	8	10	2	5	5	
	Physical Space for Computers	27	7	8	2	4	5	
	Wiring	7	1	1				
	Location	2		1				
	Teachers Changing Classes	1				1		
Time (Teacher)		32	17	9	2		2	1
	Time	20	10	7	1		2	
	Time to Practice	5	4					1
	Time to Plan	2	1	1				
	Time for Training	2		1				
	Preparation Time	2	1		1			
	Unencumbered Time	1	1					
Time (Classroom)		29	9	6	6	1	5	1
	Time in the Schedule	17	6	2	4	1	3	1
	Pressure to Cover SOL's	8	2	2	2		2	
	Time for Individual Instruction	3	1	1				
	Limited Time	1		1				

(*table continues*)

Table 27 (*Continued*)

Major Themes	Subcategories	Total Responses N = 206	Pre-Gr 2 Responses N = 46	Gr 3 - Gr 5 Responses N = 31	Gr 6 - Gr 7 Responses N=28	Gr 8 - Gr 9 Responses N = 27	Gr 10 - Gr 12 Responses N = 47	Cross Grade Level Responses N = 21
Procedural		25	4	5	1	4	7	2
	Maturity of Students	8		3		2	1	1
	Teaching Computer Skills with							
	One Computer in a Classroom	7	2	2	1		1	1
	Student Computer Training in Lower Grades	7				2	5	
	Teacher Expectations	1	1					
	Scheduling	1						
	Testing	1	1					
Support		21	7	4		3	5	
	Computer Repair	9	2	2		1	3	
	Computer Lab Teacher	3	3					
	Knowledgable Person in the Building	2	1			1		
	Classroom Aide	2	1					
	Technology Specialist	1		1				
	Computer Teacher	1		1				
	Untrained Technicians	1				1	1	
	Computer Technicians	1						
	Central Office Support	1					1	
Access Lab		18	6	4		4	3	2
	Need a Lab	13	6	4		1	1	1
	Scheduling Current Lab	5				3	2	1
Money		17		1	4	5	2	4
	Need Money for Technology	5		1		3		1
	Cost of Equipment, Software, & Supplies	9			3	2	1	3
	Funding Procedures	3			1		1	
Attitude		9	2	1	1	1	3	1
	Computers are a Distraction	2	1	1				
	No Use for Computers	1						1
	Other Subjects More Important	1	1					
	Too Much Time Spent on Computers	1				1		
	Fear of Computers	1			1			
	Computers are OK	1					1	
	Teacher Resistance to Computers	1					1	
	Student Attitudes	1					1	
Other		4	1	1			2	
	Materials	2	1	1				
	Unusual Circumstances	1					1	
	None	1					1	

classrooms. Preschool through grade 2 teachers listed teacher time as the second largest barrier: time to practice, time to plan, preparation time, and unencumbered time. Teachers in grades 3-5 listed facilities -- physical space in their classrooms for computers -- as the second most frequent barrier to computer use. Grades 6-7 and grades 8-9 teachers cited access to software as the second largest barrier. Teachers in grades P-2 and 10-12 responded with software access as their third choice. The teachers at the 10-12 grade-level listed training as the third most frequent response. The need for more software that integrates with the curriculum was the major complaint. Grade-level 3-5 teachers listed teacher time as their third choice. Classroom time, time in the daily schedule, and pressure to cover the Standards of Learning were barriers listed by grade 6-7 teachers. Physical space, a facilities issue, was the third most frequently listed barrier by 8-9 grade teachers.

The total teacher response listed in order of frequency is as follows: access to hardware, access to software, training, facilities, teacher time, and classroom time.

Strategies Recommended by Teachers

Five grade-level focus groups, consisting of four to seven teachers, met during the months of February and March, 1998. A short description of the grade-level findings from the quantitative phase of the study was shared with the group.

The findings were specific to the grade-level that the focus group represented. This overview included a short discussion of the demographic data, descriptive statistics, relative ranking by standardized scores, results of the multiple regression analyses, training-received matrix, suggested-training matrix, and the barriers to computer use matrix. The results from the Nominal Group Process during these focus groups are lists of prioritized strategies suggested by teachers from each grade-level group.

The P-2 focus group's first suggestions were training oriented; train teachers in classroom management techniques for computer instruction and provide classroom teachers, not computer technicians, as the trainers for computer classes and workshops (Table 28). The participants expressed the need for a published list of available P-2 application software. Providing trained computer "coaches" in each school who would have half of their contract day devoted to computer training and consulting was the next strategy. These "coaches" would be paid a stipend for the extra time and training which the job would require. Teachers in the preschool through grade 2 focus group suggested that each school be provided a computer lab to aid teachers in the instruction of computer skills. Providing substitutes for

Table 28

Results of Preschool - Grade 2 Nominal Group Process

Strategies to improve computer use in classroom instruction
1. Provide training with teachers--not technicians--as trainers in classroom management and scheduling practices: How to manage a class with 20 students and one computer for computer instruction. ** 1 **
2. Provide teachers with a list of good software being used in the other elementary schools. ** 2 **
3. Provide trained computer "mentors" or "coaches" in each school: A person with 1/2 day devoted just to technology. A stipend for training and extra duties. ** 3 **
4. Provide computer labs in each school to permit SOL technology training. ** 4 **
5. Provide teachers with the time to learn what is available on the computer by providing substitutes for teachers during training and sharing times. ** 5 **
6. Investigate and set up a high school student/parent/industry volunteer program (i.e., student interns, parent volunteers, industry and business partnerships) to help preschool-grade 2 teachers with computer instruction: to take students beyond drill and practice. to provide individualized instruction for students. ** 6 **
7. Provide inservice by computer hardware and software vendors to explain the types of hardware and software available that are applicable for preschool - grade 2. ** 7 **
8. Provide each classroom with big screen televisions and the equipment to hookup the computer for whole class instruction.

** # ** Denotes priority rank by nominal group participants.
Items without a priority rank were suggested strategies but were not among the priority choices

(*table continues*)

Table 28 (*continued*)

Results of Preschool - Grade 2 Nominal Group Process (continued)

Strategies to improve computer use in classroom instruction
9. Provide facilities, furniture, wiring, “space” and equipment to support newer technologies in every classroom.
10. Provide training or workshops in computer basics (i.e., hardware setup, installation and removal of software, troubleshooting)

** # ** Denotes priority rank by nominal group participants.
Items without a priority rank were suggested strategies but were not among the priority choices.

teachers as a method of providing time for training and sharing was another priority strategy. The group also suggested a student, parent, and industry volunteer program to help teachers provide individualized computer instruction for students. The final prioritized strategy was an annual update session for P-2 teachers by hardware and software vendors about the new equipment and programs on the market.

The focus group of 3-5 teachers listed training as the number one strategy (Table 29). Training was divided into some suggested grade-specific training topics (i.e., teaching in a one-computer classroom and teaching SOL's using computers) and suggested training logistics (i.e., times, places, and out-of-class assignments). Access to labs was the second most important strategy of the 3-5 group. Labs were seen as a necessity to address the Standards of Learning. The third strategy was to hire a support person (i.e., teacher, technician, "coach") in every building to provide technology assistance for teachers. The last prioritized suggestion was to provide a list of good software appropriate for grades three through five.

The sixth and seventh grade focus group chose as their first priority providing more money to purchase hardware and software (Table 30). Training in

Table 29

Results of Grade 3 - Grade 5 Nominal Group Process

Strategies to improve computer use in classroom instruction

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1. Mandatory participation by teachers in grade level appropriate computer training. ** 1 **
   - Suggested topics:
     - Scheduling one computer in a classroom with 20-25 students
     - Teaching the Standards of Learning using computers
   - Training should:
     - Occur at varied and reasonable times
     - Occur at the individual schools
     - Include reasonable out-of-class assignments for teachers working during the day.
     - Address teacher requested issues

2. Provide computer labs at each school (Must have labs to address the technology Standards of Learning) ** 2 **

3. Provide a technology teacher/technician/"coach" at each school available during the day to answer questions and provide support. ** 3 **

4. Provide each teacher with a list of good software appropriate for grades 3-5 ** 4 **

5. Provide more application software for grades 3-5.

6. Provide hardware that can address the Standards of Learning and current classroom applications.

7. Provide big screen televisions with computer connections (AVerKey). Suggestion: Provide a cart with a big screen television, AVerKey, and computer that can be moved between classrooms.

8. Provide adequate planning time for teachers (Must have access to a computer and software during this time).

** # ** Denotes priority rank by nominal group participants.
Items without a priority rank were suggested strategies but were not among the priority choices

(*table continues*)

Table 29 (*continued*)

Strategies to improve computer use in classroom instruction
9. Ask teachers, on a regular basis, for technology suggestions. - Make a list of the suggestions. - Act on the suggestions
10. Adjust master schedules to allow access to labs and classrooms equipped for whole class instruction.

** # ** Denotes priority rank by nominal group participants.
Items without a priority rank were suggested strategies but were not among the priority choices.

Table 30

Results of Grade 6 - Grade 7 Nominal Group Process

Strategies to improve computer use in classroom instruction
1. Provide money for the purchase of more hardware and software. ** 1 **
2. Provide more training in the hardware and software necessary for all types of computer use in the classroom. ** 2 **
3. Improve communication within the building by providing technology lists (i.e., items, number available, checkout procedures, contact person, checkout period). ** 3 **
4. Send students home for a half day to provide unencumbered time for staff development and training. ** 4 **
5. Provide classroom materials (i.e., video, software, CD-ROM) available from the textbook publishers which correlate with the textbooks and the Virginia Standards of Learning. ** 4 **
6. Provide staff development by hardware and software vendors to inform teachers about current technology and software in the marketplace. ** 4 **
7. Designate a person or persons in each building to oversee check out of equipment and software.
8. Provide classroom teachers access to technology and computer labs and training in the use of the equipment in the labs.
9. Provide facilities, furniture, wiring, and equipment to support newer technologies.

** # ** Denotes priority rank by nominal group participants.
Items without a priority rank were suggested strategies but were not among the priority choices.

the hardware and software specific for the grade 6-7 classroom was the second strategy listed. The third strategy for the 6-7 focus group was to provide a list of technology equipment and software for teachers (i.e., item, number available, check-out procedure, contact person, check-out period). Three strategies tied for the final priority position. First, the calendar should include days when students would be sent home for half a day to provide unencumbered time for staff development and training. Second, Carroll County Public Schools should provide materials (i.e., videos, software, CD-ROMs) available from textbook publishers which correlate with the SOL's. And finally, hardware and software vendors should be invited, on a annual basis to provide staff development for teachers regarding current technology and software in the marketplace.

The eighth and ninth grade focus group chose training which is grade and department specific as the first priority strategy (Table 31). The second suggestion was to leave one computer in every classroom and move all other computers to a lab for use by all teachers on a sign-up basis. School system provision of software that integrates with the curriculum and correlates with the Standards of Learning was the third strategy. Fourth, teachers should be provided with an unencumbered technology period, other than their planning period, to train

Table 31

Results of Grade 8 - Grade 9 Nominal Group Process

Strategies to improve computer use in classroom instruction	
1.	Provide teacher training specific to the department (curriculum) and grade level taught. ** 1 **
2.	Take "extra" computers out of classrooms and create another computer lab with a technician. Teachers could sign up to use of the lab. (Each classroom should be left with at least 1 networked computer) ** 2 **
3.	Provide software that integrates with the curriculum and the Standards of Learning. ** 3 **
4.	Arrange teacher schedules to provide a planning period AND a technology time. ** 4 **
5.	Provide every teacher with an individual classroom equipped with a computer and a printer. ** 5 **
6.	Provide training in ways to teach a class of 20-30 students using 1-3 computers.
7.	Standardize all computers in the building with the same versions of operating systems (i.e., Windows 3.1, Windows '95) and software (i.e., Word 6.0).
8.	Provide time and training in ways to evaluate software.
9.	Provide, through the media center, a list of available software with curriculum area, grade level, hardware requirements, and teacher evaluations.
10.	Provide trained technicians during the school day in every school.

** # ** Denotes priority rank by nominal group participants.
Items without a priority rank were suggested strategies but were not among the priority choices.

and prepare for integrating the technology into classroom instruction. Finally, every teacher should be provided an individual classroom equipped with a computer and a printer to allow for integration of computer use into the curriculum.

The grade-level 10-12 focus group determined training to be the main strategy (Table 32). The training strategy was divided into specific training topics (i.e., basic computer skills, teaching in a one computer classroom, computers as time managers, applications of software available), logistics (i.e., training should be time appropriate and conducted by classroom teachers--not technicians), and communication (i.e., provide a list of available software and provide quick references and videos). Providing subject appropriate software that addresses varied learning styles of students was the second strategy. The third priority of the 10-12 focus group teachers was to update the hardware and software in the labs at the high school. Searching and applying for technology grants and providing support in a timely manner were the fourth and fifth strategies.

The teachers in every focus group were responsive to the request for suggested strategies. The participants voiced an understanding of the importance of computers to the future of their students. Many participants expressed a desire

Table 32

Results of Grade 10 - Grade 12 Nominal Group Process

Strategies to improve computer use in classroom instruction
1. Provide mandatory inservice and training to develop basic skills for technology-resistant personnel. ** 1 ** Suggested training: Teaching with a single computer and a class of 20-30 students, Using computers as time managers (productivity tools), Using application software currently available to teachers. Communication suggestions: Provide a list of the software available to teachers, Provide quick references and videos about software available. Training should: Be time appropriate, Be conducted by practicing classroom teachers.
2. Provide appropriate software (i.e., subject specific, learning styles sensitive). ** 2 **
3. Provide labs with up-to-date hardware and software. ** 3 **
4. Search and apply for technology grants. ** 4 **
5. Provide timely support. ** 4 **
6. Provide supervised practice for students until they are comfortable on their own.

** # ** Denotes priority rank by nominal group participants.
Items without a priority rank were suggested strategies but were not among the priority choices.

to feel more comfortable with the use of computers in the classroom. Some participants expressed frustration with the lack of access to computers. A few participants cited feelings of inadequacy in their ability to use computers effectively with their students.

CHAPTER IV

CONCLUSIONS, DISCUSSION OF FINDINGS, DISCUSSION OF MEASUREMENT ISSUES, AND IMPLICATIONS

Which factors predict computer use by teachers in classroom instruction? What training opportunities would teachers like to see offered by the school system? What do teachers see as barriers to computer use in classroom instruction? What strategies do teachers suggest to improve computer use in classroom instruction? The answers to all these questions are different at different grade levels. Therefore, the conclusions section of this study is divided into grade-level groups. The discussion of findings is organized around the criterion and predictor variables, teacher suggested training opportunities, teacher suggested barriers, and teacher suggested strategies. The discussion of measurement issues is divided into sections on computer use, scales, combined concepts, and validity of the use measure. Discussing the implications for the school system and implications for further study summarizes the chapter.

Conclusions

Multiple regression analyses, frequency response matrices, and focus group

meetings using the nominal group technique were all utilized in analyzing the data. Across all these methods similar factors began to surface as important (Table 33).

Grades Preschool-2

In the P-2 grade-level group, the factors that appear to make a difference in computer use are age, support, access, and training. Regression analyses found age and support to be significant predictors of computer use. Age, a negative predictor of computer skills instruction, is difficult to influence. Support, a positive predictor of computer skills instruction, was also listed as a strategy by the P-2 focus group. The strategy, providing a computer or technology "coach" in each school, bolsters the conclusion that support is an important factor in computer use at these grade levels. Training, the highest priority strategy suggested by the teachers in the P-2 focus group, could be a method of influencing these other factors. Access had the highest frequency of response as a barrier to computer use.

Grades 3-5

Training and access are the major factors related to computer use in the 3-5 grade- level group. Regression analysis found training to be a high positive predictor of over-all computer use. Training was the highest priority strategy for

Table 33

Summary of Regression Analyses, Barriers Frequency-Response Matrix, and Prioritized Strategies

	1	2	3
Grades preschool - 2			
Regression analysis			
Criterion	Computer Skills Instruction	Computer Skills Instruction	*
Predictor	(-) Age	Support	*
Barriers	Access (hardware)	Time (teacher)	Access (software)
Strategies	Training	Software list	Technology "coaches"
Grades 3 -5			
Regression analysis			
Criterion	Over-all Computer Use	Over-all Computer Use	*
Predictor	(-) Support	Training	*
Barriers	Access (hardware)	Facilities	Training/Time(teacher)
Strategies	Training	Computer labs	Technology "coaches"
Grades 6-7			
Regression analysis			
Criterion	Whole class instruction	Student-directed learning	Drill and practice
Predictor	Training	Training	Attitude
Barriers	Access (hardware)	Access (software)	Time (classroom)
Strategies	Money	Training	Equipment list
Grades 8-9			
Regression analysis			
Criterion	Computer skills instruction	*	*
Predictor	Training	*	*
Barriers	Access (hardware)	Access (software)	Facilities
Strategies	Training	Computer labs	Appropriate software
Grades 10-12			
Regression analysis			
Criterion	Computer skills instruction	Student-directed learning	*
Predictor	Access	Attitude	*
Barriers	Access (hardware)	Training	Access (software)
Strategies	Training	Appropriate Software	Computer labs
Cross Grade Level			
Regression analysis			
Criterion	Computer skills instruction	Computer skills instruction	Computer skills instruction
Predictor	Gender	Attitude	Access
Barriers	Access (hardware)	Access (software)	Money
Strategies	N/F	N/F	N/F
All Classroom Teachers			
Regression analysis			
Criterion	Over-all Computer Use	Drill and Practice	Computer Skills Instruction
Predictor	Gender	Gender	Access/Training
Barriers	Access (hardware)	Access (software)	Training
Strategies	N/F	N/F	N/F

Note. 1-3, 1 = highest regression coefficient (β), highest frequency response, and first priority.
2 = second highest regression coefficient (β), second highest frequency response, and second priority.
3 = third highest regression coefficient (β), third highest frequency response, and third priority.
* = No other significant entries in this area.
N/F = No focus groups were held for these grade-level groups.

the 3-5 focus group and the third highest barrier response by participants of the survey. Training appropriate for each grade level and methods of teaching the Standards of Learning using a computer were specifically cited. All of these findings support training as an important factor of computer use. Access was the barrier most often listed by survey participants. Support was found to be a high negative predictor of over-all computer use. The finding related to support is contrary to the literature and appears to have little practical validity.

Grades 6 and 7

Regression analyses and focus group strategies both indicate training as an important factor in computer use for this grade-level group. Training was found to be a positive predictor of whole class instruction and drill and practice. The teachers of the 6-7 grade-level focus group listed training as the second highest priority strategy for improving computer use in classroom instruction. Access had the largest response as a barrier to computer use, and money was listed as the highest priority strategy. The findings point to training as the major factor related to computer use for the sixth and seventh grades.

Grades 8-9

Regression analyses and focus group strategies indicate training as the major factor related to computer use. Regression analysis found training to be a

positive predictor of computer skills instruction at the eighth and ninth grade levels. Focus group participants for these grade levels listed training specific to departments and grade levels as the highest priority strategy. Access, once again, had the largest response as a barrier by survey participants.

Grades 10-12

Attitude, access, and training are the factors related to computer use at the 10-12 grade levels. Regression analyses found that attitude was a positive predictor of student-directed learning and access a positive predictor of computer skills instruction. Access was chosen, by frequency response, as the greatest barrier for this grade-level group. Training was the highest priority strategy listed by the participants in the 10-12 focus group. Training was also the second most frequent response as a barrier to computer use.

All Classroom Teachers

Through regression analyses, gender was found to be a significant positive predictor of both drill and practice and over-all computer use for all classroom teachers. Access and training were positive predictors of computer skills instruction for all classroom teachers. Access was the most frequent barrier response from survey participants.

Discussion of Findings

Whole Class Instruction

It is not surprising that the 10-12 grade-level group had the highest relative rank in whole class instruction. Many of the classes offered at the high school are directly related to the use of the computer as an integral part of the curriculum. These particular classes have the necessary equipment and software available to present the information to the whole class. These teachers use computers in this fashion on a daily basis.

The cross grade-level group had the lowest relative rank in whole class instruction. Many of these teachers are itinerant teachers traveling between schools or between classes. Not having a classroom of their own makes it difficult to arrange all the necessary equipment in the right room at the right time for the class. Until every class is comparably equipped, cross grade-level teachers cannot be expected to improve their whole class instruction use.

Student Directed Learning

Grade 10 through grade 12 teachers are the highest users of computers for student-directed learning. Teachers in the 10-12 group assign projects which anticipate the need to use electronic research and word processing. There is a lab

available at the high school where English or social studies teachers may take their classes to work on word processing and research papers. The library has electronic encyclopedias and databases available for research purposes. It follows that high school teachers would feel more comfortable than teachers at othe r grade levels assigning a project that would require the student to work independently using the computer resources available.

One explanation for the 6-7 group being high users could be that the two schools which serve sixth and seventh grade students have computer labs specifically designed to teach computer skills and introduce technology issues. While the responses of the teachers in these labs were removed due to their extremely high use skewing the results, the teachers in these schools expect that their students have a certain level of competence because of the students' experiences in these labs. Once again, this added confidence creates a more favorable climate in which a teacher may assign student-directed use of computers.

In both groups 3-5 and 6-7 the schools are participants in a program called Accelerated Reader (AR). The AR program is a reading program that tests students on books they have read. The computer software keeps a score for each student based upon the number of books read and the score received on computer

generated tests. This is a heavily used piece of software in schools with grades K-5 and K-7. It is assumed that teachers reported the AR program as student-directed learning since students generally use the computer and software without supervision from the classroom teacher. This would help explain the high scores in student-directed learning at the 3-5 and 6-7 levels.

Preschool through grade 2 teachers often do not feel that their students have the computer skills necessary to use computers without direct supervision. Once again, cross-grade-level teachers do not have available rooms or equipment with which to assign student projects.

Drill and Practice

Teachers in the P-2 and 3-5 grade-level groups ranked first and second in drill and practice use. Teachers in these grade levels spend more time than teachers in other grade-level groups teaching and reinforcing basic language arts and math skills. The reinforcement of these basic skills is easily handled through computer software. It is a convenient way in which to assign an individual student some reinforcement practice.

High school teachers (grades 10-12) ranked third in drill and practice use. One explanation of this may be the high percentage of special education faculty at

the high school. These teachers often use drill and practice software to strengthen math and language arts skills. Eighth and ninth grade teachers ranked last in drill and practice.

Computer Skills Instruction

The 10-12 grade-level group ranked first in computer skills instruction. The high school offers several courses with curricula based on specific software. Word processing, spreadsheeting, database management, presentation software, electronic accounting, auto mechanics parts ordering, drafting, printing, electronics, art, and computer math are all examples of classes that have some or all of the curriculum based upon some degree of computer skills instruction. Teachers at the P-2 and 3-5 grade levels ranked second and third in computer skills instruction. Teachers at these grade levels are beginning to introduce computers as learning tools. Teaching computer skills is more intensive at the P-2 level and gradually decreasing with each new level 3-5, 6-7, and 8-9. The emphasis in the Virginia Standards of Learning on technology skills assessment at grade 5 and grade 8 will place more pressure on teachers to teach computer skills instruction at these levels.

Attitude and Computer Use

Attitude toward computers by Carroll County teachers is favorable across all grade levels. Teacher responses, however, to questions about computers being voluntary or compulsory and understandable or mystifying were much less definitive. These answers are understandably more varied in response. Teachers may feel very positive about the need for computers and the benefit of computers in society and the classroom, but still have reservations about their personal ability to use them. Teachers are feeling the pressure to use computers in the classroom. However, whether use is seen as compulsory or voluntary may be related to personal ability to use computers.

Are teachers who use computers in classroom instruction better teachers? Since computer use is low, it would be very difficult for a teacher to answer that they do not use computers in classroom instruction and then later in the survey respond that they believe teachers who use computers in classroom instruction are better teachers. Obviously, there are master teachers in the profession who do not use computers. And, while it is not the purpose of this study to suggest that teachers who use computers in the classroom are better teachers, it is easy to see the conflict these two questions would have caused a nonusing teacher.

This study found that teacher attitudes about computers are high. Russek (1991) and researchers at Field Research Corporation (1995) concluded that teachers had favorable attitudes toward computers. This study supports that conclusion. Rogers (1995) reported that attitude determined whether a person was willing to try new innovations. Assuming these results to be accurate, teachers in Carroll County appear to be willing to try using computers in classroom instruction.

Training and Computer Use

Communication about training offered by the school system does not appear to be a problem. Most teachers (99%) were aware that the school system provides training. Teachers reported (77%) that the training provided by the school system has been beneficial for using computers in classroom instruction. This is a little surprising considering that the majority of teacher training has focused upon personal productivity software, such as DOS, Windows, word processing, spreadsheeting, database management, and presentation. If teachers feel that the training has been beneficial to classroom instruction, then there obviously has been some transference of skills and use from personal productivity to classroom use. It should be noted that except for a few classes directly targeted for certain

groups (The One Computer Classroom K-5), there have been few classes provided which teach classroom applications.

One factor related to computer use that appeared in all grade-level groups was training. In some grade-level groups, such as the grade 6-7 group, it was a factor determined to be important to use by every type of analysis. In the 10-12 grade-level group, it did not appear in any of the statistical analysis but was the highest priority strategy suggested by the teachers in the focus group. If increased computer use is the desired outcome, school board members could spend more resources (i.e., money, time, personnel) on training.

The types of computer training offered to teachers in Carroll County, with few exceptions, have been related to the mechanics of operating computers and ways to increase teacher personal productivity (i.e., word processing, spreadsheeting). This is consistent with the U.S. Congress, Office of Technology Assessment (1995) report. The intent was to encourage teachers to use computers for their own personal use, assuming that teachers would transfer that knowledge to classroom applications. Teachers do not have the time for the type of planning it takes to transfer those skills to the classroom. Teachers need specialized training targeted to the grade level and the curriculum they teach. Training **cannot** be "one-size-fits-all." This is the most important finding of this study.

Access and Computer Use

The school system placed a new multimedia computer in most classrooms within the last two or three years, so most classrooms have at least one relatively current machine available. The other computers available to teachers in their classrooms tend to be a mixture of very old Disk Operating System (DOS) machines and slightly newer DOS or Windows machines. These machines were purchased by state, school system (local), individual school, or Parent-Teacher Organization initiatives. In some cases businesses, industries, or parents donated the computers. These observations are only to highlight the wide variety of computers, operating systems, and ages of machines. While access is relatively low for all classroom teachers, it becomes an even more critical issue due to the quality of the machines included in the average.

The K-5 elementary schools do not have computer labs available. In one instance, a principal has concentrated a large number of older computers into one classroom and designated one teacher as the technology teacher, but the school system has not provided computer labs at grade levels P-2 or 3-5. Grade levels 6-7, 8-9 and 10-12 have computer labs within the schools; however, these labs are heavily used and teachers often find random scheduling of the lab is either impossible or so cumbersome as to be not worth the effort.

Teachers reported (64%) that they did not have the necessary equipment and software for whole class instruction. This would appear to be either a communication or scheduling problem since every school was provided at least one set, and, in most instances, several sets, of the equipment to connect a computer to a television. All of the newer multimedia computers came equipped with presentation software which may be used for this purpose.

When asked if they had the necessary equipment and software for student-directed learning, 55% of the teachers respond negatively (1 = NO, 2 = YES). Remember that student-directed learning was the largest area of use. Every library in the system has an age-appropriate computerized encyclopedia and at least one database for location of periodicals. At the time of the administration of the survey, approximately half of the schools had been wired and networked to enable teachers and students to access the electronic library resources from the classroom. Lack of communication about the electronic resources in the library and lack of access for students and teachers in schools that had not been networked to these resources may help explain the low score.

Often technicians install software and hardware, train the person who has the greatest responsibility for use, and expect that person to communicate to the rest of the staff the availability of the new technology. The final step of the

process is often overlooked, delayed, overcome by the daily minutia of teaching, or hurriedly explained in a faculty meeting. This leaves the classroom teachers with, at best, a limited understanding of the possibilities of the new technology.

Another possible reason for such low scores may be that teachers are anticipating the arrival of Internet access. They have been bombarded by the media and education publications about the potential of this technology. Teachers have been told for the past year that their schools will have access to the Internet, and they are still anxiously waiting for the connection. All of these issues may have caused teachers to respond that they do not have the necessary equipment and software to use computers for student-directed learning.

Fifty-five percent of respondents reported that they had the necessary equipment and software for drill and practice computer use. Drill and practice software has been available for many years, and much of the software will run on older machines. It is a type of computer use that generally requires the least amount of teacher supervision. The P-2 and 3-5 grade-level teachers concentrate on teaching the basics. For many students this requires a lot of remediation, drill, and practice in basic language arts and math skills. These uses are easily programmed and have the least sophisticated hardware and software requirements,

so it is logical that teachers feel they have more of the necessary equipment and software.

Half of the teachers surveyed (50%) responded that they had the necessary equipment and software to teach computer skills. The more basic skills such as vocabulary and parts of the computer are skills that can be taught in a whole class situation with only one or two machines in the room. However, keyboarding, programming, word processing, spreadsheeting, and other more sophisticated skills become problematic when a teacher has 20 to 25 students and only two or three machines. Many teachers are overwhelmed by the conflict between their charge to teach these skills and the reality of their classroom.

Only 41% of Carroll County teachers have a home computer. Teachers do most of their planning and preparation for class at home. There are not enough hours in the school day for extensive professional thought and reflection, let alone planning. For teachers to incorporate a new technology such as computers into their teaching, they must learn to use computers personally. Before teachers can make those kinds of changes in lifestyle and teaching, they need to have access to all the tools at home where they may make those adjustments at their own individual pace.

Access is a major issue around which discussions about computer use seem to coalesce. In fact, it would be hard to argue that more access is needed when almost every classroom in the system has a computer and fewer than half of those computers were used in a typical week. Computer use is low throughout the school system. Access is also low throughout the school system. The results of this study are remarkably consistent with the Reilly (1996), Field Research Corporation (1995), and Russek (1991) studies in the literature review.

Providing more access to an already underutilized resource may not be a wise use of time and money. If the scenario were to occur where computer use were extremely high and access were extremely low, then a major push to increase access would be logical. This is not to say that computer purchases should be stopped. There must always be an organized system of replacement; otherwise, in the not too distant future, the cost of replacing the complete inventory of computers would be staggering.

At the 10-12 grade-level group, access was determined to be a factor in computer use. At the high school, the issue of replacement needs to be addressed. The access that teachers are requesting involves upgrading computers and labs that already exist, not adding computers.

Support and Computer Use

During the administration of the survey, more than one participant pointed out that while they were aware that the school system employed a technician (89%), they had been told not to contact the technician. Teachers have been told to refer problems via written requests for service through a contact person in the school. The contact person would then send a request to the Coordinator of Computer Services (the central office contact) who would schedule the technicians for the requested service. The intention of the procedure was to organize repair requests and provide a paper trail to track requests and responses. The unintended result was a perceived sluggishness of bureaucracy and lack of personal attention.

Ninety percent of the teachers who responded to the survey have found a person in the school to use as a resource for computer questions. It would follow that a resource person available to classroom teachers must be extremely important. The current arrangement of volunteer resource persons is an obvious advantage to the teachers in the school; however, it is a clear disadvantage for the person who has become the resource because of the added responsibility for which there is no pay and no specialized training. A resource person, technology

"coach", paid and trained by the school system might provide teachers with a better source of computer information.

High school teachers (grades 10-12) had the lowest relative rank for support. This may be due to a higher concentration of computers, a higher use, or a greater sophistication of use. The high concentration of computers increases the likelihood that one or more of those computers are in need of service. Higher use would also put a greater premium on the computers being operational. If they are used daily, then every day that they are not working is a problem. The greater sophistication of use increases the possibility that repairs will be more complex.

Carroll County Public Schools data corresponds to the results reported by OTA (1995) researchers, citing that technicians are not available in each school. However, mean scores for individual support questions are high at all grade levels. This is not consistent with the Field Research Corporation (1995) survey, where 54% of the respondents felt there was not enough support to integrate computers into curriculum.

Age and Computer Use

Age was not a consistent factor related to computer use. It was determined to be a negative predictor in the P-2 grade-level group. Years until retirement was found to have a negative correlation with most types of use at the 6-7 grade-level

group. In other grade-level groups, years remaining until retirement was positively correlated. The research on age as a factor related to computer use is conflicting (Hayden, 1995, Comber 1997). This study also found conflicting results with regard to age and years remaining until retirement and computer use.

Gender and Computer Use

This study found gender to be a significant predictor of drill and practice and over-all computer use for all classroom teachers. The literature is conflicting with regard to gender. Comber (1995) and Kay (1989) found males to be more likely to use computers. Gordon (1993) found no significant difference between computer usage by males and females. This study suggests the female teachers in Carroll County Public Schools are more likely to utilize computers in classroom instruction than males. Due to the conflicting findings between this study and the literature, there needs to be more research on the question of gender with regard to computer use.

Open-ended Questions

The two open-ended questions item 29 and item 42, were added after the first pilot test. These became the source of some of the richest data. Item 29 asked for suggested training opportunities, and while the answers were not totally unexpected, there were some interesting trends. Internet training was the number

one answer across all grade levels. Considering that none of the schools had access to the Internet at the time of the survey, it seemed odd to the researcher. It should be noted that all the teachers in Carroll County have been expecting Internet access for more than a year. This can probably be explained by the anticipation of Internet access in the near future. The other consistent issue on the minds of teachers is the pressure to integrate the Virginia Standards of Learning objectives into the curriculum. Many teachers have misgivings about their own level of competence and feel timid about teaching computer skills to their students. Specifically targeted training is the only way to dispel these feelings of inadequacy.

Item 42 asked teachers to list things that they considered being barriers to computer use in the classroom. The Matrix of Barriers to Computer Use by Teacher Groups (Table 27) is an excellent way to display and understand the data; however, it cannot give the reader a feel for the richness and expressive nature of the raw data. Responses were very polite, but very direct and to the point.

Teachers feel the need for more computers, better quality computers, less variety in type and operation, more peripherals (i.e., printers, scanners), and access to the Internet. There is a major concern about the quality of available software.

Teachers need software that integrates with their curriculum in order to implement computers as learning tools in the classroom.

The citing of facilities as a barrier to computer use is often nothing more than the lack of space for computers in many classrooms. Most of the classrooms in which these teachers are teaching were designed and built during the 1950's and 1960's, when computers in classrooms were not a consideration. These classrooms were designed for student desks, not computer tables, printer carts, television hook-ups, or Internet connections. Placing new technologies in these old rooms often creates problems. Teaching is a time-intensive activity. The daily schedule leaves little time for planning, preparation, reflection, or professional development. Teachers are expected to learn and integrate new technologies during the teaching day. Another issue related to time is scheduling. The teaching day is already completely full of academic requirements. Teachers see computers as just one more thing with which to deal in an already overburdened day. Until teachers are trained in ways to integrate computers into the current curriculum, computers will be viewed as added burdens rather than teaching tools.

Focus Groups

The most positive experiences for the researcher during this study were the focus groups. Teachers were asked by their principals to meet with the researcher after school to discuss computer issues. Most of the participants did not remember participating in the survey until after some discussion of the process. At the start of the meeting, an agenda was distributed to the participants, and the researcher explained the purpose of the meeting. For the first fifteen minutes the researcher shared the results of the survey in very condensed format (see Appendix E). Then a Nominal Group Technique was utilized for participants to prioritize a list of strategies. The process, lists, sharing, and discussions that ensued were enlightening. Participants seemed empowered through involvement in suggesting strategies to solve the issues of computer use.

The teachers in every focus group seemed intently interested in the results of the survey. Most of the participants voiced an understanding of the importance of computers to the future of their students. Many participants expressed a desire to feel more comfortable with the use of computers in the classroom. Some teachers expressed frustration with the lack of access. And a few participants explained their feelings of inadequacy in their ability to use computers effectively with their students.

In each focus group, after the strategies were listed on the flipchart, the group was given an opportunity to discuss the individual strategies for further clarification. These discussions resulted in better descriptions of the strategies and often began a rich dialogue between the participants in which they began to share ideas. The act of prioritizing the strategies enabled each participant to decide what issues were most important to her practice. The teachers involved in the focus groups seemed appreciative of the opportunity to have some input into some possible solutions. They seemed happy to be heard.

The prioritized list of strategies, by grade-level group, may be the most important product of this study. It is a list of strategies designed by classroom teachers, in order of importance, specifically targeted for the grade-level group. Most previous computer initiatives have been targeted either for all teachers or for elementary or secondary teachers. It is obvious from these grade-level group strategy lists that computer issues are not the same for all teachers.

Discussion of Measurement Issues

Measurement of Computer Use

The measurement of computer use in this study relies on the recollections of teachers about the number of times their computers were used and the number of

minutes their computers were used in a typical week (5 teaching days) for four different types of computer use. The accuracy of such a measure is suspect at best. There was no way to determine how "typical" was the previous week. The researcher was unaware of any major disruptions to the schedules in the week prior to the survey. The large population of teachers (241) should have lessened the effect of any individual classroom anomalies. In a survey of this type, there is the danger of participants overestimating their use due to a pro-computer bias. Participants were cautioned about the danger of overestimation and asked to answer as truthfully at they could. If there was overestimation on the part of the teachers in this survey, computer use in Carroll County is nonexistent; i.e., it would be hard to imagine any overestimation in view of the low amounts of use reported.

It should also be mentioned that prior to running the descriptive statistics, multiple regression analyses, and correlations, outliers were removed. The major outliers were assumed to be responses of computer lab teachers (i.e., business, word processing, keyboarding). These teachers who use the computer every period of every day were inadvertently included in the survey. The purpose of the survey was to determine classroom teacher use, not computer lab use. Any replication of this study should exclude computer lab teachers from the survey.

Combining Scales

Throughout the survey there are a number of scales used to measure responses. For example, within the section that measures attitude there were three different scales used for eleven questions. The scales range from 1 - 8 (measuring the range of response using a semantic differential format), 1-4 (measuring the range of response using a Likert scale), and 1-2 (measuring a simple 1 = NO, 2 = YES response). The researcher dealt with these varying scales by standardizing all the data before computing scores or analyzing the data.

Combining Scores

Scores were computed for use, attitude, access, training, and support. Use scores were computed for whole class instruction, student-directed learning, drill and practice, and computer skills instruction. In each case, scores were computed from the original standardized z score. Variability becomes a greater concern because the over-all computer use score is a composite of all the types of use. Once again, the researcher returned to the original standardized scores to compute the over-all computer use mean score.

Another example of this problem occurred in the computed score for support. Two concepts are included in the support mean score: first, availability and speed of computer repair and technicians; and second, the endorsement of computers in the classroom by others (i.e., principals, central office staff, school board members, parents). The responses to the questions related to the support of computers in classroom instruction by principals, central office staff, school board members, and parents were so overwhelmingly positive that the support mean score may be skewed to reflect a higher support score than truly exists. The experience of frustration with overdue repairs and service leads to a question of practical validity. This might explain the discrepancy between the findings of this study and the literature.

Another example of combining concepts occurred in the attitude section of the survey instrument. The first seven items in the attitude section were based on the semantic differential developed by Osgood (1965) in which participants were asked to rank opposite concepts regarding how they viewed computers (scale = 1-8) (i.e., bad/good, voluntary/compulsory, understandable/mystifying, beneficial/harmful, useful/useless, important/unimportant, progressive/regressive). The intent was to identify a positive or negative attitude on the part of the participant with regard to computers. The last four questions asked about the

attitudes of others and gave a hypothetical situation; i.e., students like to use computers, teachers who use computers are better teachers, principals think teachers who use computers are better teachers, and would you use a piece of software if you knew it had a positive effect on achievement. The researcher felt that the last four questions added to the concept of attitudes about computer use. These questions added the concept of the attitudes of others within the working environment of the teacher being a factor related to the teacher's attitude. These last questions could be said to misrepresent the concept of teacher attitude about computer use and should be noted as an issue in future studies.

Validity of the Use Measure

The over-all computer use mean score is a composite of four measures of use (i.e., whole class instruction, student-directed learning, drill and practice, computer skills instruction). To test the validity of the over-all use score, the researcher ran correlations between all the types of use. At first glance it would appear that they are almost collinear; however, it is not logical to check correlations between the four types of use and the over-all computer use score precisely because it is a composite of the other four scores.

The test of the over-all computer score is in the correlations between the four types of computer use. In the correlation analyses of all classroom teachers (see Table 25), the results were as follows: student-directed learning and whole class instruction (.27), drill and practice and whole class instruction (.16), drill and practice and student-directed learning (.25), computer skills instruction and whole class instruction (.29), computer skills instruction and student-directed learning (.27), and computer skills instruction and drill and practice (.43). These are all low but significant correlations, with the exception of drill and practice and whole class instruction (.16) which is borderline low and negligible. What is noteworthy is the closeness of the coefficients and the significance. Because all but one of the correlations are significant, the computer use scales seem to be measuring aspects of a single construct -- over-all computer use.

Implications for the School System

Carroll County Public Schools have been very fortunate to have had and continue to have a Board of Supervisors, a School Board, a superintendent, central office staff, and community members who have been very supportive of technology. Relatively large amounts of money and personnel time have been dedicated to placing computers and technology into classrooms. This was a huge

task requiring electrical wiring and rewiring, terminating network connections, server and hub installations, multimedia computer installations in practically every classroom, and training.

This study found computer use in Carroll County Public Schools to be low. The implications of the study support the research by Hodas (1993) who reported that for a technology to be accepted in an organization, there must be a match between the organizational values and the technology values. This study suggests a mismatch of values exists between the integration of computer use into classroom instruction and the organizational values of Carroll County Public Schools. Integration of computer use into classroom instruction requires that a high value be placed on training. Learning any new technology is a training intensive proposition.

In industry, if a programmer needs to learn to use a new piece of equipment or software, no resource is too great. Time off from work, salary plus benefits, and expenses (i.e., travel, hotels, meals) are never questioned. Training may take days, weeks, or even months. The employee is then expected to be able to perform the tasks learned during the training. In education, if a new technology (i.e., computers) is to be integrated into classroom instruction, a two-hour inservice is

planned after school. It is not difficult to discern which organization places the greater value on the technology.

The computer is one of the most amazing tools ever conceived by man. It is, however, a complicated technology that places a high value on training. If the school board members, superintendent, central office staff, and principals of Carroll County Public Schools are truly interested in computer use and integration into classroom instruction, a new organizational value should be placed on training. This would require some new and radical budget changes. It would require that a much larger percentage of the technology budget be spent on training. Computer repair, computer replacement, and support contracts would have to continue, but procuring new computers and equipment would be halted for a time (e.g., year, budget period, biennium).

Training could begin before the start of school. During the summer, teachers who were classified as non-users or beginners could be required to attend (with pay) a basic computer skills class with a classroom teacher as the instructor. During the opening workshops at the beginning of the school year, vendors could be invited to display new hardware and software by grade level and curriculum. There could be one for each grade level, preschool through grade 12. They could be scheduled by curriculum area, concentrate on math the first year and on

language arts the second year. After teachers have chosen the software that fits the curriculum, a series of training sessions with classroom teachers as trainers could be arranged. These sessions could be scheduled for half day each week during a semester. Substitutes could be used to cover classes while teachers were being trained. A second group could be trained during the second semester. Meeting a half day per week would allow the teachers to try what they have learned and return to class the next week to share experiences and problems. Ten classes could be taught per semester, with one in the morning and one in the afternoon Monday through Friday. During the next summer a cadre of teacher-trainers would be sent to software companies to train (salary plus expenses) in the use of new software packages for the next round of training. Teacher evaluation forms could be changed to include computer use as an observation goal.

At the end of the first year, a study similar to this could be conducted to measure computer use in classroom instruction. If a significant increase were recorded, the process could be repeated until an acceptable amount of use was attained. A significant change in the organizational value of computer training would be realized. When teachers see the value that the school board members, superintendent, central office staff, and principals have placed on computer training, they will place a new value on the need for computer integration into

classroom instruction. Once the values of the technology and the school system match, computer use in classroom instruction should improve.

Implications for Further Research

One possibility for further study would be to repeat this study after an intervention is attempted. The project would become a practical action research project. In the model previously suggested, once the intervention--the period of intensive training--was concluded, another study could be conducted to determine if there was any increase in computer use.

Another major implication for further study is the development of an accurate instrument to measure computer use. Such an instrument would be an invaluable tool in the planning and budget preparation processes. School board members, superintendents, budget directors, and facilities directors across Virginia and the United States would be interested in an accurate method of measuring computer use. This would provide data upon which to base decisions regarding the purchase of equipment.

Finally, a major implication for study is the development of a training model that could be duplicated in other school districts, regions, states, and the nation. A

training model similar to the model described in the previous section, once perfected, could be an invaluable tool for other school districts.

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APPENDIX A

The Survey Instrument:

Factors Related to Use of Computers

in Classroom Instruction

FACTORS RELATED TO USE OF COMPUTERS IN CLASSROOM INSTRUCTION
A Survey
(15 minute response time)

This survey is an effort to determine the amount of computer use by teachers in classroom instruction. The results of the survey will be used to make recommendations about how Carroll County Public Schools may better serve its teaching staff with regard to computer use in classroom instruction. The responses to this survey will be kept anonymous. You are under no obligation to answer this survey. Computer use in classroom instruction is defined below.

Four types of computer use are included in this survey:

1. **<u>whole class instruction</u> - use of the computer with an overhead projector, television, or other large group presentation device.**
2. **<u>student-directed learning</u> - use of the computer in student assigned projects such as reports, information searches using electronic encyclopedias or the Internet, or presentation production.**
3. **<u>drill and practice</u> - use of the computer by students to practice or learn academic skills or facts such as multiplication tables, addition, verb use, and the alphabet.**
4. **<u>computer skills</u> - use of the computer to teach students keyboarding, word processing, spreadsheeting, database management, or presentation software.**

Please answer questions 1-4 with these definitions in mind.

1A. In the past week (5 teaching days), estimate how many **<u>times</u>** you have used a computer for **whole class instruction**.

_____ NUMBER OF TIMES

1B. Estimate the average number of minutes per **whole class instruction** activity.

_____ MINUTES

2A. In the past week (5 teaching days), estimate how many **times** you have assigned a student or the whole class a **student-directed learning** activity requiring the use of a computer.

_____ NUMBER OF TIMES

2B. Estimate the average number of minutes per **student-directed learning** activity.

_____ MINUTES

3A. In the past week (5 teaching days), estimate how many **times** you have assigned a student or the whole class a **drill and practice** activity requiring the use of a computer.

_____ NUMBER OF TIMES

3B. Estimate the average number of minutes per **drill and practice** activity.

_____ MINUTES

4A. In the past week (5 teaching days), estimate how many **times** you have assigned a student or the whole class an activity to teach **computer skills** requiring the use of a computer.

_____ NUMBER OF TIMES

4B. Estimate the average number of minutes per **computer skills** activity.

_____ MINUTES

Another important part of understanding computer use by teachers in classroom instruction has to do with the factors related to computer use. So, next we would like to ask some questions about the following factors: attitudes, access, training, and support. Attitudes are defined as teacher beliefs and feelings about the use of computers in classroom instruction. Questions 5-15 are about attitudes.

WHEN YOU THINK OF COMPUTERS,
HOW DO YOU SEE THEM?

(Please rate your responses by placing an X above the number.)

5.	bad	___ 1	___ 2	___ 3	___ 4	___ 5	___ 6	___ 7	___ 8	good
6.	compulsory	___ 1	___ 2	___ 3	___ 4	___ 5	___ 6	___ 7	___ 8	voluntary
7.	understandable	___ 8	___ 7	___ 6	___ 5	___ 4	___ 3	___ 2	___ 1	mystifying
8.	harmful	___ 1	___ 2	___ 3	___ 4	___ 5	___ 6	___ 7	___ 8	beneficial
9.	useless	___ 1	___ 2	___ 3	___ 4	___ 5	___ 6	___ 7	___ 8	useful
10.	important	___ 8	___ 7	___ 6	___ 5	___ 4	___ 3	___ 2	___ 1	unimportant
11.	progressive	___ 8	___ 7	___ 6	___ 5	___ 4	___ 3	___ 2	___ 1	regressive

12. I believe students in my class like to use computers. (Circle one)

1 STRONGLY DISAGREE
2 DISAGREE
3 AGREE
4 STRONGLY AGREE

13. I believe teachers who use computers in classroom instruction are better teachers. (Circle one)

1 STRONGLY DISAGREE
2 DISAGREE
3 AGREE
4 STRONGLY AGREE

14. I believe my principal thinks teachers who use computers in classroom instruction are better teachers. (Circle one)

1 STRONGLY DISAGREE
2 DISAGREE
3 AGREE
4 STRONGLY AGREE

15. I believe if I knew a piece of software had a positive effect on student achievement, I would use it. (Circle one)

1 NO
2 YES

Next, we would like to ask about your access to computers. Access is defined as the availability of computers and software. Questions 16-22 are about access.

16A. How many computers, **that will run the software you wish to use**, are in the room in which you teach? (If you teach in different rooms during the day, please answer using the room that has the largest number of computers.)

_____ NUMBER OF COMPUTERS

16B. During the teaching day, what is the largest number of students you have in this classroom at any one time?

_____ NUMBER OF STUDENTS

17. I have access to a computer lab for use with my classes. (Circle one)

1 NO
2 YES

18. I have **both** the necessary equipment **and** software available in my classroom, a computer lab, the library, or elsewhere to use a computer for **whole class instruction**. (Circle one)

1 NO
2 YES

19. I have **both** the necessary equipment **and** software available in my classroom, a computer lab, the library, or elsewhere for my students to access electronic encyclopedias, the Internet, presentation software, **or** other programs for **student-directed learning**. (Circle one)

1 NO
2 YES

20. I have **both** the necessary equipment **and** software available in my classroom, a computer lab, the library, or elsewhere to assign my students **drill and practice** activities using the computer. (Circle one)

1 NO
2 YES

21. I have **both** the necessary equipment **and** software available in my classroom, a computer lab, the library, or elsewhere to teach my students **computer skills**. (Circle one)

1 NO
2 YES

22. I have a computer at home that will run the software I wish to use. (Circle one)

1 NO
2 YES

Our next concern is training. Training is the preparation of teachers to use computers in the classroom. Training is the subject of questions 23-29.

23. How many hours of computer-related in-service have you participated in?

_____ NUMBER OF HOURS

24. How many computer-related college classes have you taken?

_____ NUMBER OF CLASSES

25. The school system offers computer training opportunities? (Circle one)

1 NO
2 YES

26. The computer training I have received has been in the following areas: (Circle all that apply)

1 NO TRAINING
2 COMPUTER OPERATION AND BASICS (DOS, Windows, Windows95, etc.)
3 WORD PROCESSING (Word, WordPerfect, etc.)
4 PRESENTATION SOFTWARE (PowerPoint, etc.)
5 SPREADSHEETING (Excel, Lotus, etc.)
6 DATABASE MANAGEMENT (Access, Dbase, etc.)
7 Other (Please specify):

_____

27. The computer training offered by the school system has helped me to use computers in my teaching. (Circle one)

1 STRONGLY DISAGREE
2 DISAGREE
3 AGREE
4 STRONGLY AGREE
☐ I HAVE NOT PARTICIPATED IN THE TRAINING OFFERED BY THE SCHOOL SYSTEM

28. I would classify my computer training as one of the following: (Circle one) I am ...

1 A NON-USER
2 SELF TAUGHT
3 PEER TAUGHT
4 FORMALLY TRAINED (WORKSHOPS & COLLEGE CLASSES)

29. Please list any suggested computer training opportunities you would like to have offered by the school system:

_____

_____

Another factor related to the use of computers by teachers is support. Support is the help needed to use computers in the classroom; i.e., computer technicians, computer literate coworkers, and administrators who endorse computer use. Questions 30-36 are about support.

30. The **school system** has a computer technician I can call with computer-related questions and problems. (Circle one)
    1 NO
    2 YES

31. There is a person in my building with enough computer expertise to answer my computer-related questions? (Circle one)
    1 NO
    2 YES

32. How fast do you get help with your computer when you need it? (Circle one)
    1 NON-EXISTENT
    2 SLOW
    3 ADEQUATE
    4 FAST
    ☐ I HAVE NOT ASKED ANY COMPUTER-RELATED QUESTIONS

33. My principal is supportive of computers in the classroom. (Circle one)
    1 STRONGLY DISAGREE
    2 DISAGREE
    3 AGREE
    4 STRONGLY AGREE
    ☐ DON'T KNOW

34. The central administration is supportive of computers in the classroom. (Circle one)

1 STRONGLY DISAGREE
2 DISAGREE
3 AGREE
4 STRONGLY AGREE
☐ DON'T KNOW

35. The School Board is supportive of computers in the classroom. (Circle one)

1 STRONGLY DISAGREE
2 DISAGREE
3 AGREE
4 STRONGLY AGREE
☐ DON'T KNOW

36. Parents are supportive of computers in the classroom. (Circle one)

1 STRONGLY DISAGREE
2 DISAGREE
3 AGREE
☐ 4 STRONGLY AGREE
DON'T KNOW

Finally, we would like to ask some questions about yourself to help interpret the results.

37. What was your age at last birthday?

_____ YEARS

38. What grade level(s) do you currently teach?

_____ GRADE LEVEL

39. What curriculum area do you currently spend most of your day teaching? (Please specify)

_____

40. What is your gender? (Circle one)

1 MALE
2 FEMALE

41. How many years until you plan to retire? (Circle one)

1 1-3 YEARS
2 4-6 YEARS
3 7-9 YEARS
4 10-12 YEARS
5 MORE THAN 12 YEARS

42. Please list things that you consider to be barriers to computer use in the classroom. (Please specify)

_____
_____
_____
_____
_____
_____
_____
_____

Thank you for your time. The responses to this survey will be analyzed and the overall results made available to every school.

APPENDIX B

Content Validity Questionnaire:

Factors Related to Computer Use by

Teachers in Classroom Instruction

CONTENT VALIDITY

Factors Related to Computer Use by Teachers in Classroom Instruction

Item No.	Validity of Question (Does the question address the content area?) Circle One	Concerns About the Question	Suggested Corrections
	COMPUTER USAGE BY TEACHERS IN CLASSROOM INSTRUCTION		
1	Y or N		
2	Y or N		
3	Y or N		
4	Y or N		
5	Y or N		
6	Y or N		
7	Y or N		
8	Y or N		
	TEACHER ATTITUDES ABOUT THE USE OF COMPUTERS		
9	Y or N		
10	Y or N		
11	Y or N		
12	Y or N		
13	Y or N		
14	Y or N		
15	Y or N		
16	Y or N		
17	Y or N		
18	Y or N		
19	Y or N		
20	Y or N		
21	Y or N		

Item No.	**Validity of Question (Does the question address the content area?) Circle One**	**Concerns About the Question**	**Suggested Corrections**
	TEACHER AND STUDENT ACCESS TO COMPUTERS		
22	Y or N		
23	Y or N		
24	Y or N		
25	Y or N		
26	Y or N		
27	Y or N		
28	Y or N		
29	Y or N		
	TRAINING OF TEACHERS IN COPUTER USE		
30	Y or N		
31	Y or N		
32	Y or N		
33	Y or N		
34	Y or N		
35	Y or N		
36	Y or N		

	SUPPORT OF TEACHERS IN THE USE OF COMPUTERS FOR CLASSROOM INSTRUCTION		
37	Y or N		
38	Y or N		
39	Y or N		
40	Y or N		
41	Y or N		
42	Y or N		
43	Y or N		
Item No.	**Validity of Question (Does the question address the content area?) Circle One**	**Concerns About the Question**	**Suggested Corrections**
	SUPPORT OF TEACHERS IN THE USE OF COMPUTERS FOR CLASSROOM INSTRUCTION (Continued)		
44	Y or N		
	DEMOGRAPHICS		
	AGE		
45	Y or N		
	GRADE LEVEL TAUGHT		
46	Y or N		

	CURRICULUM TEACHING AREA		
47	Y or N		
	GENDER		
48	Y or N		
	YEARS TO RETIREMENT		
49	Y or N		
	BARRIERS TO COMPUTER USE BY TEACHERS IN CLASSROOM INSTRUCTION		
50	Y or N		

Reviewer Name:_____ Date:_____

APPENDIX C

Survey Introduction Script:

Factors Related to Computer Use by

Teachers in Classroom Instruction

FACTORS RELATED TO COMPUTER USE BY TEACHERS IN CLASSROOM INSTRUCTION

by Strader E. Blankenship

SURVEY INTRODUCTION SCRIPT

Good afternoon, I'm Strader Blankenship and I'm seeking your help in gathering some information on how teachers are using computers in their classrooms in Carroll County. I'm trying to identify factors associated with computer use so that our school system can work on ways that will facilitate your teaching.

Your responses will be kept confidential and anonymous. I will not be able to connect your responses with you. Please be honest in your responses.

You do not have to participate in this survey, but the information will be used to help you with your use of computers in the classroom. This survey takes approximately 15 minutes to complete.

Are there any questions?

APPENDIX D

Regression Analyses:

Tables of Insignificant Results

Table D1

Prediction of Computer Use in Whole Class Instruction for Preschool - Grade 2 Teachers, N = 32 [a]

Whole Class Instruction Use = .15 + .04 Attitude - .06 Access - .20 Training + .03 Support + .07 Age - .13 Retirement [b]

R-Sq .05

Analysis of Variance

Source	df	SS	MS	F	p
Regression	6	4.64	.77	.20	.97
Error	25	96.64	3.87		
Total	31	101.28			

Regression Analysis

Predictor	β	SD	t	p
Constant	.15	.45	.34	.74
Attitude	.04	.07	.56	.58
Access	-.06	.10	-.56	.58
Training	-.20	.27	-.76	.46
Support	.03	.09	.39	.70
Age	.07	.51	.14	.89
Retirement	-.13	.82	-.16	.87

[a] Listwise deletion of subjects with missing data.

[b] Gender is (essentially) constant.

[b] Gender has been removed from the equation.

Table D2

Prediction of Computer Use in Student-Directed Learning for Preschool - Grade 2 Teachers, N = 30 [a]

Student-Directed Learning Use = -1.06 + .06 Attitude - .02 Access - .06 Training + .00 Support + .60 Age + .61 Retirement [b]

R-Sq .17

Analysis of Variance

Source	df	SS	MS	F	p
Regression	6	7.22	1.20	.77	.60
Error	23	35.85	1.56		
Total	29	43.07			

Regression Analysis

Predictor	β	SD	t	p
Constant	-1.06	.29	-3.71	.00
Attitude	.06	.05	1.14	.27
Access	-.02	.07	-.32	.75
Training	-.06	.17	-.37	.72
Support	.00	.06	.02	.98
Age	.60	.33	1.82	.08
Retirement	.61	.53	1.15	.26

[a] Listwise deletion of subject with missing data.

[b] Gender is (essentially) constant.

[b] Gender has been removed from the equation.

Table D3

Prediction of Computer Use in Drill and Practice for Preschool - Grade 2 Teachers, N = 31 [a]

Drill and Practice Use = .52 + .07 Attitude - .03 Access + .12 Training + .14 Support + .09 Age + .24 Retirement [b]

R-Sq .22

Analysis of Variance

Source	df	SS	MS	F	p
Regression	6	19.67	3.28	1.12	.38
Error	24	70.12	2.92		
Total	30	89.80			

Regression Analysis

Predictor	β	SD	t	p
Constant	.52	.40	1.30	.21
Attitude	.07	.07	1.10	.28
Access	-.03	.09	-.38	.71
Training	.12	.24	.52	.61
Support	.14	.08	1.80	.08
Age	.09	.45	.21	.84
Retirement	.24	.71	.34	.74

[a] Listwise deletion of subject with missing data.
[b] Gender is (essentially) constant.
[b] Gender has been removed from the equation.

Table D4

Prediction of Over-all Computer Use for Preschool - Grade 2 Teachers, N = 29 [a]

Computer Use = -.11 + .10 Attitude - .17 Access + .09 Training + .30 Support - .15 Age + .46 Retirement [b]

R-Sq .20

Analysis of Variance

Source	df	SS	MS	F	p
Regression	6	73.40	12.23	.91	.51
Error	22	296.90	13.50		
Total	28	370.30			

Regression Analysis

Predictor	β	SD	t	p
Constant	-.11	.86	-.13	.90
Attitude	.10	.15	.71	.49
Access	-.17	.20	-.86	.40
Training	.09	.52	.18	.86
Support	.30	.16	1.82	.08
Age	-.15	.99	-.15	.88
Retirement	.46	1.57	.29	.77

[a] Listwise deletion of subjects with missing data.

[b] Gender is (essentially) constant.

[b] Gender has been removed from the equation.

Table D5

Prediction of Computer Use in Whole Class Instruction for Grade 3 - Grade 5 Teachers, N = 24 [a]

Whole Class Instruction Use = -.50 - .04 Attitude - .09 Access + .21 Training - .06 Support - .50 Age + .43 Gender - .55 Retirement

R-Sq .41

Analysis of Variance

Source	df	SS	MS	F	p
Regression	7	9.26	1.32	1.59	.21
Error	16	13.28	.83		
Total	23	22.54			

Regression Analysis

Predictor	β	SD	t	p
Constant	-.50	.28	-1.81	.09
Attitude	-.04	.05	-.69	.50
Access	-.09	.07	-1.37	.19
Training	.21	.10	2.02	.06
Support	-.06	.08	-.71	.49
Age	-.50	.30	-1.65	.12
Gender	.43	.41	1.05	.31
Retirement	-.55	.33	-1.65	.12

[a] Listwise deletion of subjects with missing data.

Table D6

Prediction of Computer Use in Student-Directed Learning for Grade 3 - Grade 5 Teachers, N = 26 [a]

Student-Directed Learning Use = .02 - .04 Attitude + .02 Access + .01 Training + .03 Support + .22 Age + .19 Gender + .19 Retirement

R-Sq .10

Analysis of Variance

Source	df	SS	MS	F	p
Regression	7	2.40	.34	.28	.95
Error	18	22.19	1.23		
Total	25	24.59			

Regression Analysis

Predictor	β	SD	t	p
Constant	.02	.28	.06	.95
Attitude	-.04	.06	-.66	.52
Access	.02	.08	.23	.82
Training	.01	.11	.12	.91
Support	.03	.08	.41	.69
Age	.22	.34	.64	.53
Gender	.19	.44	.42	.68
Retirement	.19	.38	.49	.63

[a] Listwise deletion of subjects with missing data.

Table D7

Prediction of Computer Use in Drill and Practice for Grade 3 - Grade 5 Teachers, N = 22 [a]

Drill and Practice Use = 1.06 + .08 Attitude + .19 Access + .25 Training - .34 Support - .23 Age - .41 Gender + .09 Retirement

R-Sq .25

Analysis of Variance

Source	df	SS	MS	F	p
Regression	7	26.33	3.76	.65	.71
Error	14	81.08	5.79		
Total	21	107.40			

Regression Analysis

Predictor	β	SD	t	p
Constant	1.06	.66	1.60	.13
Attitude	.08	.14	.62	.55
Access	.19	.18	1.07	.30
Training	.25	.25	1.02	.33
Support	-.34	.23	-1.46	.17
Age	-.23	.87	-.26	.80
Gender	-.41	1.00	-.42	.68
Retirement	.09	1.00	.09	.93

[a] Listwise deletion of subjects with missing data.

Table D8

Prediction of Computer Use in Computer Skills Instruction for Grade 3 - Grade 5 Teachers, N = 26 [a]

Computer Skills Use = .54 + .17 Attitude + .10 Access + .14 Training - .05 Support + .27 Age - .82 Gender + .31 Retirement

R-Sq .23

Analysis of Variance

Source	df	SS	MS	F	p
Regression	7	23.42	3.35	.76	.63
Error	18	79.11	4.40		
Total	25	102.53			

Regression Analysis

Predictor	β	SD	t	p
Constant	.54	.53	1.01	.33
Attitude	.17	.11	1.62	.12
Access	.10	.14	.71	.49
Training	.14	.21	.65	.53
Support	-.05	.15	-.30	.76
Age	.27	.65	.42	.68
Gender	-.82	.84	-.97	.34
Retirement	.31	.72	.44	.67

[a] Listwise deletion of subjects with missing data.

Table D9

Prediction of Computer Use in Computer Skills Instruction for Grade 6 - Grade 7 Teachers, N = 13 [a]

Computer Skills Use = -.77 - .05 Attitude - .02 Access - .25 Training - .09 Support + .28 Age + .18 Retirement [b]

R-Sq .55

Analysis of Variance

Source	df	SS	MS	F	p
Regression	6	2.95	.49	1.20	.42
Error	6	2.47	.41		
Total	12	5.42			

Regression Analysis

Predictor	β	SD	t	p
Constant	-.77	.26	-2.97	.03
Attitude	-.05	.04	-1.35	.22
Access	-.02	.06	-.28	.79
Training	-.25	.16	-1.50	.18
Support	-.09	.09	-.95	.38
Age	.28	.43	.66	.54
Retirement	.18	.41	.43	.68

[a] Listwise deletion of subjects with missing data.

[b] Gender is (essentially) constant.

[b] Gender has been removed from the equation.

Table D10

Prediction of Over-all Computer Use for Grade 6 - Grade 7 Teachers, N = 12 [a]

Computer Use = -.88 + .16 Attitude - .24 Access + .90 Training - .23 Support - .84 Age - .08 Retirement [b]

R-Sq .64

Analysis of Variance

Source	df	SS	MS	F	p
Regression	6	54.78	9.13	1.50	.34
Error	5	30.49	6.10		
Total	11	85.27			

Regression Analysis

Predictor	β	SD	t	p
Constant	-.88	1.12	-.78	.47
Attitude	.16	.16	1.00	.36
Access	-.24	.25	-.96	.38
Training	.90	.63	1.44	.21
Support	-.23	.38	-.62	.56
Age	-.84	1.74	-.48	.65
Retirement	-.08	1.58	-.05	.96

[a] Listwise deletion of subjects with missing data.

[b] Gender is (essentially) constant.

[b] Gender has been removed from the equation.

Table D11

Prediction of Computer Use in Whole Class Instruction for Grade 8 - Grade 9 Teachers, N = 20 [a]

Whole Class Instruction Use = -.20 - .09 Attitude - .01 Access + .19 Training - .02 Support - 1.12 Age + .29 Gender - .35 Retirement

R-Sq .36

Analysis of Variance

Source	df	SS	MS	F	p
Regression	7	33.40	4.77	.97	.49
Error	12	59.03	4.92		
Total	19	92.44			

Regression Analysis

Predictor	β	SD	t	p
Constant	-.20	.71	-.28	.79
Attitude	-.09	.12	-.78	.45
Access	-.01	.18	-.05	.96
Training	.19	.15	1.27	.23
Support	-.02	.16	-.16	.88
Age	-1.12	1.07	-1.04	.32
Gender	.29	.47	.62	.55
Retirement	-.35	.92	-.38	.71

[a] Listwise deletion of subjects with missing data.

Table D12

Prediction of Computer Use in Student-Directed Learning for Grade 8 - Grade 9 Teachers, N = 20 [a]

Student-Directed Learning Use = -.52 - .07 Attitude - .11 Access + .03 Training - .09 Support + .00 Age - .17 Gender + .39 Retirement

R-Sq .16

Analysis of Variance

Source	df	SS	MS	F	p
Regression	7	11.05	1.58	.33	.92
Error	12	57.11	4.76		
Total	19	68.17			

Regression Analysis

Predictor	β	SD	t	p
Constant	-.52	.70	-.75	.47
Attitude	-.07	.11	-.65	.53
Access	-.11	.18	-.65	.53
Training	.03	.15	.20	.85
Support	-.09	.14	-.63	.54
Age	.00	.88	.00	1.00
Gender	-.17	.50	-.34	.74
Retirement	.39	.83	.47	.65

[a] Listwise deletion of subjects with missing data.

Table D13

Prediction of Computer Use in Drill and Practice for Grade 8 - Grade 9 Teachers, N = 21 [a]

Drill and Practice Use = -.27 - .04 Attitude - .01 Access + .09 Training + .07 Support - .40 Age + .45 Gender - .32 Retirement

R-Sq .39

Analysis of Variance

Source	df	SS	MS	F	p
Regression	7	10.36	1.48	1.17	.38
Error	13	16.48	1.27		
Total	20	26.84			

Regression Analysis

Predictor	β	SD	t	p
Constant	-.27	.34	-.80	.44
Attitude	-.04	.06	-.66	.52
Access	-.01	.09	-.10	.92
Training	.09	.07	1.15	.27
Support	.07	.07	.95	.36
Age	-.40	.45	-.88	.39
Gender	.45	.24	1.87	.08
Retirement	-.32	.43	-.75	.47

[a] Listwise deletion of subjects with missing data.

Table D14

Prediction of Over-all Computer Use for Grade 8 - Grade 9 Teachers, N = 19 [a]

Computer Use = -1.89 - .24 Attitude - .11 Access + .57 Training + .03 Support - 2.79 Age + .65 Gender - .92 Retirement

R-Sq .46

Analysis of Variance

Source	df	SS	MS	F	p
Regression	7	202.12	28.87	1.35	.32
Error	11	235.34	21.39		
Total	18	437.46			

Regression Analysis

Predictor	β	SD	t	p
Constant	-1.89	1.56	-1.21	.25
Attitude	-.24	.25	-.98	.35
Access	-.11	.37	-.30	.77
Training	.57	.32	1.81	.10
Support	.03	.35	.10	.92
Age	-2.79	2.28	-1.22	.25
Gender	.65	1.07	.61	.56
Retirement	-.92	1.94	-.48	.64

[a] Listwise deletion of subjects with missing data.

Table D15

Prediction of Computer Use in Whole Class Instruction for Grade 10 - Grade 12 Teachers, N = 36 [a]

Whole Class Instruction Use = .52 + .00 Attitude - .04 Access + .00 Training + .07 Support - .44 Age + .45 Gender - .25 Retirement

R-Sq .15

Analysis of Variance

Source	df	SS	MS	F	p
Regressior	7	12.48	1.78	.69	.68
Error	28	71.86	2.57		
Total	35	84.34			

Regression Analysis

Predictor	β	SD	t	p
Constant	.52	.40	1.30	.21
Attitude	.00	.05	-.01	.99
Access	-.04	.10	-.37	.72
Training	.00	.10	.02	.98
Support	.07	.07	1.01	.32
Age	-.44	.54	-.81	.43
Gender	.45	.27	1.66	.11
Retirement	-.25	.51	-.49	.63

[z] Listwise deletion of subjects with missing data.

Table D16

Prediction of Computer Use in Drill and Practice for Grade 10 - Grade 12 Teachers, N = 37 [a]

Drill and Practice Use = -.53 + .06 Attitude + .04 Access - .02 Training - .04 Support + .11 Age + .12 Gender - .03 Retirement

R-Sq .14

Analysis of Variance

Source	df	SS	MS	F	p
Regression	7	6.13	.88	.66	.71
Error	29	38.71	1.34		
Total	36	44.84			

Regression Analysis

Predictor	β	SD	t	p
Constant	-.53	.29	-1.86	.07
Attitude	.06	.04	1.54	.14
Access	.04	.06	.62	.54
Training	-.02	.07	-.31	.76
Support	-.04	.06	-.69	.49
Age	.11	.40	.28	.78
Gender	.12	.18	.69	.49
Retirement	-.03	.34	-.08	.94

[a] Listwise deletion of subjects with missing data.

Table D17

Prediction of Over-all Computer Use for Grade 10 - Grade 12 Teachers, N = 32 [a]

Computer Use = .01 + .18 Attitude + .28 Access - .16 Training + .03 Support + .36 Age + .42 Gender + .06 Retirement

R-Sq .28

Analysis of Variance

Source	df	SS	MS	F	p
Regression	7	102.70	14.67	1.33	.28
Error	24	265.55	11.06		
Total	31	368.25			

Regression Analysis

Predictor	β	SD	t	p
Constant	.01	.85	.01	.99
Attitude	.18	.12	1.48	.15
Access	.28	.24	1.14	.27
Training	-.16	.22	-.71	.48
Support	.03	.19	.16	.87
Age	.36	1.63	.22	.83
Gender	.42	.62	.67	.51
Retirement	.06	1.43	.04	.97

[a] Listwise deletion of subjects with missing data.

Table D18

Prediction of Computer Use in Whole Class Instruction for Cross Grade Level Teachers, N = 16 [a]

Whole Class Instruction Use = -.86 + .00 Attitude + .00 Access + .00 Training - .00 Support - .00 Age + .00 Gender - .00 Retirement

R-Sq *

Analysis of Variance

Source	df	SS	MS	F	p
Regression	7	.00	.00	*	*
Error	8	.00	.00		
Total	15	.00			

Regression Analysis

Predictor	β	SD	t	p
Constant	-.86	.00	*	*
Attitude	.00	.00	*	*
Access	.00	.00	*	*
Training	.00	.00	*	*
Support	.00	.00	*	*
Age	.00	.00	*	*
Gender	.00	.00	*	*
Retirement	.00	.00	*	*

[a] Listwise deletion of subjects with missing data.

Table D19

Prediction of Computer Use in Student-Directed Learning for Cross Grade Level Teachers, N = 16 [a]

Student-Directed Learning Use = -.07 - .08 Attitude + .06 Access - .06 Training - .11 Support + .02 Age + .12 Gender - .31 Retirement

R-Sq .32

Analysis of Variance

Source	df	SS	MS	F	p
Regression	7	9.28	1.33	.55	.78
Error	8	19.42	2.43		
Total	15	28.71			

Regression Analysis

Predictor	β	SD	t	p
Constant	-.07	.73	-.09	.93
Attitude	-.08	.18	-.46	.66
Access	.06	.14	.47	.65
Training	-.06	.22	-.26	.80
Support	-.11	.15	-.74	.48
Age	.02	.75	.03	.98
Gender	.12	.41	.29	.78
Retirement	-.31	.83	-.37	.72

[a] Listwise deletion of subjects with missing data.

Table D20

Prediction of Computer Use in Drill and Practice for Cross Grade Level Teachers, N = 17 [a]

Drill and Practice Use = -.81 + .14 Attitude + .11 Access - .06 Training + .12 Support + .92 Age + .48 Gender + .84 Retirement

R-Sq .82

Analysis of Variance

Source	df	SS	MS	F	p
Regression	7	29.19	4.17	5.65	.01
Error	9	6.64	.74		
Total	16	35.83			

Regression Analysis

Predictor	β	SD	t	p
Constant	-.81	.37	-2.20	.06
Attitude	.14	.08	1.84	.10
Access	.11	.06	1.84	.10
Training	-.06	.12	-.54	.60
Support	.12	.08	1.46	.18
Age	.92	.42	2.21	.06
Gender	.48	.23	2.11	.06
Retirement	.84	.45	1.86	.10

[s] Listwide deletion of subjects with missing data.

Table D21

Prediction of Over-all Computer Use for Cross Grade Level Teachers, N = 15 [a]

Computer Use = -2.52 + .11 Attitude + .18 Access - .14 Training + .02 Support + 1.28 Age + .82 Gender + .81 Retirement

R-Sq .51

Analysis of Variance

Source	df	SS	MS	F	p
Regression	7	40.24	5.75	1.02	.49
Error	7	39.51	5.64		
Total	14	79.75			

Regression Analysis

Predictor	β	SD	t	p
Constant	-2.52	1.12	-2.25	.06
Attitude	.11	.30	.37	.73
Access	.18	.21	.88	.41
Training	-.14	.40	-.36	.73
Support	.02	.24	.09	.93
Age	1.28	1.19	1.08	.32
Gender	.82	.64	1.28	.24
Retirement	.81	1.284	.63	.55

[a] Listwise deletion of subjects with missing data.

Table D22

Prediction of Computer Use in Whole Class Instruction for All Classroom Teachers, N = 145 [a]

Whole Class Instruction Use = -.07 + .01 Attitude + .02 Access + .07 Training - .01 Support - .35 Age + .24 Gender - .25 Retirement

R-Sq .06

Analysis of Variance

Source	df	SS	MS	F	p
Regression	7	23.23	3.32	1.32	.24
Error	137	343.62	2.51		
Total	144	366.84			

Regression Analysis

Predictor	β	SD	t	p
Constant	-.07	.13	-.50	.61
Attitude	.01	.03	.21	.83
Access	.02	.04	.49	.63
Training	.07	.05	1.53	.13
Support	-.01	.03	-.15	.88
Age	-.35	.21	-1.72	.09
Gender	.24	.14	1.73	.09
Retirement	-.25	.21	-1.22	.23

[a] Listwise deletion of subjects with missing data.

Table D23

Prediction of Computer Use in Student-Directed Learning for All Classroom Teachers, N = 146 [a]

Student-Directed Learning Use = -.15 + .01 Attitude + .04 Access - .08 Training - .02 Support + .20 Age - .01 Gender + .05 Retirement

R-Sq .04

Analysis of Variance

Source	df	SS	MS	F	p
Regression	7	11.43	1.63	.80	.59
Error	138	283.25	2.05		
Total	145	294.68			

Regression Analysis

Predictor	β	SD	t	p
Constant	-.15	.12	-1.26	.21
Attitude	.01	.02	.50	.62
Access	.04	.03	1.29	.20
Training	-.08	.04	-1.80	.07
Support	-.02	.03	-.63	.53
Age	.20	.19	1.08	.28
Gender	-.01	.12	-.10	.92
Retirement	.05	.18	.27	.79

[a] Listwise deletion of subjects with missing data.

APPENDIX E

Focus Group Agendas

Preschool - Grade 2
Focus Group
4:00 - 4:45

I. Report of Results (20 Minutes)

A. Relative Use:
Preschool - Grade 2
Grade 3 - Grade 5
Grade 6 - Grade 7
Grade 8 - Grade 9
Grade 10 - Grade 12
Cross Grade Level

	Rank Among All Groups
Whole Class Instruction	2
Student-Directed Learning	5
Drill and Practice	1
Computer Skills Instruction	2
Over-all Computer Use	2

B. Relative Factor Score

Attitude	4
Access	2
Training	2
Support	3

C. Computer Training Received By Preschool - Grade 2 (See Table E1)

D. Matrix of Suggested Training Opportunities By Preschool - Grade 2 (See Table E2)

E. Matrix of Barriers to Computer Use by Preschool - Grade 2 (See Table E3)

F. Regression Analysis of Preschool - Grade 2 Responses
The only result of any significance with regard to this group is that **support has a high predictability of teaching computer skills use and age has a high negative predictability of teaching computer skills use**. I found **no** significant predictability of any other factors on student-directed learning, drill and practice, computer skills instruction, or over-all computer use.

II. Strategies to increase computer use by teachers in classroom instruction. (10 Minutes) The participants of this focus group will be kept confidential.

A. Each participant will spend 5 to 10 minutes considering the reported results and writing a list of 5 or more strategies to improve computer use in the classroom.
B. When the strategies are listed the participant is to sit quietly until the group is finished.

III. Roundtable Listing (5 - 10 Minutes)

A. Each participant will give one strategy on their list. The facilitator will write the strategy on the easel.
B. The next person will give a strategy on their list, the strategy must by different from any on the easel. If there are no new strategies on their list they will pass to the next participant.
C. This Roundtable will continue until all strategies have been listed on the easel.

IV. Roundtable Discussion (5 - 10 Minutes)

A. Participants will be asked if any strategy needs to be clarified by the originator.
B. All participants will be free to expand on any strategy.
C. The group will be asked to see if there is any overlap in the suggestions.

V. Prioritizing Strategies (5 - 10 Minutes)

A. Once the list has been collapsed as much as possible, participants will be asked to pick their top three choices and prioritize them in 1,2,3 order.
B. Each persons first, second, and third choice will be noted on the easel.
C. The strategy with the greatest number of first place votes will be first, the strategy with the greatest number of second place votes will be second, etc.
D. Ties will be noted.

VI. The results of this focus group will be written in the results of my study and passed on to the School Board, Technology Task Force, and presented to the principals of Carroll County Public Schools.

VII. Thank you for your time and participation.

Table E1

Computer Training Received by Teachers Grouped by Grade Level (P-2)

Type of Training	Preschool - Grade 2 *N = 47*	Total Teacher Population *N = 231*
No Training	1	8
Computer Operation and Basics	43	196
Word Processing	22	129
Presentation Software	6	59
Spreadsheeting	9	65
Database Management	6	42
Other	14	53

Table E2

Matrix of Suggested Training Opportunities by Teacher Groups (P-2)

Major Themes	Subthemes	Total Responses N = 108	Pre-Gr 2 Responses N = 24
Internet		40	6
	Internet Use	34	4
	Internet Classroom Application	4	2
	Web Page Production	1	
	e-mail Usage	1	
SOL's		11	5
	Integration of SOL's Across the Curriculum	9	3
	Teaching SOL's with a Limited Number of Computers	2	2
Classroom Instruction		11	4
	Instructional Needs	5	
	Young Students	4	3
	Reading	1	
	Whole Class Instruction	1	1
Basic Skills		8	2
Windows		8	1
	Windows	2	
	Windows 95	6	1
Software Discovery		7	2
	Software Experimentation	4	1
	List of Good Application Software	3	1
Classroom Management		8	2
	Management	4	1
	Integration	1	1
	Lessons	2	
	IEP's	1	
Presentation Software		4	1
Word		3	1
Math		3	
Excel		2	
Access		2	
Set-up & Fixing Computers		2	1
Computer Aided Music Instruction		1	
AutoCad Lt		1	
Science		1	
Social Studies		1	
Time		1	
Photos		1	
Mitchell On-Demand		1	
Network		1	
When, Where, or How Training Should be Conducted		10	2
	When	4	1
	Where	3	
	How	3	1
No Specific Suggestion		13	2
	Any Help	4	
	None	2	
	Continue Current Classes	3	
	Fun Uses of the Computer	1	1
	Other	3	1

Table E3

Matrix of Barriers to Computer Use by Teacher Groups (P-2)

Major Themes	Subthemes	Total Responses N = 206	Pre-Gr 2 Responses N = 46
Access (Hardware)		184	36
	Student/Computer Ratio	61	11
	More Access	59	14
	Peripherals	27	4
	Internet Access	14	1
	Quality of Computers	9	2
	Computer Application	5	2
	Operation of Computers	3	
	Network	2	
	Location of Computers	1	1
	Laptop Access	1	
Access (Software)		69	11
	Integration of Software Into Curriculum	36	4
	More Software	25	6
	Other	4	1
	Purchasing	3	
	Quality of Computers	1	
Training		41	9
	Adequacy of Teacher Skills	20	4
	Technology SOL Training	5	2
	Need More Training	5	2
	Classroom Application	5	1
	Teacher Initiative to Take Training	4	
	Timing of Training	2	
Facilities		37	8
	Physical Space for Computers	27	7
	Wiring	7	1
	Location	2	
	Teachers Changing Classes	1	
Time (Teacher)		32	17
	Time	20	10
	Time to Practice	5	4
	Time to Plan	2	1
	Time for Training	2	
	Preparation Time	2	1
	Unencumbered Time	1	1
Time (Classroom)		29	9
	Time in the Schedule	17	6
	Pressure to Cover SOL's	8	2
	Time for Individual Instruction	3	1
	Limited Time	1	

(*table continues*)

Table E3. (*Continued*)

Major Themes	Subthemes	Total Responses N = 206	Pre-Gr 2 Responses N = 46
Procedural		25	4
	Maturity of Students	8	
	Teaching Computer Skills with		
	One Computer in a Classroom	7	2
	Student Computer Training in Lower Grades	7	
	Teacher Expectations	1	1
	Scheduling	1	
	Testing	1	1
Support		21	7
	Computer Repair	9	2
	Computer Lab Teacher	3	3
	Knowledgable Person in the Building	2	1
	Classroom Aide	2	1
	Technology Specialist	1	
	Computer Teacher	1	
	Untrained Technicians	1	
	Computer Technicians	1	
	Central Office Support	1	
Access Lab		18	6
	Need a Lab	13	6
	Scheduling Current Lab	5	
Money		17	
	Need Money for Technology	5	
	Cost of Equipment, Software, & Supplies	9	
	Funding Procedures	3	
Attitude		9	2
	Computers are a Distraction	2	1
	No Use for Computers	1	
	Other Subjects More Important	1	1
	Too Much Time Spent on Computers	1	
	Fear of Computers	1	
	Computers are OK	1	
	Teacher Resistance to Computers	1	
	Student Attitudes	1	
Other		4	1
	Materials	2	1
	Unusual Circumstances	1	
	None	1	

Grade 3 - Grade 5
Focus Group
4:00 - 4:45

I. Report of Results (20 Minutes)

A. Relative Use:
Preschool - Grade 2
Grade 3 - Grade 5
Grade 6 - Grade 7
Grade 8 - Grade 9
Grade 10 - Grade 12
Cross Grade Level

	Rank Among All Groups
Whole Class Instruction	3
Student-Directed Learning	3
Drill and Practice	2
Computer Skills Instruction	3
Over-all Computer Use	1

B. Relative Factor Score

Attitude	2
Access	3
Training	5
Support	2

C. Computer Training Received By Grade 3 - Grade 5 (See Table E4)

D. Matrix of Suggested Training Opportunities By Grade 3 - Grade 5 (See Table E5)

E. Matrix of Barriers to Computer Use by Grade 3 - Grade 5 (See Table E6)

F. Regression Analysis of Grade 3 - Grade 5 Responses
The only result of any significance with regard to this group is that **training has a high predictability of over-all computer use** and **support has a high predictability of over-all computer use**. I found **no** significant predictability of any other factors on student-directed learning, drill and practice, computer skills instruction, or over-all computer use.

II. Strategies to increase computer use by teachers in classroom instruction. (10 Minutes) The participants of this focus group will be kept confidential.

A. Each participant will spend 5 to 10 minutes considering the reported results and writing a list of 5 or more strategies to improve computer use in the classroom.
B. When the strategies are listed the participant is to sit quietly until the group is finished.

III. Roundtable Listing (5 - 10 Minutes)

A. Each participant will give one strategy on their list. The facilitator will write the strategy on the easel.
B. The next person will give a strategy on their list, the strategy must by different from any on the easel. If there are no new strategies on their list they will pass to the next participant.
C. This Roundtable will continue until all strategies have been listed on the easel.

IV. Roundtable Discussion (5 - 10 Minutes)

A. Participants will be asked if any strategy needs to be clarified by the originator.
B. All participants will be free to expand on any strategy.
C. The group will be asked to see if there is any overlap in the suggestions.

V. Prioritizing Strategies (5 - 10 Minutes)

A. Once the list has been collapsed as much as possible, participants will be asked to pick their top three choices and prioritize them in 1,2,3 order.
B. Each persons first, second, and third choice will be noted on the easel.
C. The strategy with the greatest number of first place votes will be first, the strategy with the greatest number of second place votes will be second, etc.
D. Ties will be noted.

VI. The results of this focus group will be written in the results of my study and passed on to the School Board, Technology Task Force, and presented to the principals of Carroll County Public Schools.

VII. Thank you for your time and participation.

Table E4

Computer Training Received by Teachers Grouped by Grade Level (3-5)

Type of Training	Grade 3 - Grade 5 *N = 34*	Total Teacher Population *N = 231*
No Training	2	8
Computer Operation and Basics	26	196
Word Processing	15	129
Presentation Software	8	59
Spreadsheeting	9	65
Database Management	5	42
Other	13	53

Table E5

Matrix of Suggested Training Opportunities by Teacher Groups (3-5)

Major Themes	Subthemes	Total Responses N = 108	Gr 3 - Gr 5 Responses N = 18
Internet		40	5
	Internet Use	34	5
	Internet Classroom Application	4	
	Web Page Production	1	
	e-mail Usage	1	
SOL's		11	4
	Integration of SOL's Across the Curriculum	9	4
	Teaching SOL's with a Limited Number of Computers	2	
Classroom Instruction		11	1
	Instructional Needs	5	
	Young Students	4	1
	Reading	1	
	Whole Class Instruction	1	
Basic Skills		8	
Windows		8	1
	Windows	2	
	Windows 95	6	1
Software Discovery		7	
	Software Experimentation	4	
	List of Good Application Software	3	
Classroom Management		8	
	Management	4	
	Integration	1	
	Lessons	2	
	IEP's	1	
Presentation Software		4	
Word		3	
Math		3	
Excel		2	1
Access		2	1
Set-up & Fixing Computers		2	
Computer Aided Music Instruction		1	
AutoCad Lt		1	
Science		1	
Social Studies		1	
Time		1	
Photos		1	
Mitchell On-Demand		1	
Network		1	
When, Where, or How Training Should be Conducted		10	6
	When	4	2
	Where	3	4
	How	3	
No Specific Suggestion		13	4
	Any Help	4	2
	None	2	1
	Continue Current Classes	3	1
	Fun Uses of the Computer	1	
	Other	3	

Table E6

Matrix of Barriers to Computer Use by Teacher Groups (3-5)

Major Themes	Subthemes	Total Responses N = 206	Gr 3 - Gr 5 Responses N = 31
Access (Hardware)		184	26
	Student/Computer Ratio	61	10
	More Access	59	10
	Peripherals	27	
	Internet Access	14	2
	Quality of Computers	9	2
	Computer Application	5	1
	Operation of Computers	3	1
	Network	2	
	Location of Computers	1	
	Laptop Access	1	
Access (Software)		69	6
	Integration of Software Into Curriculum	36	2
	More Software	25	4
	Other	4	
	Purchasing	3	
	Quality of Computers	1	
Training		41	9
	Adequacy of Teacher Skills	20	4
	Technology SOL Training	5	1
	Need More Training	5	3
	Classroom Application	5	
	Teacher Initiative to Take Training	4	1
	Timing of Training	2	
Facilities		37	10
	Physical Space for Computers	27	8
	Wiring	7	1
	Location	2	1
	Teachers Changing Classes	1	
Time (Teacher)		32	9
	Time	20	7
	Time to Practice	5	
	Time to Plan	2	1
	Time for Training	2	1
	Preparation Time	2	
	Unencumbered Time	1	
Time (Classroom)		29	6
	Time in the Schedule	17	2
	Pressure to Cover SOL's	8	2
	Time for Individual Instruction	3	1
	Limited Time	1	1

(*table continues*)

Table E6. (*Continued*)

Major Themes	Subthemes	Total Responses N = 206	Gr 3 - Gr 5 Responses N = 31
Procedural		25	5
	Maturity of Students	8	3
	Teaching Computer Skills with		
	One Computer in a Classroom	7	2
	Student Computer Training in Lower Grades	7	
	Teacher Expectations	1	
	Scheduling	1	
	Testing	1	
Support		21	4
	Computer Repair	9	2
	Computer Lab Teacher	3	
	Knowledgable Person in the Building	2	
	Classroom Aide	2	
	Technology Specialist	1	1
	Computer Teacher	1	1
	Untrained Technicians	1	
	Computer Technicians	1	
	Central Office Support	1	
Access Lab		18	4
	Need a Lab	13	4
	Scheduling Current Lab	5	
Money		17	1
	Need Money for Technology	5	1
	Cost of Equipment, Software, & Supplies	9	
	Funding Procedures	3	
Attitude		9	1
	Computers are a Distraction	2	1
	No Use for Computers	1	
	Other Subjects More Important	1	
	Too Much Time Spent on Computers	1	
	Fear of Computers	1	
	Computers are OK	1	
	Teacher Resistance to Computers	1	
	Student Attitudes	1	
Other		4	1
	Materials	2	1
	Unusual Circumstances	1	
	None	1	

Grade 6 - Grade 7
Focus Group
4:00 - 5:00

I. Report of Results (20 Minutes)

A. Relative Use:
Preschool - Grade 2
Grade 3 - Grade 5
Grade 6 - Grade 7
Grade 8 - Grade 9
Grade 10 - Grade 12
Cross Grade Level

	Rank Among All Groups
Whole Class Instruction	5
Student-Directed Learning	2
Drill and Practice	4
Computer Skill Instruction	4
Over-all Computer Use	4

B. Relative Factor Score

Attitude	5
Access	5
Training	3
Support	1

C. Computer Training Received By Grade 6 - Grade 7 (See Table E7)

D. Matrix of Suggested Training Opportunities By Grade 6 - Grade 7 (See Table E8)

E. Matrix of Barriers to Computer Use by Grade 6 - Grade 7 (See Table E9)

F. Regression Analysis of Grade 6 - Grade 7 Responses
The only result of any significance with regard to this group is that **training has a high predictability of whole class instruction use, training has a high predictability of student-directed learning use, and attitude has a high predictability of drill and practice use**.
I found **no** significant predictability of any other factors on student-directed learning, drill and practice, computer skills instruction, or over-all computer use.

II. Strategies to increase computer use by teachers in classroom instruction. (10 Minutes) The participants of this focus group will be kept confidential.

A. Each participant will spend 5 to 10 minutes considering the reported results and writing a list of 5 or more strategies to improve computer use in the classroom.
B. When the strategies are listed the participant is to sit quietly until the group is finished.

III. Roundtable Listing (5 - 10 Minutes)

A. Each participant will give one strategy on their list. The facilitator will write the strategy on the easel.
B. The next person will give a strategy on their list, the strategy must by different from any on the easel. If there are no new strategies on their list they will pass to the next participant.
C. This Roundtable will continue until all strategies have been listed on the easel.

IV. Roundtable Discussion (5 - 10 Minutes)

A. Participants will be asked if any strategy needs to be clarified by the originator.
B. All participants will be free to expand on any strategy.
C. The group will be asked to see if there is any overlap in the suggestions.

V. Prioritizing Strategies (5 - 10 Minutes)

A. Once the list has been collapsed as much as possible, participants will be asked to pick their top three choices and prioritize them in 1,2,3 order.
B. Each persons first, second, and third choice will be noted on the easel.
C. The strategy with the greatest number of first place votes will be first, the strategy with the greatest number of second place votes will be second, etc.
D. Ties will be noted.

VI. The results of this focus group will be written in the results of my study and passed on to the School Board, Technology Task Force, and presented to the principals of Carroll County Public Schools.

VII. Thank you for your time and participation.

Table E7

Computer Training Received by Teachers Grouped by Grade Level (6-7)

Type of Training	Grade 6 - Grade 7 *N = 29*	Total Teacher Population *N = 231*
No Training	1	8
Computer Operation and Basics	26	196
Word Processing	15	129
Presentation Software	4	59
Spreadsheeting	6	65
Database Management	5	42
Other	7	53

Table E8

Matrix of Suggested Training Opportunities by Teacher Groups (6-7)

Major Themes	Subthemes	Total Responses N = 108	Gr 6 - Gr 7 Responses N = 14
Internet		40	5
	Internet Use	34	4
	Internet Classroom Application	4	
	Web Page Production	1	1
	e-mail Usage	1	
SOL's		11	
	Integration of SOL's Across the Curriculum	9	
	Teaching SOL's with a Limited Number of Computers	2	
Classroom Instruction		11	2
	Instructional Needs	5	2
	Young Students	4	
	Reading	1	
	Whole Class Instruction	1	
Basic Skills		8	1
Windows		8	
	Windows	2	
	Windows 95	6	
Software Discovery		7	2
	Software Experimentation	4	
	List of Good Application Software	3	2
Classroom Management		8	2
	Management	4	2
	Integration	1	
	Lessons	2	
	IEP's	1	
Presentation Software		4	2
Word		3	1
Math		3	1
Excel		2	1
Access		2	1
Set-up & Fixing Computers		2	
Computer Aided Music Instruction		1	
AutoCad Lt		1	
Science		1	1
Social Studies		1	1
Time		1	1
Photos		1	
Mitchell On-Demand		1	
Network		1	
When, Where, or How Training Should be Conducted		10	
	When	4	
	Where	3	
	How	3	
No Specific Suggestion		13	1
	Any Help	4	
	None	2	
	Continue Current Classes	3	1
	Fun Uses of the Computer	1	
	Other	3	

Table E9

Matrix of Barriers to Computer Use by Teacher Groups (6-7)

Major Themes	Subthemes	Total Responses N = 206	Gr 6 - Gr 7 Responses N = 28
Access (Hardware)		184	33
	Student/Computer Ratio	61	6
	More Access	59	11
	Peripherals	27	10
	Internet Access	14	2
	Quality of Computers	9	1
	Computer Application	5	
	Operation of Computers	3	1
	Network	2	1
	Location of Computers	1	
	Laptop Access	1	
Access (Software)		69	9
	Integration of Software Into Curriculum	36	5
	More Software	25	4
	Other	4	
	Purchasing	3	
	Quality of Computers	1	
Training		41	2
	Adequacy of Teacher Skills	20	
	Technology SOL Training	5	
	Need More Training	5	
	Classroom Application	5	1
	Teacher Initiative to Take Training	4	
	Timing of Training	2	1
Facilities		37	2
	Physical Space for Computers	27	2
	Wiring	7	
	Location	2	
	Teachers Changing Classes	1	
Time (Teacher)		32	2
	Time	20	1
	Time to Practice	5	
	Time to Plan	2	
	Time for Training	2	
	Preparation Time	2	1
	Unencumbered Time	1	
Time (Classroom)		29	6
	Time in the Schedule	17	4
	Pressure to Cover SOL's	8	2
	Time for Individual Instruction	3	
	Limited Time	1	

(*table continues*)

Table E9. (*Continued*)

Major Themes	Subthemes	Total Responses N = 206	Gr 6 - Gr 7 Responses N = 28
Procedural		25	1
	Maturity of Students	8	
	Teaching Computer Skills with		
	One Computer in a Classroom	7	1
	Student Computer Training in Lower Grades	7	
	Teacher Expectations	1	
	Scheduling	1	
	Testing	1	
Support		21	
	Computer Repair	9	
	Computer Lab Teacher	3	
	Knowledgable Person in the Building	2	
	Classroom Aide	2	
	Technology Specialist	1	
	Computer Teacher	1	
	Untrained Technicians	1	
	Computer Technicians	1	
	Central Office Support	1	
Access Lab		18	
	Need a Lab	13	
	Scheduling Current Lab	5	
Money		17	4
	Need Money for Technology	5	
	Cost of Equipment, Software, & Supplies	9	3
	Funding Procedures	3	1
Attitude		9	1
	Computers are a Distraction	2	
	No Use for Computers	1	
	Other Subjects More Important	1	
	Too Much Time Spent on Computers	1	
	Fear of Computers	1	1
	Computers are OK	1	
	Teacher Resistance to Computers	1	
	Student Attitudes	1	
Other		4	
	Materials	2	
	Unusual Circumstances	1	
	None	1	

Grade 8 - Grade 9
Focus Group
3:30 - 4:15

I. Report of Results (20 Minutes)

A. Relative Use:
Preschool - Grade 2
Grade 3 - Grade 5
Grade 6 - Grade 7
Grade 8 - Grade 9
Grade 10 - Grade 12
Cross Grade Level

	Rank Among All Groups
Whole Class Instruction	4
Student-Directed Learning	4
Drill and Practice	6
Computer Skills Instruction	6
Over-all Computer Use	5

B. Relative Factor Score

Attitude	6
Access	4
Training	3
Support	6

C. Computer Training Received By Grade 8 - Grade 9 (See Table 10)

D. Matrix of Suggested Training Opportunities By Grade 8 - Grade 9 (See Table 11)

E. Matrix of Barriers to Computer Use by Grade 8 - Grade 9 (See Table 12)

F. Regression Analysis of Grade 8 - Grade 9 Responses
The only result of any significance with regard to this group is that **training has a high predictability of teaching computer skills use.** I found **no** significant predictability of any other factors on student-directed learning, drill and practice, computer skills instruction, or over-all computer use.

II. Strategies to increase computer use by teachers in classroom instruction. (10 Minutes) The participants of this focus group will be kept confidential.

A. Each participant will spend 5 to 10 minutes considering the reported results and writing a list of 5 or more strategies to improve computer use in the classroom.
B. When the strategies are listed the participant is to sit quietly until the group is finished.

III. Roundtable Listing (5 - 10 Minutes)

A. Each participant will give one strategy on their list. The facilitator will write the strategy on the easel.
B. The next person will give a strategy on their list, the strategy must by different from any on the easel. If there are no new strategies on their list they will pass to the next participant.
C. This Roundtable will continue until all strategies have been listed on the easel.

IV. Roundtable Discussion (5 - 10 Minutes)

A. Participants will be asked if any strategy needs to be clarified by the originator.
B. All participants will be free to expand on any strategy.
C. The group will be asked to see if there is any overlap in the suggestions.

V. Prioritizing Strategies (5 - 10 Minutes)

A. Once the list has been collapsed as much as possible, participants will be asked to pick their top three choices and prioritize them in 1,2,3 order.
B. Each persons first, second, and third choice will be noted on the easel.
C. The strategy with the greatest number of first place votes will be first, the strategy with the greatest number of second place votes will be second, etc.
D. Ties will be noted.

VI. The results of this focus group will be written in the results of my study and passed on to the School Board, Technology Task Force, and presented to the principals of Carroll County Public Schools.

VII. Thank you for your time and participation.

Table E10

Computer Training Received by Teachers Grouped by Grade Level (8-9)

Type of Training	Grade 8 - Grade 9 *N = 35*	Total Teacher Population *N = 231*
No Training	2	8
Computer Operation and Basics	28	196
Word Processing	19	129
Presentation Software	10	59
Spreadsheeting	12	65
Database Management	7	42
Other	8	53

Table E11

Matrix of Suggested Training Opportunities by Teacher Groups (8-9)

Major Themes	Subthemes	Total Responses N = 108	Gr 8 - Gr 9 Responses N = 13
Internet		40	6
	Internet Use	34	5
	Internet Classroom Application	4	1
	Web Page Production	1	
	e-mail Usage	1	
SOL's		11	
	Integration of SOL's Across the Curriculum	9	
	Teaching SOL's with a Limited Number of Computers	2	
Classroom Instruction		11	2
	Instructional Needs	5	1
	Young Students	4	
	Reading	1	1
	Whole Class Instruction	1	
Basic Skills		8	1
Windows		8	
	Windows	2	
	Windows 95	6	
Software Discovery		7	2
	Software Experimentation	4	2
	List of Good Application Software	3	
Classroom Management		8	1
	Management	4	1
	Integration	1	
	Lessons	2	
	IEP's	1	
Presentation Software		4	
Word		3	
Math		3	1
Excel		2	
Access		2	
Set-up & Fixing Computers		2	
Computer Aided Music Instruction		1	
AutoCad Lt		1	1
Science		1	
Social Studies		1	
Time		1	
Photos		1	
Mitchell On-Demand		1	
Network		1	
When, Where, or How Training Should be Conducted		10	
	When	4	
	Where	3	
	How	3	
No Specific Suggestion		13	1
	Any Help	4	1
	None	2	
	Continue Current Classes	3	
	Fun Uses of the Computer	1	
	Other	3	

Table E12

Matrix of Barriers to Computer Use by Teacher Groups (8-9)

Major Themes	Subthemes	Total Responses N = 206	Gr 8 - Gr 9 Responses N = 27
Access (Hardware)		184	27
	Student/Computer Ratio	61	13
	More Access	59	8
	Peripherals	27	2
	Internet Access	14	3
	Quality of Computers	9	
	Computer Application	5	
	Operation of Computers	3	1
	Network	2	
	Location of Computers	1	
	Laptop Access	1	
Access (Software)		69	15
	Integration of Software Into Curriculum	36	12
	More Software	25	2
	Other	4	1
	Purchasing	3	
	Quality of Computers	1	
Training		41	
	Adequacy of Teacher Skills	20	
	Technology SOL Training	5	
	Need More Training	5	
	Classroom Application	5	
	Teacher Initiative to Take Training	4	
	Timing of Training	2	
Facilities		37	5
	Physical Space for Computers	27	4
	Wiring	7	
	Location	2	
	Teachers Changing Classes	1	1
Time (Teacher)		32	
	Time	20	
	Time to Practice	5	
	Time to Plan	2	
	Time for Training	2	
	Preparation Time	2	
	Unencumbered Time	1	
Time (Classroom)		29	1
	Time in the Schedule	17	1
	Pressure to Cover SOL's	8	
	Time for Individual Instruction	3	
	Limited Time	1	

(*table continues*)

Table E12. (*Continued*)

Major Themes	Subthemes	Total Responses N = 206	Gr 8 - Gr 9 Responses N = 27
Procedural		25	4
	Maturity of Students	8	2
	Teaching Computer Skills with		
	One Computer in a Classroom	7	
	Student Computer Training in Lower Grades	7	2
	Teacher Expectations	1	
	Scheduling	1	
	Testing	1	
Support		21	3
	Computer Repair	9	1
	Computer Lab Teacher	3	
	Knowledgable Person in the Building	2	1
	Classroom Aide	2	
	Technology Specialist	1	
	Computer Teacher	1	
	Untrained Technicians	1	1
	Computer Technicians	1	
	Central Office Support	1	
Access Lab		18	4
	Need a Lab	13	1
	Scheduling Current Lab	5	3
Money		17	5
	Need Money for Technology	5	3
	Cost of Equipment, Software, & Supplies	9	2
	Funding Procedures	3	
Attitude		9	1
	Computers are a Distraction	2	
	No Use for Computers	1	
	Other Subjects More Important	1	
	Too Much Time Spent on Computers	1	1
	Fear of Computers	1	
	Computers are OK	1	
	Teacher Resistance to Computers	1	
	Student Attitudes	1	
Other		4	
	Materials	2	
	Unusual Circumstances	1	
	None	1	

Grade 10 - Grade 12
Focus Group
3:30-4:15

I. Report of Results (20 Minutes)

A. Relative Use:
Preschool - Grade 2
Grade 3 - Grade 5
Grade 6 - Grade 7
Grade 8 - Grade 9
Grade 10 - Grade 12
Cross Grade Level

Whole Class Instruction -	1
Student-Directed Learning -	1
Drill and Practice -	3
Computer Skill Instruction -	3
Over-all Computer Use -	3

B. Relative Factor Score

Attitude -	4
Access -	1
Training -	6
Support -	5

C. Computer Training Received By Grade 10 - Grade 12 (See Attached Chart)

D. Matrix of Suggested Training Opportunities By Grade 10 - Grade 12 (See Attached Chart)

E. Matrix of Barriers to Computer Use by Grade 10 - Grade 12 (See Attached Chart)

F. Regression Analysis of Grade 10 - Grade 12 Responses
The only results of any significance with regard to this group is that **attitude has a high predictability of student-directed learning use and access has a high predictability of teaching computer skills use**.
I found **no** significant predictability of any other factors on student-directed learning, drill and practice, computer skills instruction, or over-all computer use.

II. Strategies to increase computer use by teachers in classroom instruction. (10 Minutes) The participants of this focus group will be kept confidential.

A. Each participant will spend 5 to 10 minutes considering the reported results and writing a list of 5 or more strategies to improve computer use in the classroom.
B. When the strategies are listed the participant is to sit quietly until the group is finished.

III. Roundtable Listing (5 - 10 Minutes)

A. Each participant will give one strategy on their list. The facilitator will write the strategy on the easel.
B. The next person will give a strategy on their list, the strategy must by different from any on the easel. If there are no new strategies on their list they will pass to the next participant.
C. This Roundtable will continue until all strategies have been listed on the easel.

IV. Roundtable Discussion (5 - 10 Minutes)

A. Participants will be asked if any strategy needs to be clarified by the originator.
B. All participants will be free to expand on any strategy.
C. The group will be asked to see if there is any overlap in the suggestions.

V. Prioritizing Strategies (5 - 10 Minutes)

A. Once the list has been collapsed as much as possible, each participant will be asked to pick their top three choices and prioritize them in 1,2,3 order.
B. Each persons first, second, and third choice will be noted on the easel.
C. The strategy with the greatest number of first place votes will be first, the strategy with the greatest number of second place votes will be second, etc.
D. Ties will be noted.

VI. The results of this focus group will be written in the results of my study and passed on to the School Board, Technology Tack Force, and presented to the principals of Carroll County Public Schools.

VII. Thank you for your time and participation.

Table E13

Computer Training Received by Teachers by Grade Level (10-12)

Type of Training	Grade 10 - Grade 12 *N = 53*	Total Teacher Population *N = 231*
No Training	2	8
Computer Operation and Basics	41	196
Word Processing	39	129
Presentation Software	21	59
Spreadsheeting	18	65
Database Management	12	42
Other	9	53

Table E14

Matrix of Suggested Training Opportunities by Teacher Groups (10-12)

Major Themes	Subthemes	Total Responses N = 108	Gr 10 - Gr 12 Responses N = 28
Internet		40	16
	Internet Use	34	14
	Internet Classroom Application	4	1
	Web Page Production	1	
	e-mail Usage	1	1
SOL's		11	1
	Integration of SOL's Across the Curriculum	9	1
	Teaching SOL's with a Limited Number of Computers	2	
Classroom Instruction		11	
	Instructional Needs	5	
	Young Students	4	
	Reading	1	
	Whole Class Instruction	1	
Basic Skills		8	2
Windows		8	6
	Windows	2	2
	Windows 95	6	4
Software Discovery		7	
	Software Experimentation	4	
	List of Good Application Software	3	
Classroom Management		8	1
	Management	4	
	Integration	1	
	Lessons	2	1
	IEP's	1	
Presentation Software		4	1
Word		3	1
Math		3	1
Excel		2	
Access		2	
Set-up & Fixing Computers		2	
Computer Aided Music Instruction		1	
AutoCad Lt		1	
Science		1	
Social Studies		1	
Time		1	
Photos		1	1
Mitchell On-Demand		1	1
Network		1	1
When, Where, or How Training Should be Conducted		10	3
	When	4	1
	Where	3	
	How	3	2
No Specific Suggestion		13	3
	Any Help	4	1
	None	2	1
	Continue Current Classes	3	
	Fun Uses of the Computer	1	
	Other	3	1

Table E15

Matrix of Barriers to Computer Use by Teacher Groups (10-12)

Major Themes	Subthemes	Total Responses N = 206	Gr 10 - Gr 12 Responses N = 47
Access (Hardware)		184	41
	Student/Computer Ratio	61	16
	More Access	59	7
	Peripherals	27	7
	Internet Access	14	6
	Quality of Computers	9	4
	Computer Application	5	1
	Operation of Computers	3	
	Network	2	
	Location of Computers	1	
	Laptop Access	1	
Access (Software)		69	16
	Integration of Software Into Curriculum	36	8
	More Software	25	7
	Other	4	
	Purchasing	3	
	Quality of Computers	1	1
Training		41	17
	Adequacy of Teacher Skills	20	10
	Technology SOL Training	5	2
	Need More Training	5	
	Classroom Application	5	2
	Teacher Initiative to Take Training	4	2
	Timing of Training	2	1
Facilities		37	5
	Physical Space for Computers	27	5
	Wiring	7	
	Location	2	
	Teachers Changing Classes	1	
Time (Teacher)		32	2
	Time	20	2
	Time to Practice	5	
	Time to Plan	2	
	Time for Training	2	
	Preparation Time	2	
	Unencumbered Time	1	
Time (Classroom)		29	5
	Time in the Schedule	17	3
	Pressure to Cover SOL's	8	2
	Time for Individual Instruction	3	
	Limited Time	1	

(*table continues*)

Table E15. (*Continued*)

Major Themes	Subthemes	Total Responses N = 206	Gr 10 - Gr 12 Responses N = 47
Procedural		25	7
	Maturity of Students	8	1
	Teaching Computer Skills with		
	One Computer in a Classroom	7	1
	Student Computer Training in Lower Grades	7	5
	Teacher Expectations	1	
	Scheduling	1	
	Testing	1	
Support		21	5
	Computer Repair	9	3
	Computer Lab Teacher	3	
	Knowledgable Person in the Building	2	
	Classroom Aide	2	
	Technology Specialist	1	
	Computer Teacher	1	
	Untrained Technicians	1	1
	Computer Technicians	1	
	Central Office Support	1	1
Access Lab		18	3
	Need a Lab	13	1
	Scheduling Current Lab	5	2
Money		17	2
	Need Money for Technology	5	
	Cost of Equipment, Software, & Supplies	9	1
	Funding Procedures	3	1
Attitude		9	3
	Computers are a Distraction	2	
	No Use for Computers	1	
	Other Subjects More Important	1	
	Too Much Time Spent on Computers	1	
	Fear of Computers	1	
	Computers are OK	1	1
	Teacher Resistance to Computers	1	1
	Student Attitudes	1	1
Other		4	2
	Materials	2	
	Unusual Circumstances	1	1
	None	1	1

APPENDIX F

Correlation Tables

Table F1

Pearson Coefficients for Relationships Among All Variables, Grades P-2, N = 47

	Over-all use	Whole class instruction	Student-directed learning	Drill and practice	Computer skills instruction	Attitude	Access	Training	Support	Age	Gender
Whole Class Instruction	.46										
Student-Directed Learning	.64	.14									
Drill and Practice	.71	-.11	.44								
Computer Skills Instruction	.68	.04	.08	.50							
Attitude	.20	.13	.11	.18	.14						
Access	-.04	.00	-.12	.00	.08	.41					
Training	.19	.01	.07	.19	.16	.25	.19				
Support	.39	.08	.13	.40	.26	-.08	-.08	.34			
Age	-.01	-.05	.27	.09	-.22	-.41	-.22	.27	.36		
Gender	-.35	-.04	-.30	-.19	-.25	*	-.23	-.15	-.08	-.19	
Years Until Retirement	-.07	.03	-.27	-.15	-.02	.33	.30	.00	-.29	-.55	.08

* All responses identical on both variables

Table F2

Pearson Coefficients for Relationships Among All Variables, Grades 3-5, N = 34

	Over-all use	Whole class instruction	Student-directed learning	Drill and practice	Computer skills instruction	Attitude	Access	Training	Support	Age	Gender
Whole Class Instruction	.82										
Student-Directed Learning	.41	.33									
Drill and Practice	.65	.23	-.03								
Computer Skills Instruction	.84	.57	.16	.35							
Attitude	.28	.17	-.12	.22	.32						
Access	.23	.06	.20	.26	.34	.23					
Training	.37	.37	.22	.13	.22	.19	.08				
Support	-.17	-.01	.12	-.16	.10	.18	.41	.46			
Age	.15	.17	.09	-.04	.03	-.11	.05	.13	.04		
Gender	.17	.14	.08	.06	.10	.59	.11	.38	.21	.01	
Years Until Retirement	-.05	-.15	.15	.06	.09	.18	.02	.23	.07	-.71	.21

Table F3

Pearson Coefficients for Relationships Among All Variables, Grades 6-7, N = 29

	Over-all use	Whole class instruction	Student-directed learning	Drill and practice	Computer skills instruction	Attitude	Access	Training	Support	Age	Gender
Whole Class Instruction	.26										
Student-Directed Learning	.81	.05									
Drill and Practice	.86	-.02	.23								
Computer Skills Instruction	.77	-.14	.58	.41							
Attitude	.32	.38	.30	.30	.16						
Access	-.28	.29	-.22	-.27	-.15	.26					
Training	.45	.67	.21	.17	.08	.24	.25				
Support	-.01	.15	.07	-.17	.20	.42	.22	-.07			
Age	-.13	-.15	-.29	.14	-.11	.07	-.07	.17	.10		
Gender	.16	.07	.14	.12	.10	.06	*	*	.39	-.06	
Years Until Retirement	-.66	.17	-.37	-.66	-.69	-.32	.20	-.15	-.14	-.52	.08

* All responses identical on both variables

Table F4

Pearson Coefficients for Relationships Among All Variables, Grades 8-9, N = 35

	Over-all use	Whole class instruction	Student-directed learning	Drill and practice	Computer skills instruction	Attitude	Access	Training	Support	Age	Gender
Whole Class Instruction	.84										
Student-Directed Learning	.59	.28									
Drill and Practice	.62	.31	.17								
Computer Skills Instruction	.72	.63	.02	.37							
Attitude	.19	.15	.03	.14	.24						
Access	.29	.31	-.12	.04	.59	.26					
Training	.46	.33	-.21	.40	.87	.24	.54				
Support	-.15	-.22	-.13	-.01	-.06	.15	.11	.20			
Age	-.30	-.32	-.16	-.02	-.17	-.28	-.04	.10	.29		
Gender	.16	.20	-.05	.28	.11	.16	-.25	.08	-.33	-.23	
Years Until Retirement	.17	.20	.20	-.06	.06	.31	.08	-.10	-.10	-.78	.11

Table F5

Pearson Coefficients for Relationships Among All Variables, Grades 10-12, N = 54

	Over-all use	Whole class instruction	Student-directed learning	Drill and practice	Computer skills instruction	Attitude	Access	Training	Support	Age	Gender
Whole Class Instruction	.78										
Student-Directed Learning	.73	.48									
Drill and Practice	.65	.42	.43								
Computer Skills Instruction	.62	.23	.40	.42							
Attitude	.42	.17	.44	.38	.21						
Access	.45	.38	.32	.45	.58	.27					
Training	-.04	.06	.12	.21	.08	.07	-.06				
Support	.36	.16	.36	.28	.34	.34	.29	.05			
Age	-.13	.03	.20	.07	.15	-.13	-.20	.40	.31		
Gender	.08	.13	.13	.28	.05	.37	.08	.10	-.12	-.19	
Years Until Retirement	-.05	.11	-.06	-.12	-.15	.18	.18	-.27	-.23	-.78	.22

VITA

VITA

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8/78-8/83	Teacher -- Social Studies, Galax High School Galax, VA
8/77-8/78	Teacher -- Social Studies, Austinville Elementary School Austinville, VA
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