A Survey of Factors Which Influence Teachers' Use of Computer-based Technology

by

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(ABSTRACT)

Current literature is plentiful on computer-based technology's influence on students. There are only a few studies which have looked at the influence that computer-based technology has on teachers. This is a study of factors which influence teachers' use of computer-based technology. It is based on inconsistencies in previous studies, areas not addressed in previous surveys and the dramatic changes in computer-based technology and Internet access using Web browsers since the previous surveys on computer-based technology were conducted.

A survey was conducted of K-12 teachers in two rural county school systems. One was in southern West Virginia and the other was in southwestern Virginia. This survey found that computer access in the classroom influenced the frequency of use for some instructional activities. Lack of Internet access and obsolete computer equipment resulted in a negative influence to the teachers use of computer-based technology in the classroom. Teachers also expressed a desire for a continuous type of training program for the use of computers.

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Chapter I
Introduction

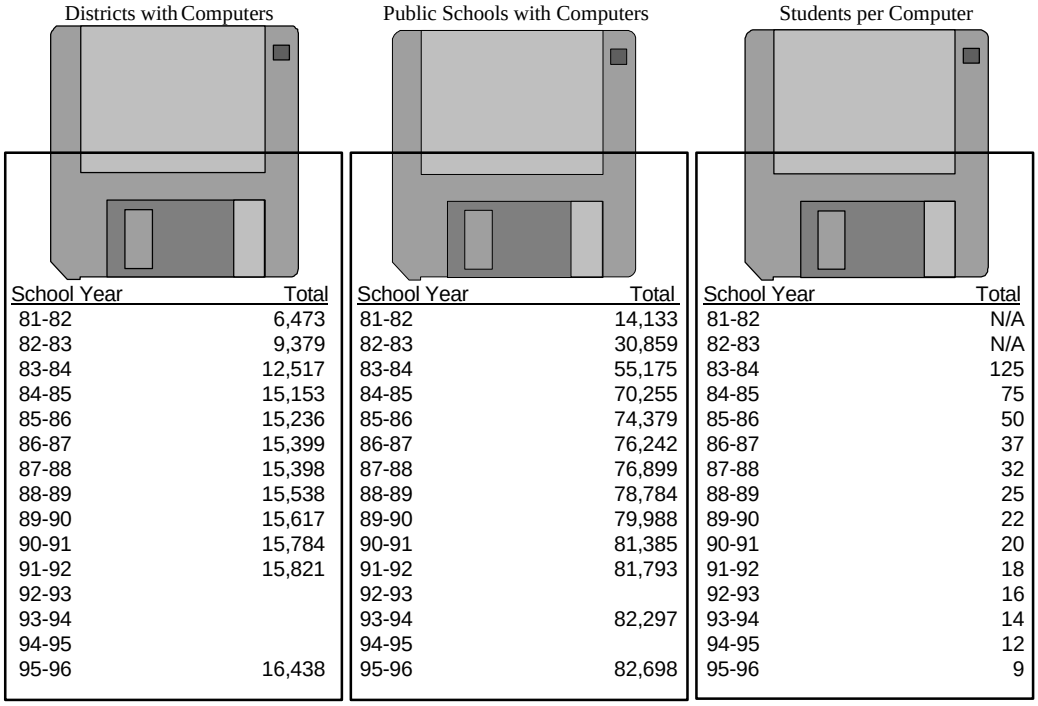
Educators have debated the use and value of technology as an instructional tool since the beginning of the twentieth century. Technology is an accepted part of our society, but the educational community has not embraced technology in the same way (Barron & Orwig, 1993). The most recent of these technologies are computer-based (See Appendix A - for a glossary of terms).

With computer-based technology's entrance into the classroom, the accolades for using computers for instruction and learning, and the steady decline in the prices of computers, there has been a steady growth of the number of computers purchased for classroom use. Quality Education Data (QED), a data marketing company which has tracked educational technology data since 1981, reports that the current student-computer ratio is nine to one (QED, 1995)(See Figure 1). However, relatively few teachers are using computers, as reflected in the question by Cuban (1993):

> Today, computers and telecommunications are a fact of life as basic as electricity. They have altered the daily work of large businesses and industry. Yet why is it that with all the talk of school reform and information technologies over the last decade, computers are used far less on a daily basis in classrooms than in other organizations? (p.185).

Becker (1994a, p. 38) states, "About three-fourths of elementary school teachers of grades 4 through 6 were reported to use computers in various academic subjects in 1992." Users were liberally defined as those using the computer on at least several occasions during the year. In his analysis of computer-using teachers, Becker (1994a) used several surveys. They included: the 1992 Computers In Education Study of the International Association for the Evaluation of Educational Attainment (IEA), the 1993 Communications Survey of Member Teachers of the National Education Association, and the 1990 "First Follow-up" of the National Educational Longitudinal Survey (NELS, 88).

In the IEA (1992) survey, the percentage of teachers who use computers with students, at least minimally, was divided by subject and by school level. This survey seemed to indicate almost half of middle/junior high and high school mathematics, language, and science teachers use computers with about 70% of elementary teachers in these areas using computers. But "minimally" was defined as "at least several times during the year." With the increased number of computers in public schools, the acceptance and use of computers would appear to be widespread. However, "several times" a year seems to indicate a failure by teachers to fully infuse computer-based technology into the classroom.



Districts with Computers

School Year	Total
81-82	6,473
82-83	9,379
83-84	12,517
84-85	15,153
85-86	15,236
86-87	15,399
87-88	15,398
88-89	15,538
89-90	15,617
90-91	15,784
91-92	15,821
92-93	
93-94	
94-95	
95-96	16,438

Public Schools with Computers

School Year	Total
81-82	14,133
82-83	30,859
83-84	55,175
84-85	70,255
85-86	74,379
86-87	76,242
87-88	76,899
88-89	78,784
89-90	79,988
90-91	81,385
91-92	81,793
92-93	
93-94	82,297
94-95	
95-96	82,698

Students per Computer

School Year	Total
81-82	N/A
82-83	N/A
83-84	125
84-85	75
85-86	50
86-87	37
87-88	32
88-89	25
89-90	22
90-91	20
91-92	18
92-93	16
93-94	14
94-95	12
95-96	9

Table by Quality Education Data (QED, 1993, QED, 1994, & QED, 1995)

Figure 1. Computer Growth

Recent research indicates that there are a few teachers who are described as exemplary in their use of computers for instruction and learning. One such study by Sheingold and Hadley (1993) described these teachers as using computers in multiple ways. Moreover, they reported changes in their teaching practice, including: presenting more complex material to students, giving students more individual attention, allowing students to work more independently, and becoming more of a coach and facilitator in the classroom (Oakland County Schools, 1991; Honey & Henriquez, 1993). Nevertheless, a substantial number of teachers still report little or no use of computers for instructional purposes from the same study in which many students report using computers less than two hours a week (OTA, 1995).

Some research has focused on technology's implications for students. However, as the report by the Office of Technology Assessment (OTA, 1995) states, "there is almost no hard data on the impacts of technology on teachers" (p. 49) . Based on previous research (Becker 1994a ; 1994b; OTA, 1995) areas which need to be addressed in future research include: (1) how is computer-based technology being infused by "exemplary" teaching practices, (2) what are the instructional uses of different types of computers, (3) what are the trends in locating computers for instruction (e.g., lab vs. classroom), and (4) does the type of computer access influence the frequency and manner of teacher and student use of computer-based technology?

Review of the Literature

Computer Influences on Teachers

Teachers have reacted both positively and negatively to computer-based technology. Some of the positive reactions have resulted from: (1) exploiting the potential of interactive technology, (2) changing teaching style, (3) assisting classroom management, and (4) having greater feelings of self-worth (Baker, Gearhart, & Herman, 1990; OTA, 1988; Sheingold & Hadley, 1990).

Computers have the potential to help students to solve problems, think for themselves, and collaborate with others (OTA, 1988). The computer's potential also influences and changes the way teachers teach. Computer-based technology allows teachers to move from the role of dispenser of knowledge to a facilitator or coach, allowing the teacher to encourage and guide students in becoming active learners. David (1991, p.39) stated, "Teaching must change from dispensing information and rewarding right answers to creating activities that engage students' minds and present complex problems with multiple solutions." Spending more time with individual students was also cited as a reason for teachers to exploit the computer's potential. Computer-based technology also permitted the teacher to present more complex material and expect more from the students (OTA, 1988).

Personal influences include improved classroom management and increased positive feelings of self-worth. The computer allows the teacher to easily keep track of grades and to average them for reports. Individual student reports can be generated very quickly. Gaining new technical skills, viewed as important and keeping current with developments in the teachers' field results in increased self-worth (OTA, 1995).

There are several perceptions by teachers in the use of computer-based technology that seem to be significant: (a) technology will support superior forms of learning (Means, Blando, Olson, Morocco, Remz, & Zorfass, 1993), (b) computer-based technology can change the way teaching/learning occurs (Dwyer, Ringstaff, & Sandholtz, 1991; OTA, 1988, 1995; Sheingold & Hadley, 1990), (c) computer-based technology helps teacher to accomplish things that they cannot do by themselves (Albright & Graf, 1992), (d) computer-based technology enhances teacher/student productivity (OTA, 1995; Sheingold & Hadley, 1990), and (e) computer-based technology prepares students for the work world (Albright & Graf, 1992). Teachers who hold these perceptions tend to be the most successful in adopting and using computer-based technology.

The perception that technology will support superior forms of learning comes from cognitive psychology. Means, Blando, Olson, Middleton, Morocco, Remz, and Zorfass (1993) conclude that advance skills of comprehension, reasoning, comprehension, and experimentation are acquired through the learners' interaction with content. Drawn from the constructivist view of learning,

> ...teaching basic skills within authentic contexts (hence more complex problems), for modeling expert thought processes, and for providing for collaboration and external supports to permit students to achieve intellectual accomplishments they could not do so on their own, provides the wellspring of

> ideas for many of this decade's curriculum and instruction reform efforts (p. 2).

Computer-based technology can change the way teaching occurs (Dwyer, Ringstaff, & Sandholtz, 1991; OTA, 1988, 1995; Sheingold & Hadley, 1990), including: (1) a move from the teacher as the dispenser of knowledge to the teacher as a facilitator or coach, (2) teachers expected more of students and presented more complex material, (3) more opportunity for individualized instruction, (4) spend less time lecturing to the whole class, (5) more comfortable with small-group activities, (6) team teaching, (7) interdisciplinary project-based instruction, and (8) altering the master schedule. Dwyer, Ringstaff, and Sandholtz (1991) indicated that these changes took place in five phases: entry, adoption, adaptation, appropriation, and invention.

Lewis and Wall's study (as cited in Albright and Graf, 1992) states that computer-based technology helps teachers to accomplish things that they cannot do by themselves, such as helping students experience times, places, people, and events that cannot be otherwise incorporated into the class. Technology also helps teachers accomplish tasks better, such as helping students visualize phenomena that are too small or too dynamic to convey effectively with print or static models or handwaving.

Computer-based technology enhances teacher productivity (OTA, 1995; Sheingold & Hadley, 1990) and administrative and management tasks. Record keeping improvements allowed teachers to provide students with more information in an efficient manner that improved student motivation.

Computer-based technology prepares students for the work world (Lewis and Wall (as cited in Albright & Graf, 1992). How to use and apply spreadsheets, word processing, or computer-aided design technologies were viewed as needed skills which students would need in the work world.

Successes reported by teachers using computer-based technology include: (1) being able to give more individualized attention to their students, (2) seeing their students accomplish tasks using computers as tools, (3) helping to make a subject more interesting using computer-based technology, (4) providing a means of expanding and applying what has been taught, (5) presenting more difficult concepts, (6) expecting more from their students, and (7) covering more material in a shorter period of time (OTA, 1988, 1995; Sheingold & Hadley, 1990; Dwyer, Ringstaff, & Sandholtz, 1991).

According to Sheingold and Hadley (1990) computers allow students to work without constant direction from the teacher, while freeing teachers to give more individualized attention to their students. This allows the teacher more time to individualize instruction. Second, teachers are able to see students apply what they have been taught by using computers as tools to accomplish difficult tasks, to solve difficult problems, and to produce more work in a shorter period of time. Third, teachers are then able to present more material because they are able to cover the material in a shorter amount of time. Fourth, teachers are able to make a subject more interesting by varying the way the material is presented and offering students a variety of ways in which they may accomplish their work (e.g., word processors, spreadsheets, databases, etc.). Dwyer, Ringstaff, and Sandholtz (1991) state,

> ....their students produced more, faster. In a self-paced, computational math program, for example, 6th grade

> students completed the year's curriculum in 60% of the time normally required, and test scores remained as strong as in previous years (p. 48).

Time is the greatest barrier to using computer-based technology (OTA, 1995; Sheingold & Hadley, 1990). Teachers are not provided with the time or training to learn hardware and software operation (Becker, 1994b). Teachers also do not have the time to develop lessons using computer-based technology.

Access is also another problem. Teachers find it difficult to schedule access to computers for classes. Although the number of computers have grown in schools, these computers are frequently located in computer labs and scheduling access is difficult if not impossible (Becker, 1994; Sheingold & Hadley, 1990).

Instructional philosophy is another barrier. Most teachers teach as they were taught. The teacher is viewed as the dispenser of knowledge and the student is the recipient of that knowledge. Studies (Dwyer, Ringstaff, & Sandholtz, 1991; OTA, 1995) have shown that technology allows the student to take an active role in the learning process and the teacher to act more as coach or facilitator. In the ACOT (Apple Classroom Of Tomorrow), project ,for example, active participation usually takes place in collaborative learning projects which produces "noise" that is contrary to a proper learning environment in the traditional classroom. These differences prompt teachers to question the use of technology or their teaching methodology. In their report on the ACOT program, Dwyer, Ringstaff, and Sandholtz (1990) state, "... the direction of change towards child-centered instruction; towards collaborative rather than individual tasks; towards active rather than passive learning. Each of these dimensions brought deeply held beliefs about traditional schooling into conflict with what teachers witnessed in their classrooms" (p. 12).

Other factors which have negatively influenced the use of computer-based technology are: (1) challenges to the teachers' philosophy of teaching and learning, (2) the amount of time required to learn how to use computer-based technology, and (3) the lack of positive models (OTA, 1988, 1995; Sheingold & Hadley, 1990). When using computer-based technologies, students are encouraged to think and be creative and find alternate solutions to problems. This shift to a "student-centered" classroom, where there is collaboration, discussion, and excitement, sometimes seems chaotic to the teacher. It is this shift which causes many teachers to rethink how they are teaching and how learning should take place.

Such factors cause many teachers to react negatively to computer-based technology. One example is shown in recent research (Dwyer, Ringstaff, & Sandholtz, 1991) on the Apple Classroom of Tomorrow (ACOT). This study reported that when using technology, some teachers would vacillate between traditional methods used previously, "teacher-centered", and newer "student-centered" approaches. This vacillation, according to Dwyer, Ringstaff, & Sandholtz, 1991, is due to the teachers' beliefs and perceptions about how instruction and learning should occur. The conflict was in the mind of the teacher as he/she wrestled with how learning should occur. For example, collaborative learning groups, which using computers, grew noisy as they became excited over what they were finding and discussed these findings. From the teacher's point of view, the noise indicated that there wasn't any learning occurring.

These teachers tended to revert back to the traditional lecture mode of instruction, which resulted in student resistance to the traditional approach. Butzin (1992) suggested that if teachers looked carefully at this behavior, they would find it actually served as a useful learning activity.

Teachers who stayed with the ACOT program and continued to use computers, changed their teaching style to a student-centered classroom. These teachers became more innovative in the implementation of computer-based technologies into the instructional process and more comfortable in using computer-based technology in the classroom. They began to expect more from their students and were able to engage students in higher order learning objectives (Baker, Gearhart, & Herman, 1990; Dwyer, Ringstaff, & Sandholtz, 1990). "Teachers who had regular access to computer technology in their classrooms over several years time experienced significant changes in their instruction, but not until they had confronted deeply held beliefs about schooling" (Dwyer, Ringstaff, & Sandholtz, 1990, p. 45).

In 1990, the Bank Street College of Education's Center for Technology in Education conducted a survey of 1200 teachers involved who used technology in grades 4 through 12 in all 50 states. From the 608 completed surveys, teachers reported changes similar to ACOT teachers in their expectations for their students (Sheingold & Hadley, 1990, p. 14).

Productivity Software (Word Processing, Spreadsheets, and Databases)

Sheingold and Hadley (1990) state that text-processing tools, particularly word processors, were used by more than 90% of the teachers they surveyed. Means, Blando, Olson, Morocco, Remz, and Zorfass (1993) stated the most frequent use of computer-based tools in U.S. education today was word processing software. Word processing programs have been used successfully in grammar classes to improve writing composition, spelling, and reading skills (Oakland County Schools, 1991). In addition to English teacher's choice and use of word processors, Sheingold and Hadley (1990) report that the word processor is the most popular application for science and social studies teachers. Because of the versatility of word processors, they can be used across all areas of the curriculum.

From the Sheingold and Hadley study (1990) it is clear that spreadsheets assist teachers in classroom management and as analytical tools. Students' grades can be recorded and updated easily. Class projects, attendance, and daily participation can be easily recorded and updated as well. Spreadsheets allow students to perform analytical functions easily, and teachers are able to present realistic simulations to students.

Databases are used to access information in an easy and rapid manner. There are numerous electronic databases with voluminous amounts of information. Teachers and students no longer have to manually look through card catalogs. They can query the database and retrieve the information. Databases, encyclopedias and other reference works on CD-ROM also allows the teacher to provide a means for interactive browsing (OTA, 1995).

Word processing, spreadsheet, and database software have been the key to attracting teachers to use computer-based technology in the classroom. Office of

Technology Assessment (1995) states that "gradebook or other record keeping software can provide a hook that gets otherwise reluctant teachers interested in using technology tools" (p. 71). Teachers report on how this technology has helped them and in ways that students benefit from the technology (Greenfield, 1990; OTA, 1995).

Telecommunications

Telecommunications provides a means for transcending school walls and accessing a wide range of local and global resources (OTA, 1995). The teacher and student have access to peers doing the same type of work and a means of interacting with experts. It provides an opportunity to collect, share, and evaluate ideas and data with these individuals which were not easily possible before. For many teachers, accessing telecommunications means doing so after school, at night, on their own time, and with their own money. Yet, these same teachers do not feel that telecommunications is too time consuming to use as a professional resource (Honey & Henriquez, 1993) and are willing to invest the time and money to have this valuable tool as an instructional resource.

In the public school arena, computer connectivity has been accomplished largely via dial-up modems to state universities or commercial providers. In 1992, QED reported 18,532 modems in public schools. In their 1995-96 report QED reported 30,452 modems in public schools. This represents an average increase of 3,973 per year. If that growth rate continues, by the year 2000, there will be 46,344 installed in schools. That number is expected to be higher based on current trends of computer manufacturers including modems with computers and current emphasis and interest by communications companies, telephone companies, and cable companies, to provide access to the Internet for accessing information.

The technology of telecommunication is changing rapidly. Modem connectivity is beginning to give way to direct connections using Ethernet and other high bandwidth technology (National Center for Educational Statistics, 1996). The current trend in accessing the WWW, however, is by ethernet connections. Many school systems are investing large sums of money to "wire" their schools for Internet access. Many telephone companies are providing fiber optic cables to make direct access possible for public schools.

In 1992 the National Center for Technology in Education at Bank Street College conducted a national survey of K-12 educators' use of telecommunications. A survey sample was posted on-line with more than 50 educational, commercial, and state-run telecommunications networks within the United States. Mailing lists, learning initiatives, conferences, state education departments and professional contacts were also used to obtain respondents. The survey had a 50% response rate (550 of 1100) from those who volunteered to participate. This survey, which was the first systematic and large-scale profile of educators' telecommunications practices, revealed several professional development activities and incentives for using telecommunication. Honey and Henriquez (1993) report that "sending e-mail to colleagues, exchanging information on forums and bulletin boards, and accessing databases containing information relevant to students are the most widely used and effective professional development activities" (p. 16).

One incentive reported was communicating with other educators on issues of sharing ideas, rapid feedback on curricular issues and other topics, keeping current on subject matter, pedagogy and technology trends. Similar findings were reported by Honey in 1994, involving telecommunications and the Mathematics Leadership Program to develop mathematical ideas and processes (Honey, Bennett, Hupert, Kanz, Meade, Panush, Powell, Spielvogel, Dubitsky, Cohn, Melnick, & Peterson, 1994). Other incentives to use telecommunications included accessing information and combating isolation. Student incentives for using telecommunications included: expanding student awareness about the world, accessing information which would otherwise be difficult to obtain, and increasing students' inquiry-based and analytical skills (Honey & Henriquez, 1993; Schrum, 1993).

D'Souza (1992) conducted a case study with 24 students on "E-mail's Role in the Learning Process." Not one negative remark was given as a response. She concluded that the use of e-mail was motivating, lead to greater communications among members of the class or group, and enhanced traditional classroom instruction by providing an alternate delivery system for classroom materials and information.

Despite e-mail's popularity and motivational benefits, the current most popular Internet service is the World Wide Web (WWW or Web) (Hill & Misic, 1996). In 1995, the Survey of Advanced Telecommunications in U.S. Public Schools reported 50% of U.S. public schools have Internet access which is a 15% increase from 1994. Of those 50% with Internet access, 80% can browse the Web. Seventy percent of schools with World Wide Web access make it available to students and 92% of schools with World Wide Web access make it available to teachers (OERI, 1996).

However, in the study reported by Honey and Henriquez (1993), Web access meant: email, news, or bulletin boards, remote access to computers, database access and file transfer. Web browsers were not mentioned, as they were just being developed. The Internet has experienced dramatic growth. In 1994, 35% of U.S. public schools had Internet access. In 1995, there was a 15% increase in the number of schools with Internet access (Malitz & Carpenter, 1996). The use of Web browsers has also experience dramatic growth. Many journals carry articles on the use of Web browsers (e.g., Quinlan, 1996, Customizing web documents for the classroom. Tech Trends. 14 (2), 27-30., Polyson, Saltzberg, & Godwin-Jones, 1996. A practical guide to teaching with the world wide web. Syllabus. 10 (2), 12-16., Descy, 1996., NCSA mosaic, netscape, and java/hotjava!! Tech Trends. 41 (1), 6-8) which has instructed teachers on how to create Web pages for their instructional use. Because of the recent dramatic growth in both Internet access and the use of Web browsers as teaching tools, new questions arise including: how Internet access and Web browsers are influencing teachers in their instruction, and how frequently Internet access and Web browsers are being used as an instructional tool.

Need For The Study

Several studies concerning the use of computer-based technology for instruction conducted and reported in the last seven years indicate: (1) training and support is needed if teachers are going to successfully use computer-based technology in their instruction (Honey & Henriquez, 1993; Becker, 1994b; OTA, 1988, 1995); (2) there is inadequate

financial support (OTA, 1988; Sheingold & Hadley, 1990; Honey & Henriquez, 1993; Becker, 1994b); (3) teachers lack the time to develop lessons and plans which use the computer (Sheingold & Hadley, 1990; Honey & Henriquez, 1993; Becker, 1994b; OTA, 1995); (4) accessibility, scheduling and availability (e.g., not enough computers or peripherals) are problems for teachers wishing to use computer-based technology (Sheingold & Hadley, 1990; Honey & Henriquez, 1993; Becker, 1994b); and (5) many (almost 1/2) teachers do not use computers for teaching even when they were available (Marcinkiewicz, 1994; OTA, 1988, 1995).

The review of literature has indicated that: (1) computer technologies have changed and are changing (e.g., increase in the number and uses of CD-ROM technology and Internet access) (QED, 1992, 1995); (2) recent reports of public school teachers' access and use of computer resources is contradictory with earlier research; (3) teachers need training to become confident and proficient users of computer-based technology; and (4) there are dramatic changes in telecommunications. Because of the changes in hardware and software capabilities and other factors (e.g., types of access and training), variables which were not specifically identified earlier and which may influence teachers use of computer technology for instructional purposes, this study will examine what factors influence K-8 public school teachers uses of computer-based technology for instruction.

Sheingold and Hadley (1990), Honey and Henriquez (1993), and Marcinkiewicz (1994) indicate research needs to: (1) describe the range of teacher practices with current technology, the perceived value of these practices, and the circumstances that may promote or hinder effective technology use; (2) analyze the range and type of telecommunication activities being conducted by teachers for either professional development or student learning purposes, identifying professional development activities; (3) inform school officials, policy makers, service providers, and educators themselves about strategies for the creative integration of this technology into instruction; and (4) provide educational planners with information about how allocated resources influence teachers use of computers for instruction.

Research (OTA, 1988, 1995; Sheingold & Hadley, 1990; Honey & Henriquez, 1993; Becker, 1994b; Marcinkiewz, 1994) has indicated areas which influence teachers use of computer-based technology. However, recent research has indicated that some of those areas (e.g., accesses) do not seem to have the influence on teachers' use of computer-based technology as earlier thought. Accessibility, scheduling, and availability were cited as problems (Sheingold & Hadley, 1990; Honey & Henriquez, 1993) for teachers wishing to use computer-based technology for instructional purposes, however, Marcinkiewicz (1994) found that when access was not a problem almost one half of the teachers did not use computers for teaching. Narrowing the focus to type of access and training is most influential in leading teachers to use computer-based technology for instruction. This focus may provide direction on where computers should be placed and what type of training should be provided to encourage teachers to want to use computer-based technology for instructional purposes.

Findings in earlier research (OTA, 1988, 1995; Sheingold & Hadley, 1990; Honey & Henriquez, 1993; Becker, 1994b), which indicated that access was an important issue for teachers to use computer-based technology, is inconsistent with a study

(Marcinkiewicz, 1994), which indicated that when access was not a problem, almost 50% of the teachers did not use computer-based technology. The rapidly changing state of technology since these studies were conducted also indicates that there is insufficient information on how the types of access influence teachers use of computer-based technology. Neither is there sufficient information about the types of training and access to a computer at home to plan for computer-based technology in instruction.

Research could identify specific types of access, such as lab versus classroom versus home, which influence teachers' use of computer-based technology for instruction. Knowing the type of access that is most influential on teachers' use of computer-based technology could help school administrators make more effective decisions in the placement of computers for teacher use, in planning and instruction. Overcoming access issues by placing computers in a classroom as opposed to placing computers in a lab or providing teachers with a computer to take home could be an influential factor in teachers choosing to use computer-based technology for instructional purposes. OTA (1988, 1995), Honey and Henriquez (1993), and Becker (1994b) identified training as an influence on teachers' use of computer-based technology. While initial training on how to operate a computer is important, continued and sustained training is just as vital, especially as the technology changes rapidly. OTA (1988, 1995), Honey and Henriquez (1993), and Becker (1994b) did not clearly indicate types of training (e.g., initial, just-in-time, self-taught, peer-taught, workshops, or academic classes) were most influential in teachers' use of computer-based technology. Becker (1994) stated that providing teachers with computers for home use will help make computer-based education a more widespread effective teaching practice. Research has not investigated whether placing a computer in the teachers' home compensated for the lack of planning time at the school.

The studies by Sheingold and Hadley (1990), Honey and Henriquez (1993), and Becker (1994b) indicated access was a problem for teachers wishing to use computers; however, Marcinkiewicz (1994) found that when access was not a problem almost one-half of the teachers did not use computers. The types of access were not discussed. Honey and Henriquez (1993) and Becker (1994b) reported that training and support is important if teachers are going to use computer-based technology in their instruction, however, the different types of training were not addressed. Sheingold and Hadley (1990), Honey and Henriquez (1993), and Becker (1994b) reported teacher's lack of time to plan. Having a computer at home and having the time at home to plan and use computers were not reported. Having a computer at home may be a means of providing time for teachers to plan for the use of computers in instruction.

During the 1990s, emphasis has been placed on using computer-based technology in teaching. Many of the surveys and reports cited (e.g., OTA, 1988, 1995; Sheingold & Hadley, 1990; Honey & Henriquez, 1993; Becker, 1994b; Marcinkiwicz, 1994) in current research on the instructional use of computer-based technology were conducted three to seven years ago. In the last three to four years computer technologies have evolved making them more robust and user-friendly. Because of the passage of time and the rapidly changing nature of computer-based technology, information on the state of the situation is outdated and incomplete. In the 1992 survey by Honey and Henriquez, the most common use of the Internet was for e-mail followed by accessing news and bulletin boards and gaining access to remote computers. For example, the use of Web browsers

and HyperText Markup Language (HTML) for instructional purposes was not mentioned or addressed because it had just been introduced. Telecommunications was mostly being used for e-mail and bulletin board access, and CD-ROM's hardware and software capabilities for data storage and multimedia environments were just beginning to be realized in education.

Purpose of Study

Based upon the review of literature and the needs indicated previously, this study will attempt to find if and what type of access to computers and training influences teachers' use of computer-based technology. The information gathered from this study should: (1) provide school administrators with data to help them make more informed decisions on the placement of computers and appropriate teacher training and support for use of computer-based technology for instruction in public schools; (2) provide more up-to-date information on the current computer-based technology uses today; and (3) provide information which will give educators an understanding of what influences teachers to use computer-based technology. The study will also attempt to identify current practices in the use of computer-based technology since the previous studies were conducted.

Research Questions

For this study the following research questions were asked:

(1a) Which type of access (e.g., laboratory, classroom, or home) influences the number of ways (e.g. remediation, presentation of new material, problem solving, or information access) and frequency with which teachers use computer-based technology for instruction? (1b) Does the availability of Internet access influence the number of ways (e.g. remediation, presentation of new material, problem solving, or information access) and the frequency with which teachers use computer-based technology for instruction?

(2) Which type of training (e.g., initial, just-in-time, continuous, academic classes or workshops) influences the number of ways (e.g. remediation, presentation of new material, problem solving, or information access) and the frequency with which teachers use computer-based technology for instruction?

(3) Does the amount of time planning for the use of computers influence the number of ways (e.g. remediation, presentation of new material, problem solving, or information access) and the frequency with which teachers use computer-based technology for instruction?

This study was a partial replication of the Sheingold and Hadley (1990), Honey and Henriquez (1993), Becker (1994b), and Marcinkiewicz (1994) studies. It is a survey of K-12 school teachers about the types of access they have to computer-based technology and its use for instruction. The survey included the following segments, which were suggested by previous studies: (1) different types of training and its influence on teachers use of computer-based technology for instruction (Honey & Henriquez, 1993; Becker, 1994); (2) teacher's lack of time to plan for the use of computer-based technology for instructional purposes (Sheingold & Hadley, 1990; Honey & Henriquez, 1993; Becker, 1994b); and (3) current uses of telecommunications for instructional purposes (Honey & Henriquez, 1993).

A survey instrument (Appendix B) was developed to address the research questions. The survey was sent to K-12 teachers in two county public school systems, one in West Virginia and one in Virginia. The school administrators in these two systems expressed a need for information concerning teachers' access and training to make computer-based technology use for instruction more effective. In order to acquire data from a broader range of instructional settings elementary, middle, and high school teachers were chosen. Many subject areas emphasizes computer use, but, because elementary school teachers teach a variety of subjects, they are less likely to be influenced to use computers (Marcinkiewicz, 1994).

The nature of this study assumes the following: (1) the county boards of education provide staff development and training for using computer-based technology; (2) the ISTE (International Society for Technology in Education) computer competencies and skills guidelines (Appendix C) provide a dependable list of skills for elementary and middle school teachers; (3) based on current trends, computer-based technology will be used more in the future than it is today and will become an even more integral part of the school curriculum; (4) computer-based technologies are a valuable instructional tool for

teachers; (5) teachers who do not integrate computer-based technology in their instruction will limit their students' experiences for living in a technological society; (6) survey questionnaires are a suitable method of collecting data needed for this study; (7) the findings will reflect the current state of access and training which influence use of computer-based technology by elementary, middle, and high school teachers in these two counties; (8) guidelines for the types of access and the types of training and support which are most successful in influencing teachers' use of computer-based technology can be developed on the basis of the findings.

Limitations of the Study

This study essentially investigated the access to and training in computer-based technology for elementary, middle, and high school teachers in a county in southwestern Virginia and a county in southern West Virginia. The study is subject to the following limitations:

(1) This study only looked at the access, practice, and training of the use of computer-based technology by elementary, middle, and high school teachers in two public school counties, one in southwestern Virginia and one in southern West Virginia.
(2) The population of the schools was confined to the public schools in two counties in southwestern Virginia and southern West Virginia.
(3) Questions in the survey were not intended to be exhaustive. They have been tailored to examine the areas of need.

In the next section, the research methodology will be discussed. It will cover the following areas: (1) design of the study, (2) population, (3) instrumentation, (4) reliability test, (5) data collection, and (6) data analysis.

Chapter 2
Methodology
Design of the Study

The purpose of this study was to investigate factors which influence teachers' use of computer-based technology. This chapter will include a description of the population of the study, the specific procedures, the development and administration of the instrument, data collection and data analysis.

Research Questions

This study investigated selected K-12 educators' use of computer-based technology. For this study the following research questions were asked:

(1a) Which type of access (e.g., laboratory, classroom, or home) influences the number of ways (e.g. remediation, presentation of new material, problem solving, or information access) and frequency with which teachers use computer-based technology for instruction? (1b) Does the availability of Internet access influence the number of ways (e.g. remediation, presentation of new material, problem solving, or information access) and the frequency with which teachers use computer-based technology for instruction?

(2) Which type of training (e.g., initial, just-in-time, continuous, academic classes or workshops) influences the number of ways (e.g. remediation, presentation of new material, problem solving, or information access) and the frequency with which teachers use computer-based technology for instruction?

(3) Does the amount of time planning for the use of computers influence the number of ways (e.g. remediation, presentation of new material, problem solving, or information access) and the frequency with which teachers use computer-based technology for instruction?

For the purposes of clarity the outline of the procedures is as follows:

(1) Background information was obtained from a study of the literature in area of computer-based technology (e.g. Becker, 1994a; Chin, 1993; Honey & Henriquez, 1993).

(2) A survey was developed by using information from other studies in the literature (e.g. Chin, 1993; Honey & Henriquez, 1993; Marcinkiewicz, 1994; OTA, 1995 and OTA, 1988). The survey focused on elementary, middle, and high school teachers' access and the type of use of computer-based technology for instructional purposes, the type of training which influences teachers' use of computer-based technology for instructional purposes, and the amount of time planning for the use of technology which influences teachers' use of computer-based technology for instructional purposes.

(3) A panel of jurors from the fields of instructional technology and educational research was asked to evaluate the survey instrument for validity.

(4) A study was performed to determine the reliability of the instrument.

(5) The recipients of the survey were selected and the survey instrument was distributed to them.
(6) The data on each returned survey were coded, recorded, and statistical tests were utilized to answer the research questions.

Population

The population for this study was 1017 (according to figures from both school systems, June, 1996) elementary (47%), middle school (22%), and high (31%) school teachers from two county school systems, including general education and special education teachers. Participants were chosen from two rural school systems. One school system is in southwest Virginia and one school system is in southern West Virginia. School administrators, specialists, and support personnel were excluded.

This population was chosen based upon the following criteria: (1) ease of access due to the geographical location; (2) granting of permission for an in-depth look; (3) an expressed need and interest in the type information which this survey could provide; and (4) unlikely use of computers by elementary teachers due to their specialization in a subject area (Marcinkiewicz, 1994).

Based on the population size of 1017, the sample size needed to be a minimum of 278, according to Krejcie and Morgan (as cited in Isaac and Michael, 1990). One in three was selected which resulted in a sample size of 339. A random table of numbers was used to generate the first three numbers. The first number generated was two and every third number after that was used as the random selection number.

The two school systems provided a list of all teachers in their county. The list was alphabetized by the teacher's last name and county and then numbered from one to 1017. The first teacher selected was the second teacher listed alphabetically and every third teacher after that was selected which resulted in a random selection of 339 teachers from the 1017 population in both counties.

Instrumentation

Isaac and Michael (1990) state that "Surveys are the most widely used technique in education and behavioral sciences for the collection of data. They are a means of gathering information that describes the nature and extent of a specified set of data ranging from physical counts and frequencies to attitudes and opinions" (p. 128). Babbie (1990) states that a survey has three general objectives: (1) describe a population, (2) explain differences in sub-groups, or (3) explore little known areas of a population. A survey instrument was developed (see Appendix B) based on the review of the literature, interviews, and existing surveys. Parts of the instrument were extracted from existing surveys from Montgomery County, VA (1995), Chin (1993), West Virginia Department of Education (1990), Standards of Learning for Virginia Public Schools (1995), Marcinkiewicz (1994), Sheingold and Hadley (1990), and the ISTE (International Society for Teaching in Education) (See Appendix C for computer competencies and skills guidelines (1992).

Table 1
Research Questions and Corresponding Survey Sections

Table of Research Questions and Corresponding Survey Sections	
Research Questions	**Survey Sections**
(1) Which type of access (e.g., laboratory, classroom, or home) influences the number of ways (e.g. remediation, presentation of new material, problem solving, or information access) and frequency with which teachers use computer-based technology for instruction? Does the availability of Internet access influence the number of ways (e.g. remediation, presentation of new material, problem solving, or information access) and the frequency with which teachers use computer-based technology for instruction?	Part one, Section one Division two (e.g., "I use computer-based technology for problem solving, daily") Section two Division one (e.g., "The computers I use for instruction are in the classroom, The Internet access I use for instruction is in the classroom")
(2) Which type of training (e.g., initial, just-in-time, continuous, academic classes or workshops) influences the number of ways (e.g. remediation, presentation of new material, problem solving, or information access) and the frequency with which teachers use computer-based technology for instruction?	Part one, Section one Division two (e.g., "I use computer-based technology for problem solving, daily") Section three Division one (e.g., "The type/types of computer-based training I have had are initial (training when I first got my computer/s")
	Part two, Section two Questions 8 - 13, 15, 16 (e.g., "Indicate the numbers of computers available to you for instructional activities?")
(3) Does planning for the use of computers influence the number of ways (e.g. remediation, presentation of new material, problem solving, or information access) and the frequency with which teachers use computer-based technology for instruction?	Part one, Section one Division two (e.g., "I use computer-based technology for problem solving, daily") Part two, Section one Question 14 (e.g., "Approximately how much time each day do you spend in the preparation for and the utilization of computer-based technology for instructional purposes")

The instrument was validated by a panel of thirteen jurors from the fields of instructional technology, educational research in a university setting, and classroom teachers in the public school system. Two jurors are professors in instructional technology at mid-Atlantic universities, one juror is a professor in educational research in a Midwest college, one juror is a professor in extension information systems and one juror is a public school teacher. The jurors were asked to give comments and recommendations from an elementary or middle school teacher's perspective. The instrument questions were revised based on the comments and responses from the panel of jurors and from the pilot study.

The instrument was also developed to include areas that previous research did not address: types of access, training, planning time and availability of Internet access using Web browsers. The instrument was divided into five sections: computer-based technology use, computer-based technology access, computer-based technology training and support, computer inventory, and demographic data. The computer-based technology use section, Part One, Section I, Division 1, had questions with three response options: yes, no or not available (e.g., "Are the computers that you use in your classroom?"). Part One, Section I, Division 2 had six response options: daily, every other day, weekly, every other week, monthly, every other month or less, or never (e.g., "I use computer-based technology for

The computer-based technology access section, Part One, Section II, Division 1, had questions with five possible responses for computer and Internet access: classroom, computer lab, media center, home or none (e.g., "The computers I use for instruction are in the classroom.") and two responses for Internet use and access, Part One, Section III, Division 2, yes or no (e.g., "Do you use the Internet for e-mail?"). The computer-based technology training and support section, Part One, Section III, Divisions 1 & 2, had questions with three possible responses yes; no; no, but would if available, or don't know (e.g., "Do you receive workshops on integrating computers into the curriculum?"). The computer inventory section, Part Two, Section I, had multiple choice responses with the possibility of multiple responses (e.g., "Indicate the numbers of computers available to you for instructional activities. a. IBM compatible, b. MAC, c. other"). The demographic data section had multiple choice questions with single answers. A field test was done and necessary modifications were performed to reflect the needed changes.

Pilot Study

Forty-two percent of the questions were answered the same. There may be several reasons to explain this percentage which include: (1) the teachers could not remember how they answered the questions on the first test, (2) the survey instrument was not clear, or (3) news of a staff reduction announced by the principal prior to giving the survey instrument out caused poor responses and poor response rates. The survey instrument was revised to reflect the need for clarity in the instructions given in each section. Revisions were also made in how some of the questions were asked with definition of terms and explanations given to clarify some of the questions (e.g., "Do you use a scanner? Do you use a scanner (a device which scans text or images into a computer?").

Reliability Test

A reliability test was performed to insure, as much as is possible, an accurate measurement by survey. Thirteen middle school teachers took the trial test. The Cronbach alpha was used as a statistical method for determining internal consistency and not item by item reliability. The reliability value was .84.

Data Collection

The superintendent of the West Virginia county school system faxed all the principals of their schools that a survey of teachers in the county would be conducted and he asked for their support in the data collection efforts. Data collection began March 7, 1997. The assistant superintendent of the Virginia county school system sent out a memo to all the principals notifying them that a survey of their teachers would be conducted and enlisted their support for the survey. A cover letter to teachers (Appendix D) and to principals (Appendix E) describing the reasons for the survey and soliciting the teachers' and principals' help with a prompt response along with the confidentiality of the results was sent to the recipients. A note of approval from the Superintendent and /or Technology Director was sent to each principal stating the purpose and encouraging their support prior to the mailing of the survey to the teachers. A coded, stamped, and self-addressed return envelope was included with each survey. No names or codes were placed on the survey instrument, but the return envelope was coded for identification and the respondents' names were checked on a master list as the replies were received. The 339 pre-packaged, pre-sorted questionnaires were delivered to the boards of education for distribution.

As the surveys were returned, each survey was logged and the date received was entered onto a log sheet. The log sheet has seven columns with the receiving date, code, individual number, first name, last name school, status, and county. A follow-up contact (survey) was made 10 days after the first mailing for those who did not respond. The follow-up survey was coded with a code number, placed behind the stamp which was a different kind than the stamp on the initial response. This helped to quickly identify responses to the first or second survey. A second follow-up was made 20 days after the first mailing for those who had not responded. A third follow-up was made 30 days after the initial mailing for those who did not respond by that time.

A record of the teacher mailing list was kept for the purpose of sending out "reminders" to those who did not respond promptly. A second letter (See Appendix F) and another copy of the survey was sent in the second mailing to those teachers who had not responded by the end of ten days after the initial mailing. A third letter (See Appendix G) was mailed to those teachers who had not responded by the end of twenty days after the initial mailing. The assistant superintendent from the Virginia county school system and the superintendent from the West Virginia county school system sent out a second letter (See Appendix H) encouraging the teachers to respond to the survey.

Thirty percent of the teachers randomly selected returned the survey within a twelve-day period. Within three weeks, 36% had returned the survey. After the second letter from the superintendent's office when out with the third request, an additional 38%

of the teachers responded within the deadline. Among those responding, two declined to participate and ten responded twice. The second responses, however, were not tabulated. Two hundred seventy-two completed the survey, 80% of the population. Twenty-two of those were received after the deadline and were not analyzed. This reduced the return rate of analyzed responses to 74%.

Chapter 3
Data Analysis, Results and Discussion

This chapter is organized in the following manner: (1) the data analysis will briefly describe the statistical tests used for analysis, (2) general and demographic data will precede the research questions, (3) each research question will be presented with results, and discussion, and (4) observations will close the chapter.

Data Analysis

All returned surveys were examined for completeness and accuracy. The data collected was in the form of nominal data. Nominal data is data reported as frequencies in categories as opposed to ordinal data (on a continuum), as interval data (periods of time), or ratio data (having a true zero point). The first research question was tested and analyzed using chi-square as the appropriate statistical method. Chi-square is a test used with frequency data and requires that the data be classified according to categories. Chi-square was used to determine if there is a significant relationship between: the type of access, the instructional activities employed, and the frequency of use for Question 1a; and the amount of time planning for the use of computers, the instructional activities employed and the frequency of use of computer-based technology for instruction for Question 3. The descriptive data was reported by traditional means (e.g. frequencies and percents) for the type of Internet access, the instructional activities employed, and the frequency of use for question 1b and the type of training received, the instructional activities employed, and the frequency of use for Question 2. The surveys, upon return, were entered into the computer using spreadsheet software (Microsoft Excel™). Survey questions 29 A - E, 30 A - E, 43 - 50 (See Appendix B) were concatenated and then converted from hex to a decimal to give single and multiple responses a unique value. This kept categories of responses independent from each other allowing a chi-square test to be performed. A contingency table was constructed for each section of data which applied to the research questions. A chi-square was used to analyze the data by using the statistical software package Minitab™.

The percentage of teachers who responded to the question “Do you use computers for instructional purposes?” is shown in Table 2. Sixty-seven percent of the teachers from both counties indicated that they used computers for instructional purposes which contrasts Marcinkiewicz (1994), which indicated almost 50% of the teachers did not use computers when access was not a problem. Of the 24% which did not use computers, a few indicated that the computers were not made available to their classes or that the computer equipment was old and did not have LAN or Internet capabilities. Four of the eight of those which did not respond to the question “Do you use computers for instructional purposes?” indicated, however, that they did use modems, LANs, CD-ROMs or the Internet.

Table 2
Teachers Who Use Computers For Instructional Purposes

Teachers Who Use Computer-based Technology For Instructional Purposes		
Responses	Frequency	Percentage of Total Respondents
Yes	167	67%
No	61	24%
NA (Not Available)	14	6%
No Response	8	3%
Total	250	100%

Demographic Data

Teachers' age, gender, degree, teaching experience, teaching assignment grade level and subject areas were tabulated by frequency and percentage. Table 2 reports these counts and percentages. Two hundred fifty teachers responded to the survey. Of the 250 which responded 91 (36.55%) were from the West Virginia county and 158 (63.45%) were from the Virginia county. Of the 250 teachers responding 51.03% were between the ages of 41 and 50, 72.73% were female, 54.47% has a bachelor's degree, and 69.51% had over 15 years experience teaching. The highest percentages (44.94%) of the teachers responding were elementary teachers. Social studies teachers were the largest percentage (18.95%) responding by subject area (See Table 3).

Table 3
Demographic Data

Item	Count	Percent	Item	Count	Percent
Age			Grade Level		
20 - 30	17	7.00	Elementary	111	44.94
31 - 40	47	19.34	Middle	52	21.05
41 - 50	124	51.03	Jr. High	8	3.24
51 - 60	52	21.40	Sr. High	70	28.34
more than 60	3	1.23	Other	6	2.43
Gender			Subject Area		
Male	66	27.27	Grammar	19	14.29
Female	176	72.73	Science	18	13.53
			Computer	1	0.75
Degree			Foreign	3	2.56
Bachelor's	134	54.47	Math	19	14.29
Master's	104	42.28	Business	4	3.01
Ph.D./Ed.D.	3	1.22	Social Studies	24	18.05
Other	5	2.03	Other	45	33.83

(table continued)

Table 3
Demographic Data

Item	Count	Percent	Item	Count	Percent
Teaching Experience					
0 - 3 years	10	4.07			
4 - 6	21	8.54			
7 - 10	21	8.54			
11 - 14	23	9.35			
15 & Over	171	69.51			

*Counts may not total 250 due to some respondents not answering the question.

Research Questions

Question 1a: Which type of access (e.g. laboratory, classroom, or home) influences the number of ways (e.g. remediation, presentation of new material, problem solving, or information access) and frequency with which teachers use computer-based technology for instruction?

To determine if there was a significant relationship between the types of access, the frequency of use, and instructional activity from the survey, the frequency of use was collapsed to three categories from the survey's seven categories of: "daily", "every other day", "weekly", "every other week", "monthly", "every other month or less", and "never" to: $\leq$ weekly ("daily", "every other day" and "weekly"), > weekly ("every other week", "monthly", "every other month or less"), and never. The reason for doing this was to allow for a minimum of five observations in each category for the chi-square test and yet maintain a proper representation of the frequency of use of computer-based technology from the survey.

A chi-square was performed on each instructional activity question with regard to type of access and frequency of use. This resulted in 16 separate chi-square tests being performed to test the significance of the relationship between access and frequency of use. The total observations for each chi-square varies from question to question and is less than the total number of teachers which responded to using computers for instructional purposes, because not all teachers use the particular instructional activity, multiple types of computer access were possible, and multiple responses were permitted on the section of the survey asking about the type of computer access available to the teacher. The degrees of freedom (df) for this question was six. Survey question 28 relating to "Other" instructional activity was deleted from the chi-square testing because there were not enough observations per cell to permit a chi-square analysis.

Seven of the tests performed yielded a score higher than the significant value of 12.592 at the $p < .05$ level with 6 df as shown in Table 4. The seven instructional activities were: tutorials, remediation/acceleration, drill and practice, recreational/educational games, enrichment activities, information access via CD-ROMs and problem solving. Among those teachers responding to the survey, instructional activity and frequency of use is significantly related to computer access in those six areas. One instructional activity, information access via the Internet, yielded an invalid chi-square

score due to low cell counts. Many of the schools in the survey area reported that they did not have Internet access.

Chi-square returned significant values in seven of 16 instructional activities (See Table 4). The individual significant χ^2 (chi-square) test for each instructional activity is presented in Tables 6-12 that show the relationship that each cell had on the total score. See Appendix I for a complete table of chi-square tests (e.g., those not significant). The column "Significant Access/Frequency of Use" in Table 4 was derived from the individual chi-square tests. It represents the individual cells of the type of access and the frequency of use which made the most significant contribution to the chi-square score for the tested instructional activity.

Table 4
Table of Chi-square Values for Access, Frequency of Use and Instructional Activity

Instructional Activity	χ^2	p	Significant Access/Frequency of Use
df = 6			
Tutorials	17.992	0.006	Classroom/≤ Weekly
Testing	8.414	0.209	
Presentation of New Material	6.327	0.387	
Remediation/ Acceleration	13.189	0.040	Classroom/≤ Weekly
Keyboarding	8.159	0.226	
Drill & Practice	47.445	0.000	Classroom/≤ Weekly
Recreational & Educational Games	19.140	0.004	Classroom/≤ Weekly
Enrichment Activities	15.991	0.014	Classroom/≤ Weekly
Experimentations/Simulations	6.107	0.411	
Information Access via CD-ROMs	15.915	0.014	Classroom/Never
Information Access via the Internet	8.180	0.062	
Word Processing	4.817	0.567	
Authoring	4.161	0.655	
Multimedia Applications	8.279	0.218	
Problem Solving	13.258	0.039	Classroom/≤ Weekly
Collaborative Learning	8.540	0.201	

Tutorials

For access and frequency of use, the chi-square was significant (χ^2 (6, n = 152) = 17.992, $p < 0.05$) for the use of computer-based technology for tutorials (See Table 5). Fifty-six of the teachers responding (37%) indicated that they had access to computer-based technology in their classroom for this instructional activity. Ninety teachers (59%) also indicated that they use the computer "Weekly or less than Weekly" for tutorials across all types of access. Forty-eight teachers (53%) which used computer-based technology for tutorials had access in their classroom. Multiple access was the second largest response with 34 teachers (22%). Sheingold and Hadley (1990) found 73% of the teachers surveyed used tutorial programs. In the present survey combined frequency of use for computer-based technology for tutorials totaled 116 teachers (76%), which

supports earlier studies by OTA (1988, 1995); Honey and Henriquez, (1993); Sheingold and Hadley (1990); and Becker (1994b) indicating that access is an important issue for teachers to use computer-based technology. The significant chi-square score (χ^2 (6, n = 152) = 17.992, $p < 0.05$) for tutorials shows that there is a relationship between access and frequency of use for tutorials.

Table 5
Summary of Significant Chi-square Tests for Tutorials

Tutorials
Rows: Frequency of Use Columns: Computer Access

	Media Center	Multiple Access	Lab	Classroom	Row Margin
≤Weekly -- % of Access	1.11	28.89	16.67	53.33	100.00
% of Frequency of Use	11.11	57.78	46.88	72.73	59.21
% of Chi-square	0.66	17.11	9.87	31.58	59.21
Frequency	1	26	15	48	90
Expected Frequency	5.33	26.64	18.95	39.08	90
>Weekly -- % of Access	7.69	30.77	30.77	30.77	100.00
% of Frequency of Use	22.22	17.78	25	12.12	17.11
% of Chi-square	1.32	5.26	5.26	5.26	17.11
Frequency	2	8	8	8	26
Expected Frequency	1.54	7.7	5.47	11.29	26
Never -- % of Access	16.67	30.56	25	27.78	100.00
% of Frequency of Use	66.67	24.44	28.12	15.15	23.68
% of Chi-square	3.95	7.24	5.92	6.58	23.68
Frequency	6	11	9	10	36
Expected Frequency	2.13	10.66	7.58	15.63	36
Column Margin -- % of Access	5.92	29.61	21.05	43.42	100.00
% of Frequency of Use	100.00	100.00	100.00	100.00	100.00
% of Chi-square	5.92	29.61	21.05	43.42	100.00
Frequency	9	45	32	66	152
Expected Frequency	9	45	32	66	152

Chi-Square = 17.992, DF = 6, P-Value = 0.006
2 cells with expected counts less than 5.0

Remediation/Acceleration

For access and frequency of use, the chi-square was significant (χ^2 (6, n = 154) = 13.189, $p < 0.05$) for the use of computer-based technology for remediation/acceleration (See Table 6). Fifty-seven of the teachers responding (37%) indicated that they used computer-based technology in their classroom for remediation/acceleration. One hundred

seven (69%) indicated that they used computers "Weekly or less than Weekly" for remediation/acceleration across all types of access. Fifty-one (48%) of the teachers using computer-based technology for remediation/acceleration had access in their classroom. The second largest response was 43 teachers (28%) with multiple types of access. Sheingold and Hadley (1990) reported 50% of the least experienced teachers and between 30 and 35% of more experienced teachers used computers for remediation. Combined frequency of use for computer-based technology for remediation/acceleration totaled 134 (87%) which supports studies by OTA (1988, 1995); Honey and Henriquez (1993); and Becker (1994b) indicating that access is an important issue for teachers to use computer-based technology. The significant chi-square score (χ^2 (6, n = 154) = 13.189, $p < 0.05$) for remediation/acceleration shows that there is a relationship between access and frequency of use for remediation/acceleration.

Table 6

Summary of Significant Chi-square Test for Remediation/Acceleration

Remediation/Acceleration

Rows: Frequency of Use Columns: Computer Access

	Media Center	Multiple Access	Lab	Classroom	Row Margin
≤Weekly -- % of Access	3.74	31.78	16.82	47.66	100.00
% of Frequency of Use	44.44	73.91	56.25	76.12	69.48
% of Chi-square	2.6	22.08	11.69	33.12	69.48
Frequency	4	34	18	51	107
Expected Frequency	6.25	31.96	22.23	46.55	107
>Weekly -- % of Access	7.41	33.33	37.04	22.22	100.00
% of Frequency of Use	22.22	19.57	31.25	8.96	17.53
% of Chi-square	1.3	5.84	6.49	3.9	17.53
Frequency	2	9	10	6	27
Expected Frequency	1.58	8.06	5.61	11.75	27
Never -- % of Access	15	15	20	50	100.00
% of Frequency of Use	33.33	6.52	12.5	14.93	12.99
% of Chi-square	1.95	1.95	2.6	6.49	12.99
Frequency	3	3	4	10	20
Expected Frequency	1.17	5.97	4.16	8.7	20
Column Margin -- % of Access	5.84	29.87	20.78	43.51	100.00
% of Frequency of Use	100.00	100.00	100.00	100.00	100.00
% of Chi-square	5.84	29.87	20.78	43.51	100.00
Frequency	9	46	32	67	154
Expected Frequency	9	46	32	67	154

Chi-Square = 13.189, DF = 6, P-Value = 0.040

3 cells with expected counts less than 5.0

Drill and Practice

For access and frequency of use, the chi-square was significant (χ^2 (6, n = 157) = 47.445, $p < 0.05$) for the use of computer-based technology for drill and practice (See Table 7). Sixty-six teachers (42%) responded that the computer-based technology used for drill and practice was in their classroom. One hundred eleven teachers (71%) indicated that computer-based technology was used "Weekly or less than Weekly" for drill and practice across all types of access. Thirty-seven percent of the teachers reporting the use of computer-based technology for drill and practice had access in their classroom. Twenty-seven percent reported multiple types of access to computer-based technology. Sheingold and Hadley (1990) reported between less than 30% to more than 40% of the teachers used computers for drills. Teachers who used computer-based technology were 139 (89%). This does, however, support earlier studies by the OTA (1988, 1995), Honey and Henriquez (1993), and Becker (1994b), which indicated that access was an important issue for teachers to use computer-based technology. The significant chi-square score (χ^2 (6, n = 157) = 47.445, $p < 0.05$) for drill and practice shows that there is a relationship between access and frequency of use for drill and practice.

Table 7
Summary of Significant Chi-square Test for Drill and Practice

Drill and Practice
Rows: Frequency of Use Columns: Computer Access

	Media Center	Multiple Access	Lab	Classroom	Row Margin
≤Weekly -- % of Access	2.7	27.93	17.12	52.25	100.00
% of Frequency of Use	30	67.39	57.58	85.29	70.7
% of Chi-square	1.91	19.75	12.1	36.94	70.7
Frequency	3	31	19	58	111
Expected Frequency	7.07	32.52	23.33	48.08	111
>Weekly -- % of Access	--	42.86	28.57	28.57	100.00
% of Frequency of Use	--	26.09	24.24	11.76	17.83
% of Chi-square	--	7.64	5.1	5.1	17.83
Frequency	0	12	8	8	28
Expected Frequency	1.78	8.2	5.89	12.13	28
Never -- % of Access	38.89	16.67	33.33	11.11	100.00
% of Frequency of Use	70	6.52	18.18	2.94	11.46
% of Chi-square	4.46	1.91	3.82	1.27	11.46
Frequency	7	3	6	2	18
Expected Frequency	1.15	5.27	3.78	7.8	18

(table continues)

Table 7
Summary of Significant Chi-square Test for Drill and Practice

Drill and Practice					
Rows: Frequency of Use					
Columns: Computer Access					
	Media Center	Multiple Access	Lab	Classroom	Row Margin
Column Margin -- % of Access	6.37	29.3	21.02	43.31	100.00
% of Frequency of Use	100.00	100.00	100.00	100.00	100.00
% of Chi-square	6.37	29.3	21.02	43.31	100.00
Frequency	10	46	33	68	157
Expected Frequency	10	46	33	68	157
Chi-Square = 47.445, DF = 6, P-Value = 0.000					
3 cells with expected counts less than 5.0					

Recreational and Educational Games

For access and frequency of use, the chi-square was significant (χ^2 (6, n = 162) = 19.140, p <0.05) for the use of computers for recreational and educational games (See Table 8). Sixty-seven of the teachers responding (41%) indicated that they had access to computers in their classroom for recreational and educational games. Ninety-one (56%) also indicated that they used computers "Weekly or less than Weekly" for recreational and educational games across all types of access. Fifty teachers (55%) which used computer-based technology for recreational and educational games had access in their classroom. Multiple access was the second largest response with 37 teachers (23%). Combined frequency of uses for computer-based technology for recreational and educational games totaled 138 teachers (85%) which supports studies by OTA (1988, 1995); Honey and Henriquez (1993); and Becker (1994b), as reported earlier, indicating that access is an important issue for teachers to use computer-based technology. Sheingold and Hadley (1990) reported 74% of the teachers surveyed used game and simulation software. The significant chi-square score (χ^2 (6, n = 162) = 19.140, p <0.05) for recreational and educational games shows that there is a relationship between access and frequency of use for recreational and educational games.

Table 8
Summary of Significant Chi-square test for Recreational and Educational Games

Recreational & Educational Games					
Rows: Frequency of Use Columns: Computer					
	Media Center	Multiple Access	Lab	Classroom	Row Margin
≤Weekly -- % of Access	3.3	27.47	14.29	54.95	100.00
% of Frequency of Use	30	53.19	38.24	70.42	56.17

(table continues)

Table 8
Summary of Significant Chi-square test for Recreational and Educational Games
Recreational & Educational Games
Rows: Frequency of Use Columns: Computer

	Media Center	Multiple Access	Lab	Classroom	Row Margin
% of Chi-square	1.85	15.43	8.02	30.86	56.17
Frequency	3	25	13	50	91
Expected Frequency	5.62	26.4	19.1	39.88	91
>Weekly -- % of Access	6.38	25.53	31.91	36.17	100.00
% of Frequency of Use	30	25.53	44.12	23.94	29.01
% of Chi-square	1.85	7.41	9.26	10.49	29.01
Frequency	3	12	15	17	47
Expected Frequency	2.9	13.64	9.86	20.6	47
Never -- % of Access	16.67	41.67	25	16.67	100.00
% of Frequency of Use	40	21.28	17.65	5.63	14.81
% of Chi-square	2.47	6.17	3.7	2.47	14.81
Frequency	4	10	6	4	24
Expected Frequency	1.48	6.96	5.04	10.52	24
Column Margin -- % of Access	6.17	29.01	20.99	43.83	100.00
% of Frequency of Use	100.00	100.00	100.00	100.00	100.00
% of Chi-square	6.17	29.01	20.99	43.83	100.00
Frequency	10	47	34	71	162
Expected Frequency	10	47	34	71	162

Chi-Square = 19.140, DF = 6, P-Value = 0.004
2 cells with expected counts less than 5.0

Enrichment Activities

For access and frequency of use, the chi-square was significant (χ^2 (6, n = 159) = 15.991, p < 0. 05) for the use of computers for enrichment activities (See Table 9). Sixty-two (39%) of the teachers responding indicated that they had access to computers in their classroom for this instructional activity. Ninety-six teachers (60%) also indicated that they used computer-based technology "Weekly or less than Weekly" for enrichment activities across all types of access. Fifty teachers (52%) who used computer-based technology for enrichment activities had access in their classroom. Multiple access was the second largest response with 44 teachers (28%). Combined frequency of uses for computer-based technology for enrichment activities totaled 141 teachers (89%) which supports earlier studies by OTA (1988, 1995); Honey and Henriquez (1993); and Becker (1994b), as reported earlier, indicating that access is an important issue for teachers to use computer-based technology. Sheingold and Hadley (1990) reported 50% of the experienced and

between 30 and 35% of teachers surveyed used the computer for enrichment. The significant chi-square score (χ^2 (6, n = 159) = 15.991, p < 0. 05) for enrichment activities shows that there is a relationship between access and frequency of use for enrichment activities.

Table 9
Summary of Significant Chi-square Tests for Enrichment Activities

Enrichment Activities
Rows: Frequency of Use Columns: Computer Access

	Media Center	Multiple Access	Lab	Classroom	Row Margin
≤Weekly -- % of Access	3.12	30.21	14.58	52.08	100.00
% of Frequency of Use	30	61.7	41.18	73.53	60.38
% of Chi-square	1.89	18.24	8.81	31.45	60.38
Frequency	3	29	14	50	96
Expected Frequency	6.04	28.38	20.53	41.06	96
>Weekly -- % of Access	11.11	33.33	28.89	26.67	100.00
% of Frequency of Use	50	31.91	38.24	17.65	28.3
% of Chi-square	3.14	9.43	8.18	7.55	28.3
Frequency	5	15	13	12	45
Expected Frequency	2.83	13.3	9.62	19.25	45
Never -- % of Access	11.11	16.67	38.89	33.33	100.00
% of Frequency of Use	20	6.38	20.59	8.82	11.32
% of Chi-square	1.26	1.89	4.4	3.77	11.32
Frequency	2	3	7	6	18
Expected Frequency	1.13	5.32	3.85	7.7	18
Column Margin -- % of Access	6.29	29.56	21.38	42.77	100.00
% of Frequency of Use	100.00	100.00	100.00	100.00	100.00
% of Chi-square	6.29	29.56	21.38	42.77	100.00
Frequency	10	47	34	68	159
Expected Frequency	10	47	34	68	159

Chi-Square = 15.991, DF = 6, P-Value = 0.014
3 cells with expected counts less than 5.0

Information Access Via CD-ROMs

For access and frequency of use, the chi-square was significant (χ^2 (6, n = 149) = 15.915, p < 0. 05) for the use of computers for information access via CD-ROMs (See Table 10). Fourteen (9%) of the teachers responding indicated that they had multiple access to computers for this instructional activity. This is the only instruction activity showing a significant relationship between access and frequency of use where multiple

access had the greatest significance. Thirty-four teachers (23%) also indicated that they used computer-based technology "Weekly or less than Weekly" for information access via CD-ROMs across all types of access. Twenty-three teachers (15%) who used computer-based technology for enrichment activities had multiple access. Classroom access was the second largest response with 18 teachers (12%). Combined frequency of uses for computer-based technology for enrichment activities totaled 64 teachers (43%). This supports earlier studies by OTA (1988, 1995); Honey and Henriquez (1993); Sheingold and Hadley (1990); and Becker (1994b), which stated the importance of access as a key to the use of computer-based technology, but did not state the how much CD-ROMs are being used. OTA (1995), reported:

> One-half of the computers used for instruction were 8-bit computers, primarily Apple IIs and about one-fourth, 16-bit computers. Most of the new software being designed today cannot run on either of these types of machines. Surveys have not yet collected data on the number of school computers equipped with CD-ROM, ... or how much they are being used. CD-ROM equipped computers tend to be placed in the school library or media center, to make them accessible to a larger number of students and teachers. (p. 95-97)

The significant chi-square (χ^2 (6, n = 149) = 15.915, p < 0. 05) for information access via CD-ROMs shows that there is a relationship between access and frequency of use for information access via CD-ROMs.

Table 10

Summary of Significant Chi-square Test for Information Access Via CD-ROMs

Information Access via CD-ROMs

Rows: Frequency of Use Columns: Computer Access

	Media Center	Multiple Access	Lab	Classroom	Row Margin
≤Weekly -- % of Access	11.76	41.18	17.65	29.41	100.00
% of Frequency of Use	40	31.82	20	15.38	22.82
% of Chi-square	2.68	9.4	4.03	6.71	22.82
Frequency	4	14	6	10	34
Expected Frequency	2.28	10.04	6.85	14.83	34
>Weekly -- % of Access	13.33	30	30	26.67	100.00
% of Frequency of Use	40	20.45	30	12.31	20.13
% of Chi-square	2.68	6.04	6.04	5.37	20.13
Frequency	4	9	9	8	30
Expected Frequency	2.01	8.86	6.04	13.09	30

(table continues)

Table 10
Summary of Significant Chi-square Test for Information Access Via CD-ROMs

Information Access via CD-ROMs Rows: Frequency of Use Columns: Computer Access	Media Center	Multiple Access	Lab	Classroom	Row Margin
Never -- % of Access	2.35	24.71	17.65	55.29	100.00
% of Frequency of Use	20	47.73	50	72.31	57.05
% of Chi-square	1.34	14.09	10.07	31.54	57.05
Frequency	2	21	15	47	85
Expected Frequency	5.7	25.1	17.11	37.08	85
Column Margin -- % of Access	6.71	29.53	20.13	43.62	100.00
% of Frequency of Use	100.00	100.00	100.00	100.00	100.00
% of Chi-square	6.71	29.53	20.13	43.62	100.00
Frequency	10	44	30	65	149
Expected Frequency	10	44	30	65	149
Chi-Square = 15.915, DF = 6, P-Value = 0.014 2 cells with expected counts less than 5.0					

Problem Solving

For access and frequency of use the chi-square was significant (χ^2 (6, n = 154) = 13.258, p < 0. 05) for the use of computers for problem solving (See Table 11). Fifty-three (34%) of the teachers responding indicated that they had access to computers in their classroom for this instructional activity. Eighty-five teachers (55%) also indicated that they used computer-based technology "Weekly or less than Weekly" for enrichment activities across all types of access. Forty-two teachers (52%) which used computer-based technology for problem solving had access in their classroom. Multiple access was the second largest response with 35 teachers (23%). Combined frequency of uses for computer-based technology for enrichment activities totaled 112 teachers (73%), which supports earlier studies by OTA (1988, 1995); Honey and Henriquez (1993); and Becker (1994b), as reported earlier, indicating that access is an important issue for teachers to use computer-based technology. Sheingold and Hadley (1990) reported 75% of the teachers surveyed used the computer for problem solving. The significant chi-square score (χ^2 (6, n = 154) = 13.258, p < 0. 05) for problem solving shows that there is a relationship between access and frequency of use for problem solving.

Table 11
Summary of Significant Chi-square Test for Problem Solving

Problem Solving
Rows: Frequency of Use Columns: Computer Access

	Media Center	Multiple Access	Lab	Classroom	Row Margin
Weekly or Less Than Weekly -- % of Access	3.53	32.94	14.12	49.41	100.00
% of Frequency of Use	30	63.64	36.36	62.69	55.19
% of Chi-square	1.95	18.18	7.79	27.27	55.19
Frequency	3	28	12	42	85
Expected Frequency	5.52	24.29	18.21	36.98	85
More Than Weekly -- % of Access	3.7	25.93	29.63	40.74	100.00
% of Frequency of Use	10	15.91	24.24	16.42	17.53
% of Chi-square	0.65	4.55	5.19	7.14	17.53
Frequency	1	7	8	11	27
Expected Frequency	1.75	7.71	5.79	11.75	27
Never -- % of Access	14.29	21.43	30.95	33.33	100.00
% of Frequency of Use	60	20.45	39.39	20.9	27.27
% of Chi-square	3.9	5.84	8.44	9.09	27.27
Frequency	6	9	13	14	42
Expected Frequency	2.73	12	9	18.27	42
Column Margin -- % of Access	6.49	28.57	21.43	43.51	100.00
% of Frequency of Use	100.00	100.00	100.00	100.00	100.00
% of Chi-square	6.49	28.57	21.43	43.51	100.00
Frequency	10	44	33	67	154
Expected Frequency	10	44	33	67	154

Chi-Square = 13.258, DF = 6, P-Value = 0.039
2 cells with expected counts less than 5.0

Home Computer Access

Table 12 shows the count of home access and frequency of use for each instructional activity. Twenty percent (33) of the teachers who use computer-based technology for instruction responded to having home access to computers. Only 3% (5) of the teachers indicated that computers at home were used for instructional purposes and those responses were “Weekly or less than Weekly”. The rest of those teachers (28) never used computers at home for instructional purposes.

Table 12
Home Computer Access Summary Table

Instructional Activity	Number of Teachers With Home Computer Access			Total
Frequency of Use	≤ Weekly	> Weekly	Never	Teachers
Tutorials	0	0	2	2
Testing	0	0	2	2
Presentation of New Material	1	0	1	2
Remediation / Acceleration	0	0	2	2
Keyboarding	0	0	2	2
Drill & Practice	0	0	2	2
Recreational & Educational Games	0	0	2	2
Enrichment Activities	1	0	1	2
Experimentations / Simulations	0	0	2	2
Information Access via CD-ROMs	1	0	1	2
Information Access via the Internet	1	0	1	2
Word Processing	1	0	1	2
Authoring	0	0	2	2
Multimedia Applications	0	0	3	3
Problem Solving	0	0	2	2
Collaborative Learning	0	0	2	2
Total	5	0	28	33

"Other" Instructional Activity

Chi-square was also not performed on the survey item "Other" under instructional activity. There were not enough observations to obtain a valid chi-square score in "Other" instructional activity. Table 13 shows the count for the type of access and frequency of use for "Other" instructional activity. Only six teachers responded to using computer-based technology for "Other" instructional activities. Most of the instructional activities used by the teachers surveyed were reported by instructional activities listed in the survey, therefore, there were very few responses reported by the "Other" category.

Table 13
Summary Table for "Other" Instructional Activity

Other
Rows: Frequency of Use Columns: Computer Access

	Media Center	Multiple Access	Lab	Classroom	All
≤ Weekly	0	1	1	2	4
> Weekly	0	0	2	0	2
Never	4	3	6	5	18
All	4	4	9	7	24

Access in the classroom contributed more to the total chi-square score than any other type of access for six of these seven instructional activities. Access in the classroom also contributed more to the total chi-square score in frequency of use in more frequently than weekly. Combined frequency of uses for computer-based technology for the seven instructional activities was 78% of the teachers surveyed, which contrasts Marcinkiewicz's (1994) study, who indicated almost 50% of the teachers did not use technology when access was not a problem.

Because there were not enough observations, chi-square did not report a significant relationship between access and frequency of use for the following instructional activities: (1) testing, (2) presentation of new material, (3) keyboarding, (4) experimentations/simulations, (5) information access via the Internet, (6) word processing, (7) authoring, (8) multimedia applications, and collaborative learning. Chi-square was not performed on "home" access.

According to the responses received, the teachers surveyed reported using computers for a variety of instructional activities. Seven of the 16 instructional activities produced a significant chi-square score which suggests that access influenced the frequency of use and instructional activity for those instructional activities.

For these instructional activities, having access in the classroom resulted in teachers using computers more frequently(weekly or more frequently) than teachers with other types of access. Placement of computers in the classroom, over other locations (e.g. lab, media center, etc.), resulted in more frequent use in some instructional activities by teachers. Information access via CD-ROMs produced a significant chi-square relationship for multiple types of access. Computers with more current technology advances, such as CD-ROMs, are not placed in the classroom but in other locations (e.g. labs and media centers). Teachers with computer access in the classroom tend to use computers more frequently for some instructional activities (e.g. tutorials, remediation/acceleration, problem solving, etc.) For instructional activities, such as "information access via CD-ROMs", to produce a significant relationship in classroom access, current computer technology must be placed in the classroom for the teachers to use for instructional purposes.

Access was not an influencing factor in frequency of use for the other instructional activities. Possible explanation for this finding include: (1) the instructional activity may not be used by the teacher regardless of the presence of computers (teachers were not questioned about the types of instructional activities employed before they had access to computers); (2) computer equipment in many of the classrooms covered by the study is outdated and does not support newer software, CD-ROMs, networking, etc. or (3) access may not be easily available. One teacher responded, "I have my students use the computers in the media center for research purposes. We do not use the outdated classroom computer for instruction." Another teacher responded, "There is no longer a computer lab at our school for primary use. I do not have a computer in my classroom. There are new computers in the library, but they have not been made available to my class at this time. I used to use computers daily." Another teacher responded, "I have never had a computer available in my classroom.." Another said, "inadequate room--one outdated computer."

In the survey, when asked about computer inventory, most teachers instead of giving a count of the types of computers which were available to them, responded with a check. It is impossible to determine how current or out-dated the computers are. It is believed that a survey of a technology rich county may produce different results. Therefore, counties, when placing computers in schools, should place computers in classrooms where teachers will have access and may be more influenced to use computers more frequently for more instructional activities.

Question 1b: Does the availability of Internet access influence the number of ways (e.g. remediation, presentation of new material, problem solving, or information access) and the frequency with which teachers use computer-based technology for instruction?

Internet access in the two counties surveyed was lower than the survey conducted by Honey and Henriquez (1993). Honey and Henriquez (1993) reported 48% of the telecommunication teachers had Internet access. The teachers included in this survey reported 30% had Internet access that had computer access.

Table 14 summarizes the count and percentage of Internet access and the type of access which was available to the teacher. The number of teachers who reported using computers and having access to the Internet was 50 (30%). Internet access in the media center showed the largest number (22) and percentage (44%). This differed from the survey conducted by Honey and Henriquez (1993), where teachers reported that the classroom had the greatest percent for professional (28%) and student activities (42%) followed by computer labs. The percentage of Internet access represents the percentage of those teachers who reported Internet accesses. The percentage with computers represents the percentage of teacher who reported using computer-based technology for instructional purposes.

Table 14
Summary Table of Internet Access

Types of Access	Count	% of Internet Access	% w/Computers
Classroom	5	10%	3%
Lab	6	12%	4%
Multiple Accesses	7	14%	4%
Media Center	22	44%	13%
Home	10	20%	6%
Total	50	100%	30%

Table 15 shows how teachers surveyed are using the Internet for instructional activities. The two largest responses in types of Internet activities that were reported were browsing the Web (e.g. using Netscape or some other browser) (78%) and E-mail (62%). The percent of use with Internet access represents usage based on those teachers reporting Internet access. In the national survey conducted by Honey and Henriquez (1993), the high use among professionals (91%) and students (79%) was electronic mail (E-mail).

The next highest use was by newsgroups and bulletin boards. Using a Web browser was not listed as a use.

Table 15
Summary of Internet Activity Use

Internet Uses	Count	Percentage of Use w/Internet Access
Information Access via Web Browsers	39	78%
E-mail	31	62%
Newsgroups or Bulletin Boards	10	20%
Database Access	10	20%
Downloading Software	8	16%
File Transfer	7	14%

Thirty percent of those teachers using computer-based technology for instruction reported having Internet access. Internet access was most often reported as being in the media center, followed by Internet access at home which differed from the Honey and Henriquez (1993), study cited earlier. The two largest uses of the Internet were browsing the Web and E-mail. This differs from the survey conducted by Honey and Henriquez (1993), in which browsing the Web was not listed as a use of the Internet. At the time of Honey and Henriquez's (1993), study Web browsers were being developed but had not been released and were not available for use.

Internet access was lower in the two counties surveyed than the access found by Honey and Henriquez (1993). Forty-four percent of the teachers reporting Internet access reported access in the Media Center followed by access at home (20%). The largest use of the Internet was browsing the Web (78%) followed by E-mail (72%). This differed from the findings by Honey and Henriquez (1993) where E-mail was the largest activity on the Internet and Web browsing was not listed as an activity.

Forty-four percent of the teachers reported Internet access in the Media Center followed by access at home (20%). The largest use of the Internet was browsing the Web (78%) followed by E-mail (72%). This differed from the findings by Honey and Henriquez (1993) where E-mail was the largest activity on the Internet and Web browsing was not listed as an activity.

Internet access was available to only 30% of the teachers responding. Most of the access to the Internet (13%) is available in media centers, which limits the amount of access, which are available to all teachers. As such, Internet access did not influence the instructional activity or frequency of use of the teachers surveyed. Information access via Web browsers had the greatest use (78%) by the teachers who did have Internet access. The greatest reason that there is not more Internet use is due to lack of access in the counties surveyed. The West Virginia county, according to the superintendent, is serviced by an independent telephone company and has received very limited access at this time. The superintendent is optimistic that this will improve in the near future. One teacher responded, "Our school is scheduled to be online in the next few
teacher responded, "(We)are in the process of obtaining (Internet) access." Another teacher responded, "(We are) in process of acquiring (Internet access in the) 97-98 yr.

We have not yet (obtained Internet access)." Another responded, "(Internet access is) not available." Because of the lack of Internet access, chi-square could not produce a valid chi-square score which would show significance or lack of significance. It is likely that a survey in a county which has more Internet access would produce different results. This is based in part on greater numbers would allow a chi-square test to determine significance and trends by those surveyed who used the Internet for information access via Web browsers (78%) and e-mail (62%).

Two reasons for the differences are lack of Internet access by Internet providers (e.g. telephone companies) and changes in technology which did not previously support Web browsing. The West Virginia county is serviced by an independent telephone company which had been very slow to respond to the county school system's need for Internet access. Although the state of West Virginia is committed to having every school wired to the Internet, several school systems are serviced by small independent telephone companies which do not have the financial resources to currently wire schools in the very near future. This will act as a hindrance to the use of Internet resources and cause a lack of significance to appear between the instructional activity, access and frequency of use. It is believed that future Internet access in the classroom will result in more frequent use than Internet access provided in another location. It will also result in teachers using different instructional strategies. Secondly, since the study conducted by Honey and Henriquez (1993), computer technology and Internet capabilities and uses have changed very rapidly. Computers are more powerful, Internet access is faster, and the introduction and use of Web browsers have changed how people are accessing and using the Internet to display and access information. Without current computer technology and software, using Web browsers is not possible.

Question 2: Which type of training (e.g., initial, just-in-time, continuous, academic classes or workshops) influences the number of ways (e.g. remediation, presentation of new material, problem solving, or information access) and the frequency with which teachers use computer-based technology for instruction?

In previous research, OTA (1988, 1995), Sheingold and Hadley (1990), and Honey and Henriquez (1993), reporting the need and categories of training, did not report which type of training might be most influential in influencing teachers to use computer-based technology. For the current research, Table 16 shows the frequency and percentages of teachers, who have had various types of training and those who would like to have a particular type of training. Multiple answers to this question were permitted. Chi-square statistical analysis was not performed on data from this research question because there were too few observations in each cell to obtain a valid chi-square score. The results are reported as frequencies and percentages in each category.

Sheingold and Hadley (1990) reported that 87% of the teachers were self-taught and Honey and Henriquez (1993) reported 96% of telecommunication teachers were self-taught. This was the largest group in both studies. "Peer" training in Sheingold and Hadley (1990) was 40% and in Honey and Henriquez (1993) "Peer" training was 55%. The findings in the current study differed from the previous studies. The largest percentage (86%) of teachers was trained by their peers to use computer-based technology. "Self-taught" teachers (80%) were the second largest group. The smallest percentage (24%) was in training from workshops by other agencies. The largest percentage of teachers (30%) which responded that they did not have training expressed a preference for a continuous training program if it were available for future training. The two types of training which teachers showed they were least interest in receiving were "self-taught" (2%) and "peer" taught (5%).

Table 16
Summary Table of Types of Computer Training

Summary Statistics for Types of Training

Type of Training				Type of Training		
Initial Training	Count	Percent		County Workshops	Count	Percent
Yes	128	74.42		Yes	125	72.25
No	27	15.70		No	19	10.98
Would If Available	17	9.88		Would If Available	29	16.76
n=	172			n=	173	
*=	78			*=	77	
Just-In-Time	Count	Percent		Other Workshops	Count	Percent
Yes	106	68.39		Yes	37	24.18
No	38	24.52		No	75	49.02
Would If Available	11	7.10		Would If Available	41	26.80
n=	155			n=	153	
*=	95			*=	97	

(table continues)

Table 16
Summary Table of Types of Computer Training

Summary Statistics for Types of Training

Continuous	Count	Percent		Peer-taught	Count	Percent
Yes	42	26.75		Yes	146	86.39
No	68	43.31		No	14	8.28
Would If Available	47	29.94		Would If Available	9	5.33
n=	157			n=	169	
*=	93			*=	81	
Academic Classes	**Count**	**Percent**		**Self-taught**	**Count**	**Percent**
Yes	116	67.84		Yes	131	80.37
No	33	19.30		No	29	17.79
Would If Available	22	12.87		Would If Available	3	1.84
n=	171			n=	163	
*=	79			*=	87	

n= Number responding.
*= No responses

The different types of training received by the teachers surveyed resulted in 83 combinations of training techniques. This resulted in counts that were too small for chi-square to produce a valid score. The greatest number of teachers (11) reported training by the following combination: initial, just-in-time, county workshops, peer, and self-taught. Ten reported a combination of initial, academic classes, county workshops, peer, and self-taught. Eighty-six percent of the teachers surveyed had received their training from peers. The second highest method (80%) of training was "self-taught". Placement of these findings differed from previous studies by Sheingold and Hadley (1990) and Honey and Henriquez (1993) which reported that most teachers were self-taught. Teachers who were peer taught were eighth and fourth place respectively in those studies. However, 30% of the teachers preferred continuous training as a method of training in the future.

Teachers previously taught themselves or depended on peers to help them learn how to use computer-based technology for instructional purposes. Teachers in this study indicate they want a continuous training program which will keep up with the changes in hardware and software. Therefore, counties, by providing a continuous training program for teachers, should see teachers who are more confident and willing to use computer-based technology more frequently and employ different instructional activities.

Question 3: Does the amount of time planning for the use of computers influence the number of ways (e.g. remediation, presentation of new material, problem solving, or information access) and the frequency with which teachers use computer-based technology for instruction?

Sheingold and Hadley reported the highest rated current barrier to using computers in the classroom was the teacher's lack of "time to develop lessons that use computers" (1990, p. 21). In the study by Honey and Henriquez (1993), teachers reported "advance planning" as the greatest influence in the success of student learning activities. Table 17 shows the type of instructional activities that produced a significant chi-square score. Four out of 18 instructional activities showed a significant relationship between type of instructional activity, frequency of use, and amount of time for planning.

Presentation of New Material

For planning and frequency of use, the chi-square was significant (χ^2 (8, n = 128) = 26.381, $p < 0.05$) for the use of computer-based technology for presentation of new material (See Table 17). Although a significant chi-square was obtained for the presentation of new material, it is not meaningful because there was a low count in one of the cells. For frequency of use "More Than Weekly", one cell did not have any responses and one cell had three or less responses. Ninety-one of the teachers responding (71%) indicated that they planned for the use computer-based technology for presentation of new material. Sixty-four (50%) indicated that they used computers Weekly or more frequently for presentation of new material across all amounts of time for planning to use computer-based technology.

Table 17
Summary of Significant Chi-square Test for Presentation of New Materials
Presentation of New Material

Rows: Frequency of Use Columns: Planning	Amount of Time Planning					
	15 Min.	30 Min.	45 Min.	60 Min.	> 60 Min.	Row Margin
Weekly or Less Than Weekly -- % of Access	25	35.94	14.06	4.69	20.31	100
% of Frequency of Use	32	58.97	60	37.5	81.25	50
% of Chi-square	12.5	17.97	7.03	2.34	10.16	50
Frequency	16	23	9	3	13	64
Expected Frequency	25	19.5	7.5	4	8	64

(table continues)

Table 17
Summary of Significant Chi-square Test for Presentation of New Materials
Presentation of New Material

Rows: Frequency of Use Columns: Planning	Amount of Time Planning					
	15 Min.	30 Min.	45 Min.	60 Min.	> 60 Min.	Row Margin
More Than Weekly -- % of Access	33.33	40.74	14.81	11.11	--	100
% of Frequency of Use	18	28.21	26.67	37.5	--	21.09
% of Chi-square	7.03	8.59	3.12	2.34	--	21.09
Frequency	9	11	4	3	0	27
Expected Frequency	10.55	8.23	3.16	1.69	3.37	27
Never -- % of Access	67.57	13.51	5.41	5.41	8.11	100
% of Frequency of Use	50	12.82	13.33	25	18.75	28.91
% of Chi-square	19.53	3.91	1.56	1.56	2.34	28.91
Frequency	25	5	2	2	3	37
Expected Frequency	14.45	11.27	4.34	2.31	4.62	37
Column Margin -- % of Access	39.06	30.47	11.72	6.25	12.5	100
% of Frequency of Use	100	100	100	100	100	100
% of Chi-square	39.06	30.47	11.72	6.25	12.5	100
Frequency	50	39	15	8	16	128
Expected Frequency	50	39	15	8	16	128

Chi-Square = 26.381, DF = 8, P-Value = 0.001
7 cells with expected counts less than 5.0

Experimentations/Simulations

For planning and frequency of use, the chi-square was significant (χ^2 (8, n = 126) = 24.782, $p < 0.05$) for the use of computer-based technology for experimentations/simulations (See Table 18). Although a significant chi-square was obtained for experimentations/simulations, it is not meaningful because there was a low count in several of the cells. For frequency of use "Weekly or Less Than Weekly", one cell had a count of less than three. For frequency of use " More Than Weekly", two cells had a count of less than three. Forty-eight of the teachers responding (38%) indicated that they planned for the use computer-based technology for experimentations/simulations. Twenty-two (17%) indicated that they used computers Weekly or more frequently for experimentations/simulations across all amounts of time for planning to use computer-based technology. Twenty-six (21%) indicated that they used computers less than Weekly for experimentations/simulations across all amount of time for planning to use computer-based technology.

Table 18
Summary of Significant Chi-square Test for Experimentations/Simulations
Eperimentations/Simulations

Rows: Frequency of Use Columns: Planning	Amount of Time Planning					
	15 Min.	30 Min.	45 Min.	60 Min.	> 60 Min.	Row Margin
Weekly or Less Than Weekly -- % of Access	22.73	22.73	18.18	4.55	31.82	100
% of Frequency of Use	9.43	13.89	28.57	11.11	50	17.46
% of Chi-square	3.97	3.97	3.17	0.79	5.56	17.46
Frequency	5	5	4	1	7	22
Expected Frequency	9.25	6.29	2.44	1.57	2.44	22
More Than Weekly -- % of Access	26.92	38.46	23.08	3.85	7.69	100
% of Frequency of Use	13.21	27.78	42.86	11.11	14.29	20.63
% of Chi-square	5.56	7.94	4.76	0.79	1.59	20.63
Frequency	7	10	6	1	2	26
Expected Frequency	10.94	7.43	2.89	1.86	2.89	26
Never -- % of Access	52.56	26.92	5.13	8.97	6.41	100
% of Frequency of Use	77.36	58.33	28.57	77.78	35.71	61.9
% of Chi-square	32.54	16.67	3.17	5.56	3.97	61.9
Frequency	41	21	4	7	5	78
Expected Frequency	32.81	22.29	8.67	5.57	8.67	78
Column Margin -- % of Access	42.06	28.57	11.11	7.14	11.11	100
% of Frequency of Use	100	100	100	100	100	100
% of Chi-square	42.06	28.57	11.11	7.14	11.11	100
Frequency	53	36	14	9	14	126
Expected Frequency	53	36	14	9	14	126

Chi-Square = 24.782, DF = 8, P-Value = 0.002
6 cells with expected counts less than 5.0

Word Processing

For planning and frequency of use, the chi-square was significant (χ^2 (8, n = 131) = 15.546, $p < 0.05$) for the use of computer-based technology for word processing (See Table 19). Although a significant chi-square was obtained for word processing, it is not meaningful because there was a low count in several of the cells. For frequency of use "Weekly or Less Than Weekly", one cell had a count of three or less. For frequency of use "More Than Weekly", two cells had a three or less. Eighty-four of the teachers responding (64%) indicated that they planned for the use computer-based technology in their classroom for word processing. Fifty-six (43%) indicated that they used computers

Weekly or more frequently for word processing across all amounts of time for planning to use computer-based technology. Twenty-eight (21%) indicated that they used computers less than Weekly for word processing across all amount of time for planning to use computer-based technology.

Table 19
Summary of Significant Chi-square Test for Word Processing
Word Processing

Rows: Frequency of Use Columns: Planning	Amount of Time Planning					
	15 Min.	30 Min.	45 Min.	60 Min.	> 60 Min.	Row Margin
Weekly or Less Than Weekly -- % of Access	28.57	37.5	14.29	3.57	16.07	100
% of Frequency of Use	29.09	56.76	53.33	22.22	60	42.75
% of Chi-square	12.21	16.03	6.11	1.53	6.87	42.75
Frequency	16	21	8	2	9	56
Expected Frequency	23.51	15.82	6.41	3.85	6.41	56
More Than Weekly -- % of Access	42.86	17.86	17.86	10.71	10.71	100
% of Frequency of Use	21.82	13.51	33.33	33.33	20	21.37
% of Chi-square	9.16	3.82	3.82	2.29	2.29	21.37
Frequency	12	5	5	3	3	28
Expected Frequency	11.76	7.91	3.21	1.92	3.21	28
Never -- % of Access	57.45	23.4	4.26	8.51	6.38	100
% of Frequency of Use	49.09	29.73	13.33	44.44	20	35.88
% of Chi-square	20.61	8.4	1.53	3.05	2.29	35.88
Frequency	27	11	2	4	3	47
Expected Frequency	19.73	13.27	5.38	3.23	5.38	47
Column Margin -- % of Access	41.98	28.24	11.45	6.87	11.45	100
% of Frequency of Use	100	100	100	100	100	100
% of Chi-square	41.98	28.24	11.45	6.87	11.45	100
Frequency	55	37	15	9	15	131
Expected Frequency	55	37	15	9	15	131

Chi-Square = 15.546, DF = 8, P-Value = 0.049
5 cells with expected counts less than 5.0

Problem Solving

For planning and frequency of use, the chi-square was significant (χ^2 (8, n = 133) = 19.482, $p < 0.05$) for the use of computer-based technology for problem solving (See Table 20). Although a significant chi-square was obtained for problem solving, it is not

meaningful because there was a low count in several of the cells. For frequency of use "More Than Weekly", one cell did not have any responses and two cells had responses of three or less. One hundred two of the teachers responding (77%) indicated that they planned for the use computer-based technology in their classroom for problem solving. Eighty-five (64%) indicated that they used computers Weekly or more frequently for word processing across all amounts of time for planning to use computer-based technology. Seventeen (13%) indicated that they used computers less than Weekly for problem solving across all amount of time for planning to use computer-based technology.

Table 20
Summary of Significant Chi-square Test for Problem Solving
Problem Solving

Rows: Frequency of Use Columns: Planning	Amount of Time Planning					
	15 Min.	30 Min.	45 Min.	60 Min.	> 60 Min.	Row Margin
Weekly or Less Than Weekly -- % of Access	30.59	36.47	9.41	8.24	15.29	100
% of Frequency of Use	50.98	75.61	50	77.78	81.25	63.91
% of Chi-square	19.55	23.31	6.02	5.26	9.77	63.91
Frequency	26	31	8	7	13	85
Expected Frequency	32.59	26.2	10.23	5.75	10.23	85
More Than Weekly -- % of Access	41.18	17.65	35.29	--	5.88	100
% of Frequency of Use	13.73	7.32	37.5	--	6.25	12.78
% of Chi-square	5.26	2.26	4.51	--	0.75	12.78
Frequency	7	3	6	0	1	17
Expected Frequency	6.52	5.24	2.05	1.15	2.05	17
Never -- % of Access	58.06	22.58	6.45	6.45	6.45	100
% of Frequency of Use	35.29	17.07	12.5	22.22	12.5	23.31
% of Chi-square	13.53	5.26	1.5	1.5	1.5	23.31
Frequency	18	7	2	2	2	31
Expected Frequency	11.89	9.56	3.73	2.1	3.73	31
Column Margin -- % of Access	38.35	30.83	12.03	6.77	12.03	100
% of Frequency of Use	100	100	100	100	100	100
% of Chi-square	38.35	30.83	12.03	6.77	12.03	100
Frequency	51	41	16	9	16	133
Expected Frequency	51	41	16	9	16	133

Chi-Square = 19.482, DF = 8, P-Value = 0.012
6 cells with expected counts less than 5.0

The significant chi-squares showed a relationship between planning and frequency of use for four types of instructional activities: (1) presentation of new material, (2) experimentations/simulations, (3) word processing, and (4) problem solving. The other 12 instructional activities did not show a significant relationship.

Although a chi-square produced a significant score on the four instructional activities of presentation of new material, experimentations/simulations, word processing and problem solving, they were not meaningful relationships. This was due to low observations in the individual cells in the cross tabulation table. One of the cells in the instructional activities of "presentation of new material" and "problem solving" did not have any responses. Ten of the cells in the four instructional activities had three or less responses.

Time for planning is important to the use of computers in the classroom as reported by Sheingold and Hadley (1990) and Honey and Henriquez (1993). A chi-square produced four significant scores for a relationship between amount of time for planning, instructional activity, and frequency of use. The scores were, however, not meaningful based on low cell counts. Responses by instructional activity indicated, that teachers are planning 15-30 minutes daily for the use of computer-based technology. In all instructional activities except experimentations/simulations, teachers indicated they were using the instructional activity weekly or more frequent based on planning 15-30 minutes, daily. Most teachers indicated that they never plan daily for experimentations/simulations (62%), information access via CD-ROMs (56%), information access via the Internet (79%), authoring (56%), and multimedia applications (53%). The low amounts of time may be related to access to current computer technology, Internet access, and sufficient time provided in the schedule for planning. From the data gathered in this study, it is not possible to determine the relationship between the amount of time planning for the use of computer based technology, instructional activity, and frequency of use.

Sheingold and Hadley (1990) and Honey and Henriquez (1993) reported time for planning is important to the use of computers in the classroom. Very few teachers in this study, however, reported planning for more than 30 minutes. Although time for planning has been reported as being important to the use of computers in the classroom (OTA, 1988, 1995), teachers are not being provided time for planning or are not planning for the use of computers. If teachers are going to be expected to use computer-based technology for instructional purposes, then extra time must be provided for the teacher to plan for the use of instructional activities with computers. By providing teachers with more planning time in the use of computer-based technology, counties may see teachers who use computers more frequently and who use different instructional activities.

Observations

The population was 1017, K-12 teachers from a county public school system in southwest Virginia and a county public school system in southern West Virginia. One in three was selected which resulted in a sample size of 339. Responses were received from 250 teachers. One hundred fifty-eight teachers (63%) were from the county in southwest Virginia and 91 teachers (37%) were from the county in southern West Virginia. According to the responses by the teachers 67% used computers for instructional

purposes, 24% did not use computers, 6% did not have computers available for them to use and 3% did not respond to using computers for instructional purposes. According to the responses of the teachers surveyed, when access to computers is available, they will use computers for instructional purposes. This differed from findings by Marcinkiewicz (1994), which indicated almost 50% of the teachers did not use computers when access was not a problem.

The goal of this study, by doing a partial replication of earlier studies, was to address issues which had not been addressed in previous research: determine if computer and Internet access, type of training and amount of time planning of the use of computers influences the instructional activity and frequency of use by teachers. Unlike Marcinkiewicz (1994), it is the belief of the researcher that teachers will use computers when they have access to them.

The results obtained in this study indicate that access influences instructional activity and frequency of use, at least in some instructional activities. The findings also show that teachers' use of the Internet has changed since Honey and Henriquez (1993) reported their national telecommunications survey. It is believed that a survey of technology and Internet rich counties will show a relationship between Internet access, instructional activity and frequency of use for some instructional activities. The results still show that teachers received most of their training from their peers (86%) and by being self-taught (80%). Teachers also reported that continuous training was preferred for future training. Teachers reported spending 30 minutes or less daily to use computers for instructional purposes.

Based on the findings from the four research questions, the following observations are made: Only 30% of the teachers responding to the survey had computers. Of those who had access, 67% use computers for instruction. Given the teachers with access to computers in the classroom, seven instructional activities: tutorials, remediation/acceleration, drill and practice, recreational and educational games, enrichment activities, information access via CD-ROMs, and problem solving produced a significant chi-square relationship between computer access, the instructional activity, and frequency of use. Thus, it is not surprising that it is concluded that classroom access to computers is a key factor to using computers instructionally. Anecdotal comments from teachers support the importance of classroom access to computers. Anecdotal comments also suggest that obsolescence is a barrier to the instructional use of computers. It is, therefore, reasonable to recommend that school systems give an instructional priority to placing up-to-date computers in the classroom.

Most teachers responding in this study did not have Internet access. With the increased availability of instructional related resources via the Web, such as: research tools, lesson plans, online classes, Internet instructional units, professional organizations, etc. Therefore, it is important to place an instructional priority on providing Internet access in the classroom for use by teachers and students.

Currently, teachers in this survey were self-taught or peer taught to use computers. Teachers surveyed preferred a continuous type of computer training in the future**.** Continuous type training has been defined as training conducted on an ongoing basis throughout the year to provide the teachers with the necessary competencies for employing computer-based technology in instruction. Therefore, it is incumbent on

school systems to establish a formal plan for regular teacher inservice and staff training on computer-based technology that should include provision for the type of training, such as: Web navigation, e-mail, presentation software, scanning, image manipulation software, etc., teachers feel will be most beneficial to them.

Teachers reported currently spending no more than 30 minutes for planning. This time is already fully utilized without adding the burden to become skilled at using computer-based technology in instruction and the additional planning that such planning requires. School systems will have to make planning a priority for teachers using computer-based technology in instruction. Extra planning time as well as continuous inservice training will add cost and training staff which will ultimately have to come from school budgets.

The following area is suggested for future research:

A study of the types of training given to teachers who are just beginning to use computers and the types of instructional activities and frequency of use employed by these teachers over a period of time to determine which type of training has the most influence on teachers use of computers. In order to determine if there is a relationship between type of training and instructional activity and frequency of use, the survey should have asked which type of training most influenced a particular type of instructional activity and its frequency of use. The answer could also be approached from a study over time and with various types of training given to teachers.

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Appendix A
Glossary

Glossary of Terms

The following terms are defined as they apply to this study.

Academic classes: college classes taken for college credit taken for renewal of teaching certificate, professional development, or personal satisfaction.

Access: ability to use computer-based technology without constraints of location, time schedule, or availability.

Computer-based Technology: computers or any device connected to and controlled by the computer such as CD-ROMs, Internet access, LANs, Laserdisk, modems, or scanners.

Continuous training: Training conducted on an ongoing basis throughout the year to provide the teachers with the necessary competencies for employing computer-based technology in instruction.

Exemplary: practices which have broken with traditional practice which employs computers largely as substitutes for paper-and-pencil worksheets and for "enrichment" to reward the completion of other work. The use of a wide variety of computer software--including simulations, programming languages, spreadsheets, database programs, graphing programs, logic and problem-solving programs, writing tools, and electronic bulletin-board communications software--often working collaboratively, to directly address class curricular goals (Becker, 1994b).

Influence: factors which have an affect on the decision of teachers to use computer-based technology for instruction.

Initial training: Training provided at the time when new equipment or software is provided to teachers for use in instruction.

Just-in-time training: Training provided only at the time and in the amounts which are necessary at a particular time, not overloading an individual with more information than what is needed at a particular time.

Practice: to exercise, train, drill, or carry on an activity which gives the teacher experience in using computer-based technology for instruction.

Telecommunications: Communication over a distance using a means such as telephone lines, Internet, or satellite.

Use: the customary practice of using computer-based technology for instruction which is described as low, medium and high use.

Workshop: Training provided county school systems which are one to three days in length and do not carry any academic credit.

Web/WWW: World Wide Web

Appendix B
Survey

INSTRUCTIONAL TECHNOLOGY USE STUDY

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"This survey is being conducted under guidelines established by Virginia Tech. By cooperating, you will help the survey administrator find answers to important questions; however, your participation is strictly voluntary. You should omit any questions which you feel unduly invade your privacy or which are otherwise offensive to you. Confidentiality is guaranteed; your name will not be associated with your answers in any public or private report of the results."

Instructions:

Your response should be based on your experience as a teacher in your current teaching discipline. **Please answer all questions as best as you can.** Please use a **#2 lead pencil** or **pen with dark ink** to mark your answer sheet.
PART ONE: Please answer the following questions with a lead pencil. If you are not familiar with the terms, it is likely that you do not have this equipment.

	Section I: Computer-based Technology Usage	**Y**	**N**	**NA**				
Div	**Please answer the following questions based on the following coding.** **Y---Yes N---No NA---Not Available**							
1	**Do you use computers for instructional purposes?**							
	(if your answer to the above question is no, go to Part Two, Section II)							
	Do you use CD-ROMs (5 1/4" disk, like an audio CD)?							
	Do you use LCD (Liquid Crystal Display) projection panels?							
	Do you use the Internet?							
	Do you use a LAN (Local Area Network)?							
	Do you use a Laserdisk (11" disk, like an LP record) connected to a computer?							
	Do you use a scanner (a device which scans text or images into a computer)?							
	Do you use a modem (a device used to connect two computers by telephone line)?							
	Do you use a digital camera (stores pictures electronically for computer use)?							
	Do you use an Integrated Learning System (i.e. Jostens)?							
	Other (please specify)_____							
	Approximately how often do you use computer-based technology for the following types of instructional activities. Please answer "D---Daily", "ED---Every Other Day", "W--Weekly", "EW--Every Other Week", "M--Monthly", "EM--Every Other Month or Less", or "Never", to the following questions.	**D**	**ED**	**W**	**EW**	**M**	**EM**	**N**
2	**I use computer-based technology for:**							
	tutorials							
	testing							
	presentation of new material							
	remediation/acceleration							
	keyboarding							
	drill and practice							
	recreational & educational games							
	enrichment activities							
	experimentations/simulations							
	information access via CD-ROMs(i.e. ERIC, Compton's, Grolier's or Encarta)							
	information access via the Internet							
	word processing							
	authoring							
	multimedia applications(with combinations of text, audio, video, & images)							

	Approximately how often do you use computer-based technology for the following types of instructional activities. Please answer "D---Daily", "ED---Every Other Day", "W--Weekly", "EW--Every Other Week", "M--Monthly", "EM--Every Other Month or Less", or "Never", to the following questions.	**D**	**ED**	**W**	**EW**	**M**	**EM**	**N**
	problem solving							
	collaborative learning							
	other (please specify)_____							
	Please indicate which type/types of computer/Internet access you have by using "C--classroom", "L--computer lab", "M--media center", "H--home" or "N--none". You may have more than one answer for the questions in Part 1 of this section, check all that apply	**C**	**L**	**M**	**H**	**N**		
Div	**Section II: Computer-based Technology Access**							
1	**Types of computer and Internet access**							
	The computers that I use for instruction are in the							
	The Internet access I use for instruction is in the							
	The modems I use are in the							
	The ethernet connection I use is in the							
	Please indicate "Y--Yes" or "N--No" for the following questions.	**Y**	**N**					
2	**Do you use the Internet for**							
	e-mail?							
	information access via Web browsers (e.g. Netscape)?							
	transferring files (e.g. FTP)?							
	news or bulletin boards?							
	downloading software?							
	database access?							
3	**Is your Internet access through a**							
	college or university?							
	state service?							
	educational service?							
	commercial provider (e.g. America Online or a local provider)?							
	Section III: Computer-based Technology Training and Support							
Div	**Please answer "Y---Yes", "N---No", "A---No, But Would if Available" as answers to each of the following statements. Answer as many as apply to you.**	**Y**	**N**	**A**				
1	**The type/types of computer training I have had are _____**							
	initial (training when I first got my computer/s)							
	just-in-time (only training that was needed at the time)							
	continuous (a continuous training program throughout the year)							
	academic classes (classes taken for college credit or renewal)							
	workshops given by my county							
	non credit workshops given by other agencies							
	peer (training received from other teachers or individuals)							
	self taught							
2	**My training has**							
	taught me to competently operate computers?							

	taught me how to implement computers into my curriculum?			
	Please answer "Y---Yes", "N---No", "A---No, But Would if Available" as answers to each of the following statements. Answer as many as apply to you.	**Y**	**N**	**A**
	taught me how to evaluate software/hardware for instruction?			
	been for self-improvement?			
	fit my time schedule?			
	been hands-on experience?			
	Please answer "Y--Yes", "N--No", or "D--Don't Know" to the following statements/questions.	**Y**	**N**	**D**
3	**My support is adequate**			
	at the county level?			
	district level?			
	school level?			
4	**Would you like more _____support?**			
	training			
	technical			
	financial			

PART TWO: Please check the ones that are most appropriate on the questionnaire.

Section I: Inventory

8. Indicate the numbers of computers available to you for instructional activities?

a. IBM/compatible(clone)

_____ 1. PC Jr. _____ 4. 286 _____ 7. Pentium
_____ 2. PC/XT _____ 5. 386 _____ 8. Don't Know
_____ 3. AT _____ 6. 486

b. Macintosh series

_____ 1. Classic _____ 5. Quadra _____ 9. Don't Know
_____ 2. SE _____ 6. Quadra A/V
_____ 3. LC _____ 7. PowerPC
_____ 4. CI _____ 8. PowerPC A/V

_____ c. APPLE II series (IIgs, IIe, Iic)

_____ d. Tandy _____ e. Commodore _____ f. Other _____ g. Don't Know

9. To how many modems do you have access for instructional purposes? _____

10. What speed are the modems which you use?
_____ a. 28800 baud _____ b. 14400 baud _____ c. 9600 baud _____ d. slower than 9600 baud
_____ e. none

11. To how many ethernet connections do you have access for instructional purposes? _____

12. Are students expected to use the computer in the classroom? _____

13. Are students expected to use the computer outside the classroom? _____

14. Approximately how much time each day do you spend in the preparation for and utilization of computer-based technology for instructional purposes? (check one)
_____ a. 15 min. _____ c. 45 min. _____ e. more than 60 min.
_____ b. 30 min. _____ d. 60 min. _____ f. do not use

15. How many computer courses have you taken?
_____ a. One _____ b. Two _____ c. Three _____ d. More than three _____ e. None

16. Of the computer courses that you have taken how many were in the areas of:
_____ a. computer operation _____ b. presentation graphics _____ c. telecommunications
_____ d. multimedia _____ e. curriculum integration

Section II: Demographics

17. My age is: (check one)
____ a. 20-30 years ____ d. 51-60
____ b. 31-40 ____ e. 61 or more
____ c. 41-50

18. Gender? (check one)
____ a. Male ____ b. Female

19. My highest degree (check one)
____ a. Bachelor's ____ b. Master's ____ c. Ph.D./Ed.D. _____ d. other.

20. Including this year, I have ___ years of full-time teaching experience. (check one)
____ a. 0 - 3 ____ d. 11 - 14
____ b. 4 - 6 ____ e. 15 and over
____ c. 7 - 10

21. Average number of students in your class/classes. _____

22. I teach the major portion of my day in the ____ grade level. (check one)
____ a. Elementary ____ c. Jr. High ____ e. Other
____ b. Middle ____ d. Sr. High

23. If you are a middle, jr. high or sr. high teacher, what is your subject area?
_____ Grammar _____ Foreign Language _____ Business
_____ Science _____ Math _____ Social Studies
_____ Computer Programming Other _____
Please Specify

24. I have used a computer for _____ years at home.
_____ a. less than a year _____ d. 3 years _____ g. more that 5 years
_____ b. 1 year _____ e. 4 years
_____ c. 2 years _____ f. 5 years

25. I have used a computer for _____ years in my teaching.

This is the end of the study. Thank you very much for your effort and input. ***Please return the survey to*****William E. Jaber** ***in the stamped self-addressed envelope.*** Once again, your participation is greatly appreciated.

Appendix C
ISTE Computer Competencies and Skills Guideline

Recommendations of ISTE for national accreditation standards for educational technology. According to ISTE (International Society for Technology in Education), all teachers should be able to perform the following tasks:

1. operate a computer system in order to use software successfully;

2. evaluate and use computers and other related technologies to support the instructional process;

3. apply current instructional principles, research, and appropriate assessment practices to the use of computers and related technologies;

4. explore, evaluate, and use computer technology-based materials;

5. demonstrate knowledge of uses of computers for problem solving, data collection, information management, communications presentations, and decision making;

6. design and develop student learning activities that integrate computing and technology for a variety of student grouping strategies and for diverse student populations;

7. evaluate, select, and integrate computer technology-based instruction in the curriculum of one's subject area(s) and/or grade level(s);

8. demonstrate knowledge of multimedia, hypermedia, and telecommunications activities to support instruction;

9. demonstrate skill in using productivity tools for professional and personal use, including word processing, database, spreadsheet, and print/graphic utilities;

10. demonstrate knowledge of equity, ethical, legal, and human issues of computing and technology

11. identify resources for staying current in applications of computing and related technologies in education;

12. use computer-based technologies to access information to enhance personal and professional productivity; and

13. apply computers and related technologies to facilitate emerging roles of the learner and the educator.

Appendix D
Cover Letter to Teachers

To: Public School Teachers in XXXXXXXX County
From: William E. Jaber
Re: Computer-based Technology Use Study
Date: March 3, 1997

Having come through the public school system in XXXXXXXX as a child and then teaching with some of you in my first teaching assignment in XXXXXXXX County, I appreciate your dedication to the teaching of public school children in XXXXXXXX County. No parent, school official, or political official can thank you enough for the impact and difference you are making on the children of XXXXXXXX County.

As a Ph. D. candidate in the process of doing my dissertation research at Virginia Polytechnic and State University, I am interested in the factors which influence the reasons for choosing or not choosing to use computer-based technology in instruction. With increasing commitments in technology, it is important for professional staff developers and teacher educators to know what factors influence your choice to use or not to use computer-based technology in instruction. Therefore the purpose of this study is to assess what factors are influential in your decision to use computer-based technology and provide direction for interested parties to improve access, training and planning for the use of computer-based technology in instruction.

You have been randomly selected to participate in this study. This study is confidential. No individual responses will be revealed. Your county has given me permission to conduct this survey and your principal has been notified of my efforts. Your participation by promptly completing the enclosed survey and returning it directly to me would be greatly appreciated. A stamped, self-addressed envelope has been provided for your convenience.

Thank you for your cooperation and help.

Sincerely,

William E. Jaber

Office: 220 War Memorial Hall
Virginia Tech
Blacksburg, VA 24061-0341
Phone: 540-231-5587

Home: 1543 East Main Street
Oak Hill, WV 25901
Phone: 304-465-1414
Email: wejaber@vt.edu

Appendix E
Cover Letter to Principals

To: Principals in XXXXXXXX County Public Schools
From: William E. Jaber
Re: Computer-based Technology Use Study
Date: March 3, 1997

I am a graduate student at Virginia Tech working on my Ph. D. in Instructional Technology, and live in Oak Hill, WV. I am conducting a survey of teacher in your county. I came through the public school system in XXXXXXXX as a child and then taught with some of you in my first teaching assignment in XXXXXXXX County. No parent, school official, or political official can thank you enough for the impact and difference you are making on the children of XXXXXXXX County.

As a Ph. D. candidate in the process of doing my dissertation research at Virginia Polytechnic and State University, I am interested in the factors which influence the reasons for choosing or not choosing to use computer-based technology in instruction. With increasing committments in technology, it is important for professional staff developers and teacher educators to know what factors influence your choice to use or not to use computer-based technology in instruction. Therefore the purpose of this study is to assess what factors are influential in teachers decision to use computer-based technology and provide direction for interested parties to improve access, training and planning for the use of computer-based technology in instruction.

I have received permission from Dr. XXXXXXXX XXXXXXXX to conduct this survey in your county. Teachers from your school have been randomly selected to participate in this survey. This study is confidential. No individual responses will be revealed. I need you help in conducting this survey. Could you encourage your teachers which have been selected to participate in this survey to promptly complete the survey and return it directly to me? I would greatly appreciate your help in this area. A stamped, self-addressed envelope has been provided for their convenience.

Thank you for your cooperation and help.

Sincerely,

William E. Jaber

Appendix F
Second Letter to Teachers

To: Public School Teachers in XXXXXXXX County
From: William E. Jaber
Re: Computer-based Technology Use Study
Date: March 20, 1997

I know that time is very important to you as a teacher and there are many demands being placed on your valuable time. A couple of weeks ago you were sent a survey in my efforts to collect data on teachers' use of computer-based technology. If you have not completed the survey or lost the first survey, could you take 15 minutes to fill out the enclosed survey and return it to me in the self-addressed, stamped envelope. If your response on the first survey and this request have crossed in the mail, please disregard this request and accept my thanks for your help in gathering data for my dissertation.

As I stated in the first request, you have been randomly selected to participate in this study. This study is confidential. No individual responses will be revealed. Your county has given me permission to conduct this survey and your principal has been notified of my efforts. Your participation by promptly completing the enclosed survey and returning it directly to me would be greatly appreciated. A stamped, self-addressed envelope has been provided for your convenience.

Thank you for your cooperation and help.

Sincerely,

William E. Jaber

Office: 220 War Memorial Hall
Virginia Tech
Blacksburg, VA 24061-0341
Phone: 540-231-5587
Email: wejaber@vt.edu

Appendix G
Third Letter to Teachers

To: Public School Teachers in XXXXXXXX County
From: William E. Jaber
Re: Computer-based Technology Use Study
Date: April 1, 1997

I trust that you had a restful and enjoyable Easter holiday. As the school year gets closer to an end, I know that you are very busy. However, I need your help by completing the Computer-based Technology Survey which you received several weeks ago. It should only take about 15 minutes to fill out the survey.

Yes, you still have the opportunity to complete and return the Computer-based Technology Survey which you received a couple of weeks ago! Don't delay and miss the opportunity to participate in this survey.

Your response is very important to my study and to your county. You do not have to be a computer user, but I do need you to respond in the next ***two or three days***. If you have already responded and our mail has crossed, please accept my thanks for your time and efforts. If you have not responded, would you please take the time, now, to fill out the survey and mail it back to me? You will be playing an important role in the completion of my Ph. D.

Again let me thank you for your time and help in filling out and returning the survey.

Sincerely,

William E. Jaber

Appendix H
Fourth Letter to Teachers

TO: Survey Participants
FROM: XXXXXXXXXXXX, Assistant Superintendent
DATE: April 3, 1997
SUBJECT: TECHNOLOGY SURVEY

It is my understanding that you have been selected as a participant in a Technology Survey for Bill Jaber. At the present time, Mr. Jaber has not received your completed survey. I realize this is a voluntary survey, but the information is quite valuable to both Mr. Jaber and to the school system. Although the information is confidential, the results of Mr. Jaber's study will be helpful to our school system.

If you would take a few minutes of your valuable time to complete and return the survey by Wednesday, April 9, 1997, it would be appreciated. If your survey is in the mail, let me take this opportunity to thank you for your time and consideration.

Appendix I
Table of Chi-square Tests for Question 1a

Summary of Chi-square Tests for Each Instructional Activity

Tutorials

Rows: Frequency of Use Columns: Computer Access

	Media Center	Multiple Access	Lab	Classroom	Row Margin
≤Weekly -- % of Access	1.11	28.89	16.67	53.33	100.00
% of Frequency of Use	11.11	57.78	46.88	72.73	59.21
% of Chi-square	0.66	17.11	9.87	31.58	59.21
Frequency	1	26	15	48	90
Expected Frequency	5.33	26.64	18.95	39.08	90
>Weekly -- % of Access	7.69	30.77	30.77	30.77	100.00
% of Frequency of Use	22.22	17.78	25	12.12	17.11
% of Chi-square	1.32	5.26	5.26	5.26	17.11
Frequency	2	8	8	8	26
Expected Frequency	1.54	7.7	5.47	11.29	26
Never -- % of Access	16.67	30.56	25	27.78	100.00
% of Frequency of Use	66.67	24.44	28.12	15.15	23.68
% of Chi-square	3.95	7.24	5.92	6.58	23.68
Frequency	6	11	9	10	36
Expected Frequency	2.13	10.66	7.58	15.63	36
Column Margin -- % of Access	5.92	29.61	21.05	43.42	100.00
% of Frequency of Use	100.00	100.00	100.00	100.00	100.00
% of Chi-square	5.92	29.61	21.05	43.42	100.00
Frequency	9	45	32	66	152
Expected Frequency	9	45	32	66	152

Chi-Square = 17.992, DF = 6, P-Value = 0.006
2 cells with expected counts less than 5.0

(table continues)

Testing

Rows: Frequency of Use Columns: Computer Access

	Media Center	Multiple Access	Lab	Classroom	Row Margin
≤Weekly -- % of Access	3.85	40.38	17.31	38.46	100.00
% of Frequency of Use	25	47.73	26.47	31.75	34.9
% of Chi-square	1.34	14.09	6.04	13.42	34.9
Frequency	2	21	9	20	52
Expected Frequency	2.79	15.36	11.87	21.99	52
>Weekly -- % of Access	--	31.82	31.82	36.36	100.00
% of Frequency of Use	--	15.91	20.59	12.7	14.77
% of Chi-square	--	4.7	4.7	5.37	14.77
Frequency	0	7	7	8	22
Expected Frequency	1.18	6.5	5.02	9.3	22
Never -- % of Access	8	21.33	24	46.67	100.00
% of Frequency of Use	75	36.36	52.94	55.56	50.34
% of Chi-square	4.03	10.74	12.08	23.49	50.34
Frequency	6	16	18	35	75
Expected Frequency	4.03	22.15	17.11	31.71	75
Column Margin -- % of Access	5.37	29.53	22.82	42.28	100.00
% of Frequency of Use	100.00	100.00	100.00	100.00	100.00
% of Chi-square	5.37	29.53	22.82	42.28	100.00
Frequency	8	44	34	63	149
Expected Frequency	8	44	34	63	149

Chi-Square = 8.414, DF = 6, P-Value = 0.209
3 cells with expected counts less than 5.0

(table continues)

Presentation of New Material

Rows: Frequency of Use Columns Computer Access

	Media Center	Multiple Access	Lab	Classroom	Row Margin
≤Weekly -- % of Access	4.69	34.37	15.62	45.31	100.00
% of Frequency of Use	30	47.83	32.26	46.03	42.67
% of Chi-square	2	14.67	6.67	19.33	42.67
Frequency	3	22	10	29	64
Expected Frequency	4.27	19.63	13.23	26.88	64
>Weekly -- % of Access	5.56	36.11	27.78	30.56	100.00
% of Frequency of Use	20	28.26	32.26	17.46	24
% of Chi-square	1.33	8.67	6.67	7.33	24
Frequency	2	13	10	11	36
Expected Frequency	2.4	11.04	7.44	15.12	36
Never -- % of Access	10	22	22	46	100.00
% of Frequency of Use	50	23.91	35.48	36.51	33.33
% of Chi-square	3.33	7.33	7.33	15.33	33.33
Frequency	5	11	11	23	50
Expected Frequency	3.33	15.33	10.33	21	50
Column Margin -- % of Access	6.67	30.67	20.67	42	100.00
% of Frequency of Use	100.00	100.00	100.00	100.00	100.00
% of Chi-square	6.67	30.67	20.67	42	100.00
Frequency	10	46	31	63	150
Expected Frequency	10	46	31	63	150

Chi-Square = 6.327, DF = 6, P-Value = 0.387
3 cells with expected counts less than 5.0

(table continues)

Remediation/Acceleration

Rows: Frequency of Use Columns: Computer Access

	Media Center	Multiple Access	Lab	Classroom	Row Margin
≤Weekly -- % of Access	3.74	31.78	16.82	47.66	100.00
% of Frequency of Use	44.44	73.91	56.25	76.12	69.48
% of Chi-square	2.6	22.08	11.69	33.12	69.48
Frequency	4	34	18	51	107
Expected Frequency	6.25	31.96	22.23	46.55	107
>Weekly -- % of Access	7.41	33.33	37.04	22.22	100.00
% of Frequency of Use	22.22	19.57	31.25	8.96	17.53
% of Chi-square	1.3	5.84	6.49	3.9	17.53
Frequency	2	9	10	6	27
Expected Frequency	1.58	8.06	5.61	11.75	27
Never -- % of Access	15	15	20	50	100.00
% of Frequency of Use	33.33	6.52	12.5	14.93	12.99
% of Chi-square	1.95	1.95	2.6	6.49	12.99
Frequency	3	3	4	10	20
Expected Frequency	1.17	5.97	4.16	8.7	20
Column Margin -- % of Access	5.84	29.87	20.78	43.51	100.00
% of Frequency of Use	100.00	100.00	100.00	100.00	100.00
% of Chi-square	5.84	29.87	20.78	43.51	100.00
Frequency	9	46	32	67	154
Expected Frequency	9	46	32	67	154

Chi-Square = 13.189, DF = 6, P-Value = 0.040
3 cells with expected counts less than 5.0

(table continues)

Keyboarding

Rows: Frequency of Use Columns: Computer Access

	Media Center	Multiple Access	Lab	Classroom	Row Margin
≤Weekly -- % of Access	4.35	28.99	18.84	47.83	100.00
% of Frequency of Use	33.33	44.44	41.94	52.38	46.62
% of Chi-square	2.03	13.51	8.78	22.3	46.62
Frequency	3	20	13	33	69
Expected Frequency	4.2	20.98	14.45	29.37	69
>Weekly -- % of Access	--	47.83	21.74	30.43	100.00
% of Frequency of Use	--	24.44	16.13	11.11	15.54
% of Chi-square	--	7.43	3.38	4.73	15.54
Frequency	0	11	5	7	23
Expected Frequency	1.4	6.99	4.82	9.79	23
Never -- % of Access	10.71	25	23.21	41.07	100.00
% of Frequency of Use	66.67	31.11	41.94	36.51	37.84
% of Chi-square	4.05	9.46	8.78	15.54	37.84
Frequency	6	14	13	23	56
Expected Frequency	3.41	17.03	11.73	23.84	56
Column Margin -- % of Access	6.08	30.41	20.95	42.57	100.00
% of Frequency of Use	100.00	100.00	100.00	100.00	100.00
% of Chi-square	6.08	30.41	20.95	42.57	100.00
Frequency	9	45	31	63	148
Expected Frequency	9	45	31	63	148

Chi-Square = 8.159, DF = 6, P-Value = 0.226
4 cells with expected counts less than 5.0

(table continues)

Drill and Practice

Rows: Frequency of Use Columns: Computer Access

	Media Center	Multiple Access	Lab	Classroom	Row Margin
≤Weekly -- % of Access	2.7	27.93	17.12	52.25	100.00
% of Frequency of Use	30	67.39	57.58	85.29	70.7
% of Chi-square	1.91	19.75	12.1	36.94	70.7
Frequency	3	31	19	58	111
Expected Frequency	7.07	32.52	23.33	48.08	111
>Weekly -- % of Access	--	42.86	28.57	28.57	100.00
% of Frequency of Use	--	26.09	24.24	11.76	17.83
% of Chi-square	--	7.64	5.1	5.1	17.83
Frequency	0	12	8	8	28
Expected Frequency	1.78	8.2	5.89	12.13	28
Never -- % of Access	38.89	16.67	33.33	11.11	100.00
% of Frequency of Use	70	6.52	18.18	2.94	11.46
% of Chi-square	4.46	1.91	3.82	1.27	11.46
Frequency	7	3	6	2	18
Expected Frequency	1.15	5.27	3.78	7.8	18
Column Margin -- % of Access	6.37	29.3	21.02	43.31	100.00
% of Frequency of Use	100.00	100.00	100.00	100.00	100.00
% of Chi-square	6.37	29.3	21.02	43.31	100.00
Frequency	10	46	33	68	157
Expected Frequency	10	46	33	68	157

Chi-Square = 47.445, DF = 6, P-Value = 0.000
3 cells with expected counts less than 5.0

(table continues)

Recreational & Educational Games

Rows: Frequency of Use Columns: Computer

	Media Center	Multiple Access	Lab	Classroom	Row Margin
≤Weekly -- % of Access	3.3	27.47	14.29	54.95	100.00
% of Frequency of Use	30	53.19	38.24	70.42	56.17
% of Chi-square	1.85	15.43	8.02	30.86	56.17
Frequency	3	25	13	50	91
Expected Frequency	5.62	26.4	19.1	39.88	91
>Weekly -- % of Access	6.38	25.53	31.91	36.17	100.00
% of Frequency of Use	30	25.53	44.12	23.94	29.01
% of Chi-square	1.85	7.41	9.26	10.49	29.01
Frequency	3	12	15	17	47
Expected Frequency	2.9	13.64	9.86	20.6	47
Never -- % of Access	16.67	41.67	25	16.67	100.00
% of Frequency of Use	40	21.28	17.65	5.63	14.81
% of Chi-square	2.47	6.17	3.7	2.47	14.81
Frequency	4	10	6	4	24
Expected Frequency	1.48	6.96	5.04	10.52	24
Column Margin -- % of Access	6.17	29.01	20.99	43.83	100.00
% of Frequency of Use	100.00	100.00	100.00	100.00	100.00
% of Chi-square	6.17	29.01	20.99	43.83	100.00
Frequency	10	47	34	71	162
Expected Frequency	10	47	34	71	162

Chi-Square = 19.140, DF = 6, P-Value = 0.004
2 cells with expected counts less than 5.0

(table continues)

Enrichment Activities

Rows: Frequency of Use Columns: Computer Access

	Media Center	Multiple Access	Lab	Classroom	Row Margin
≤Weekly -- % of Access	3.12	30.21	14.58	52.08	100.00
% of Frequency of Use	30	61.7	41.18	73.53	60.38
% of Chi-square	1.89	18.24	8.81	31.45	60.38
Frequency	3	29	14	50	96
Expected Frequency	6.04	28.38	20.53	41.06	96
>Weekly -- % of Access	11.11	33.33	28.89	26.67	100.00
% of Frequency of Use	50	31.91	38.24	17.65	28.3
% of Chi-square	3.14	9.43	8.18	7.55	28.3
Frequency	5	15	13	12	45
Expected Frequency	2.83	13.3	9.62	19.25	45
Never -- % of Access	11.11	16.67	38.89	33.33	100.00
% of Frequency of Use	20	6.38	20.59	8.82	11.32
% of Chi-square	1.26	1.89	4.4	3.77	11.32
Frequency	2	3	7	6	18
Expected Frequency	1.13	5.32	3.85	7.7	18
Column Margin -- % of Access	6.29	29.56	21.38	42.77	100.00
% of Frequency of Use	100.00	100.00	100.00	100.00	100.00
% of Chi-square	6.29	29.56	21.38	42.77	100.00
Frequency	10	47	34	68	159
Expected Frequency	10	47	34	68	159

Chi-Square = 15.991, DF = 6, P-Value = 0.014
3 cells with expected counts less than 5.0

(table continues)

Experimentations/Simulations

Rows: Frequency of Use Columns: Computer Access

	Media Center	Multiple Access	Lab	Classroom	Row Margin
≤Weekly -- % of Access	4.17	33.33	16.67	45.83	100.00
% of Frequency of Use	10	17.78	12.9	17.74	16.22
% of Chi-square	0.68	5.41	2.7	7.43	16.22
Frequency	1	8	4	11	24
Expected Frequency	1.62	7.3	5.03	10.05	24
>Weekly -- % of Access	--	41.94	19.35	38.71	100.00
% of Frequency of Use	--	28.89	19.35	19.35	20.95
% of Chi-square	--	8.78	4.05	8.11	20.95
Frequency	0	13	6	12	31
Expected Frequency	2.09	9.43	6.49	12.99	31
Never -- % of Access	9.68	25.81	22.58	41.94	100.00
% of Frequency of Use	90	53.33	67.74	62.9	62.84
% of Chi-square	6.08	16.22	14.19	26.35	62.84
Frequency	9	24	21	39	93
Expected Frequency	6.28	28.28	19.48	38.96	93
Column Margin -- % of Access	6.76	30.41	20.95	41.89	100.00
% of Frequency of Use	100.00	100.00	100.00	100.00	100.00
% of Chi-square	6.76	30.41	20.95	41.89	100.00
Frequency	10	45	31	62	148
Expected Frequency	10	45	31	62	148

Chi-Square = 6.107, DF = 6, P-Value = 0.411
2 cells with expected counts less than 5.0

(table continues)

Information Access via CD-ROMs

Rows: Frequency of Use Columns: Computer Access

	Media Center	Multiple Access	Lab	Classroom	Row Margin
≤Weekly -- % of Access	11.76	41.18	17.65	29.41	100.00
% of Frequency of Use	40	31.82	20	15.38	22.82
% of Chi-square	2.68	9.4	4.03	6.71	22.82
Frequency	4	14	6	10	34
Expected Frequency	2.28	10.04	6.85	14.83	34
>Weekly -- % of Access	13.33	30	30	26.67	100.00
% of Frequency of Use	40	20.45	30	12.31	20.13
% of Chi-square	2.68	6.04	6.04	5.37	20.13
Frequency	4	9	9	8	30
Expected Frequency	2.01	8.86	6.04	13.09	30
Never -- % of Access	2.35	24.71	17.65	55.29	100.00
% of Frequency of Use	20	47.73	50	72.31	57.05
% of Chi-square	1.34	14.09	10.07	31.54	57.05
Frequency	2	21	15	47	85
Expected Frequency	5.7	25.1	17.11	37.08	85
Column Margin -- % of Access	6.71	29.53	20.13	43.62	100.00
% of Frequency of Use	100.00	100.00	100.00	100.00	100.00
% of Chi-square	6.71	29.53	20.13	43.62	100.00
Frequency	10	44	30	65	149
Expected Frequency	10	44	30	65	149

Chi-Square = 15.915, DF = 6, P-Value = 0.014
2 cells with expected counts less than 5.0

(table continues)

Information Access via the Internet

Rows: Frequency of Use Columns: Computer Access

	Media Center	Multiple Access	Lab	Classroom	Row Margin
≤Weekly -- % of Access	15.38	30.77	23.08	30.77	100.00
% of Frequency of Use	20	9.3	10	6.25	8.84
% of Chi-square	1.36	2.72	2.04	2.72	8.84
Frequency	2	4	3	4	13
Expected Frequency	0.88	3.8	2.65	5.66	13
>Weekly -- % of Access	11.76	41.18	29.41	17.65	100.00
% of Frequency of Use	20	16.28	16.67	4.69	11.56
% of Chi-square	1.36	4.76	3.4	2.04	11.56
Frequency	2	7	5	3	17
Expected Frequency	1.16	4.97	3.47	7.4	17
Never -- % of Access	5.13	27.35	18.8	48.72	100.00
% of Frequency of Use	60	74.42	73.33	89.06	79.59
% of Chi-square	4.08	21.77	14.97	38.78	79.59
Frequency	6	32	22	57	117
Expected Frequency	7.96	34.22	23.88	50.94	117
Column Margin -- % of Access	6.8	29.25	20.41	43.54	100.00
% of Frequency of Use	100.00	100.00	100.00	100.00	100.00
% of Chi-square	6.8	29.25	20.41	43.54	100.00
Frequency	10	43	30	64	147
Expected Frequency	10	43	30	64	147

Chi-Square = 8.180, DF = 6
* WARNING * 1 cells with expected counts less than 1.0
* Chi-Square approximation probably invalid
6 cells with expected counts less than 5.0

(table continues)

Word Processing

Rows: Frequency of Use Columns: Computer Access

	Media Center	Multiple Access	Lab	Classroom	Row Margin
≤Weekly -- % of Access	5.26	35.09	19.3	40.35	100.00
% of Frequency of Use	30	44.44	33.33	34.33	36.77
% of Chi-square	1.94	12.9	7.1	14.84	36.77
Frequency	3	20	11	23	57
Expected Frequency	3.68	16.55	12.14	24.64	57
>Weekly -- % of Access	8.82	35.29	20.59	35.29	100.00
% of Frequency of Use	30	26.67	21.21	17.91	21.94
% of Chi-square	1.94	7.74	4.52	7.74	21.94
Frequency	3	12	7	12	34
Expected Frequency	2.19	9.87	7.24	14.7	34
Never -- % of Access	6.25	20.31	23.44	50	100.00
% of Frequency of Use	40	28.89	45.45	47.76	41.29
% of Chi-square	2.58	8.39	9.68	20.65	41.29
Frequency	4	13	15	32	64
Expected Frequency	4.13	18.58	13.63	27.66	64
Column Margin -- % of Access	6.45	29.03	21.29	43.23	100.00
% of Frequency of Use	100.00	100.00	100.00	100.00	100.00
% of Chi-square	6.45	29.03	21.29	43.23	100.00
Frequency	10	45	33	67	155
Expected Frequency	10	45	33	67	155

Chi-Square = 4.817, DF = 6, P-Value = 0.567
3 cells with expected counts less than 5.0

(table continues)

Authoring

Rows: Frequency of Use Columns: Computer Access

	Media Center	Multiple Access	Lab	Classroom	Row Margin
≤Weekly -- % of Access	2.94	38.24	17.65	41.18	100.00
% of Frequency of Use	11.11	30.95	18.75	21.21	22.82
% of Chi-square	0.67	8.72	4.03	9.4	22.82
Frequency	1	13	6	14	34
Expected Frequency	2.05	9.58	7.3	15.06	34
>Weekly -- % of Access	3.45	20.69	24.14	51.72	100.00
% of Frequency of Use	11.11	14.29	21.87	22.73	19.46
% of Chi-square	0.67	4.03	4.7	10.07	19.46
Frequency	1	6	7	15	29
Expected Frequency	1.75	8.17	6.23	12.85	29
Never -- % of Access	8.14	26.74	22.09	43.02	100.00
% of Frequency of Use	77.78	54.76	59.37	56.06	57.72
% of Chi-square	4.7	15.44	12.75	24.83	57.72
Frequency	7	23	19	37	86
Expected Frequency	5.19	24.24	18.47	38.09	86
Column Margin -- % of Access	6.04	28.19	21.48	44.3	100.00
% of Frequency of Use	100.00	100.00	100.00	100.00	100.00
% of Chi-square	6.04	28.19	21.48	44.3	100.00
Frequency	9	42	32	66	149
Expected Frequency	9	42	32	66	149

Chi-Square = 4.161, DF = 6, P-Value = 0.655
2 cells with expected counts less than 5.0

(table continues)

Multimedia Applications

Rows: Frequency of Use Columns: Computer Access

	Media Center	Multiple Access	Lab	Classroom	Row Margin
≤Weekly -- % of Access	10	36.67	13.33	40	100.00
% of Frequency of Use	30	25	13.79	18.18	20.13
% of Chi-square	2.01	7.38	2.68	8.05	20.13
Frequency	3	11	4	12	30
Expected Frequency	2.01	8.86	5.84	13.29	30
>Weekly -- % of Access	12.12	36.36	21.21	30.3	100.00
% of Frequency of Use	40	27.27	24.14	15.15	22.15
% of Chi-square	2.68	8.05	4.7	6.71	22.15
Frequency	4	12	7	10	33
Expected Frequency	2.21	9.74	6.42	14.62	33
Never -- % of Access	3.49	24.42	20.93	51.16	100.00
% of Frequency of Use	30	47.73	62.07	66.67	57.72
% of Chi-square	2.01	14.09	12.08	29.53	57.72
Frequency	3	21	18	44	86
Expected Frequency	5.77	25.4	16.74	38.09	86
Column Margin -- % of Access	6.71	29.53	19.46	44.3	100.00
% of Frequency of Use	100.00	100.00	100.00	100.00	100.00
% of Chi-square	6.71	29.53	19.46	44.3	100.00
Frequency	10	44	29	66	149
Expected Frequency	10	44	29	66	149

Chi-Square = 8.279, DF = 6, P-Value = 0.218
2 cells with expected counts less than 5.0

(table continues)

Problem Solving

Rows: Frequency of Use Columns: Computer Access

	Media Center	Multiple Access	Lab	Classroom	Row Margin
≤Weekly -- % of Access	3.53	32.94	14.12	49.41	100.00
% of Frequency of Use	30	63.64	36.36	62.69	55.19
% of Chi-square	1.95	18.18	7.79	27.27	55.19
Frequency	3	28	12	42	85
Expected Frequency	5.52	24.29	18.21	36.98	85
>Weekly -- % of Access	3.7	25.93	29.63	40.74	100.00
% of Frequency of Use	10	15.91	24.24	16.42	17.53
% of Chi-square	0.65	4.55	5.19	7.14	17.53
Frequency	1	7	8	11	27
Expected Frequency	1.75	7.71	5.79	11.75	27
Never -- % of Access	14.29	21.43	30.95	33.33	100.00
% of Frequency of Use	60	20.45	39.39	20.9	27.27
% of Chi-square	3.9	5.84	8.44	9.09	27.27
Frequency	6	9	13	14	42
Expected Frequency	2.73	12	9	18.27	42
Column Margin -- % of Access	6.49	28.57	21.43	43.51	100.00
% of Frequency of Use	100.00	100.00	100.00	100.00	100.00
% of Chi-square	6.49	28.57	21.43	43.51	100.00
Frequency	10	44	33	67	154
Expected Frequency	10	44	33	67	154

Chi-Square = 13.258, DF = 6, P-Value = 0.039
2 cells with expected counts less than 5.0

(table continues)

Collaborative Learning

Rows: Frequency of Use Columns: Computer Access

	Media Center	Multiple Access	Lab	Classroom	Row Margin
≤Weekly -- % of Access	3.9	29.87	12.99	53.25	100.00
% of Frequency of Use	30	51.11	33.33	61.19	50.66
% of Chi-square	1.97	15.13	6.58	26.97	50.66
Frequency	3	23	10	41	77
Expected Frequency	5.07	22.8	15.2	33.94	77
>Weekly -- % of Access	9.68	32.26	25.81	32.26	100.00
% of Frequency of Use	30	22.22	26.67	14.93	20.39
% of Chi-square	1.97	6.58	5.26	6.58	20.39
Frequency	3	10	8	10	31
Expected Frequency	2.04	9.18	6.12	13.66	31
Never -- % of Access	9.09	27.27	27.27	36.36	100
% of Frequency of Use	40	26.67	40	23.88	28.95
% of Chi-square	2.63	7.89	7.89	10.53	28.95
Frequency	4	12	12	16	44
Expected Frequency	2.89	13.03	8.68	19.39	44
Column Margin -- % of Access	6.58	29.61	19.74	44.08	100.00
% of Frequency of Use	100.00	100.00	100.00	100.00	100.00
% of Chi-square	6.58	29.61	19.74	44.08	100.00
Frequency	10	45	30	67	152
Expected Frequency	10	45	30	67	152

Chi-Square = 8.540, DF = 6, P-Value = 0.201
2 cells with expected counts less than 5.0

Appendix J
Table of Chi-square Tests for Question 3

Summary Table of Planning Statistics

Cell Contents --
% of Row
% of Col
% of Tbl
Count
Exp Freq

Tutorials

Rows: Frequency of Use Columns: Planning	15 Min.	30 Min.	45 Min.	60 Min.	> 60 Min	Row Margin
Weekly or Less Than Weekly -- % of Access	37.08	30.34	12.36	6.74	13.48	100
% of Frequency of Use	63.46	67.5	73.33	66.67	85.71	68.46
% of Chi-square	25.38	20.77	8.46	4.62	9.23	68.46
Frequency	33	27	11	6	12	89
Expected Frequency	35.6	27.38	10.27	6.16	9.58	89
More Than Weekly -- % of Access	52.94	17.65	11.76	11.76	5.88	100
% of Frequency of Use	17.31	7.5	13.33	22.22	7.14	13.08
% of Chi-square	6.92	2.31	1.54	1.54	0.77	13.08
Frequency	9	3	2	2	1	17
Expected Frequency	6.8	5.23	1.96	1.18	1.83	17
Never -- % of Access	41.67	41.67	8.33	4.17	4.17	100
% of Frequency of Use	19.23	25	13.33	11.11	7.14	18.46
% of Chi-square	7.69	7.69	1.54	0.77	0.77	18.46
Frequency	10	10	2	1	1	24
Expected Frequency	9.6	7.38	2.77	1.66	2.58	24
Column Margin -- % of Access	40	30.77	11.54	6.92	10.77	100
% of Frequency of Use	100	100	100	100	100	100
% of Chi-square	40	30.77	11.54	6.92	10.77	100
Frequency	52	40	15	9	14	130
Expected Frequency	52	40	15	9	14	130

Chi-Square = 5.868, DF = 8, P-Value = 0.662
6 cells with expected counts less than 5.0

(table continues)

Testing

Rows: Frequency of Use Columns: Planning	15 Min.	30 Min.	45 Min.	60 Min.	> 60 Min	Row Margin
Weekly or Less Than Weekly -- % of Access	31.37	39.22	15.69	3.92	9.8	100
% of Frequency of Use	29.63	52.63	53.33	22.22	45.45	40.16
% of Chi-square	12.6	15.75	6.3	1.57	3.94	40.16
Frequency	16	20	8	2	5	51
Expected Frequency	21.69	15.26	6.02	3.61	4.42	51
More Than Weekly -- % of Access	38.89	27.78	22.22	5.56	5.56	100
% of Frequency of Use	12.96	13.16	26.67	11.11	9.09	14.17
% of Chi-square	5.51	3.94	3.15	0.79	0.79	14.17
Frequency	7	5	4	1	1	18
Expected Frequency	7.65	5.39	2.13	1.28	1.56	18
Never -- % of Access	53.45	22.41	5.17	10.34	8.62	100
% of Frequency of Use	57.41	34.21	20	66.67	45.45	45.67
% of Chi-square	24.41	10.24	2.36	4.72	3.94	45.67
Frequency	31	13	3	6	5	58
Expected Frequency	24.66	17.35	6.85	4.11	5.02	58
Column Margin -- % of Access	42.52	29.92	11.81	7.09	8.66	100
% of Frequency of Use	100	100	100	100	100	100
% of Chi-square	42.52	29.92	11.81	7.09	8.66	100
Frequency	54	38	15	9	11	127
Expected Frequency	54	38	15	9	11	127

Chi-Square = 12.159, DF = 8, P-Value = 0.144
6 cells with expected counts less than 5.0

(table continues)

Presentation of New Material

Rows: Frequency of Use Columns: Planning	15 Min.	30 Min.	45 Min.	60 Min.	> 60 Min	Row Margin
Weekly or Less Than Weekly -- % of Access	25	35.94	14.06	4.69	20.31	100
% of Frequency of Use	32	58.97	60	37.5	81.25	50
% of Chi-square	12.5	17.97	7.03	2.34	10.16	50
Frequency	16	23	9	3	13	64
Expected Frequency	25	19.5	7.5	4	8	64
More Than Weekly -- % of Access	33.33	40.74	14.81	11.11	--	100
% of Frequency of Use	18	28.21	26.67	37.5	--	21.09
% of Chi-square	7.03	8.59	3.12	2.34	--	21.09
Frequency	9	11	4	3	0	27
Expected Frequency	10.55	8.23	3.16	1.69	3.37	27
Never -- % of Access	67.57	13.51	5.41	5.41	8.11	100
% of Frequency of Use	50	12.82	13.33	25	18.75	28.91
% of Chi-square	19.53	3.91	1.56	1.56	2.34	28.91
Frequency	25	5	2	2	3	37
Expected Frequency	14.45	11.27	4.34	2.31	4.62	37
Column Margin -- % of Access	39.06	30.47	11.72	6.25	12.5	100
% of Frequency of Use	100	100	100	100	100	100
% of Chi-square	39.06	30.47	11.72	6.25	12.5	100
Frequency	50	39	15	8	16	128
Expected Frequency	50	39	15	8	16	128

Chi-Square = 26.381, DF = 8, P-Value = 0.001
7 cells with expected counts less than 5.0

(table continues)

Remediation/Acceleration

Rows: Frequency of Use Columns: Planning	15 Min.	30 Min.	45 Min.	60 Min.	> 60 Min	Row Margin
Weekly or Less Than Weekly -- % of Access	39.05	31.43	8.57	7.62	13.33	100
% of Frequency of Use	74.55	82.5	64.29	88.89	93.33	78.95
% of Chi-square	30.83	24.81	6.77	6.02	10.53	78.95
Frequency	41	33	9	8	14	105
Expected Frequency	43.42	31.58	11.05	7.11	11.84	105
More Than Weekly -- % of Access	46.67	20	26.67	6.67	--	100
% of Frequency of Use	12.73	7.5	28.57	11.11	--	11.28
% of Chi-square	5.26	2.26	3.01	0.75	--	11.28
Frequency	7	3	4	1	0	15
Expected Frequency	6.2	4.51	1.58	1.02	1.69	15
Never -- % of Access	53.85	30.77	7.69	--	7.69	100
% of Frequency of Use	12.73	10	7.14	--	6.67	9.77
% of Chi-square	5.26	3.01	0.75	--	0.75	9.77
Frequency	7	4	1	0	1	13
Expected Frequency	5.38	3.91	1.37	0.88	1.47	13
Column Margin -- % of Access	41.35	30.08	10.53	6.77	11.28	100
% of Frequency of Use	100	100	100	100	100	100
% of Chi-square	41.35	30.08	10.53	6.77	11.28	100
Frequency	55	40	14	9	15	133
Expected Frequency	55	40	14	9	15	133

Chi-Square = 8.719, DF 8
* WARNING * 1 cells with expected counts less than 1.0
* Chi-Square approximation probably invalid
8 cells with expected counts less than 5.0

(table continues)

Keyboarding

Rows: Frequency of Use Columns: Planning	15 Min.	30 Min.	45 Min.	60 Min.	> 60 Min	Row Margin
Weekly or Less Than Weekly -- % of Access	34.78	31.88	10.14	5.8	17.39	100
% of Frequency of Use	45.28	61.11	58.33	44.44	75	54.76
% of Chi-square	19.05	17.46	5.56	3.17	9.52	54.76
Frequency	24	22	7	4	12	69
Expected Frequency	29.02	19.71	6.57	4.93	8.76	69
More Than Weekly -- % of Access	46.67	26.67	13.33	13.33	--	100
% of Frequency of Use	13.21	11.11	16.67	22.22	--	11.9
% of Chi-square	5.56	3.17	1.59	1.59	--	11.9
Frequency	7	4	2	2	0	15
Expected Frequency	6.31	4.29	1.43	1.07	1.9	15
Never -- % of Access	52.38	23.81	7.14	7.14	9.52	100
% of Frequency of Use	41.51	27.78	25	33.33	25	33.33
% of Chi-square	17.46	7.94	2.38	2.38	3.17	33.33
Frequency	22	10	3	3	4	42
Expected Frequency	17.67	12	4	3	5.33	42
Column Margin -- % of Access	42.06	28.57	9.52	7.14	12.7	100
% of Frequency of Use	100	100	100	100	100	100
% of Chi-square	42.06	28.57	9.52	7.14	12.7	100
Frequency	53	36	12	9	16	126
Expected Frequency	53	36	12	9	16	126

Chi-Square = 7.546, DF = 8, P-Value = 0.479
7 cells with expected counts less than 5.0

(table continues)

Drill and Practice

Rows: Frequency of Use Columns: Planning	15 Min.	30 Min.	45 Min.	60 Min.	> 60 Min	Row Margin
Weekly or Less Than Weekly -- % of Access	37.61	31.19	10.09	6.42	14.68	100
% of Frequency of Use	77.36	80.95	73.33	77.78	100	80.74
% of Chi-square	30.37	25.19	8.15	5.19	11.85	80.74
Frequency	41	34	11	7	16	109
Expected Frequency	42.79	33.91	12.11	7.27	12.92	109
More Than Weekly -- % of Access	36.84	31.58	21.05	10.53	--	100
% of Frequency of Use	13.21	14.29	26.67	22.22	--	14.07
% of Chi-square	5.19	4.44	2.96	1.48	--	14.07
Frequency	7	6	4	2	0	19
Expected Frequency	7.46	5.91	2.11	1.27	2.25	19
Never -- % of Access	71.43	28.57	--	--	--	100
% of Frequency of Use	9.43	4.76	--	--	--	5.19
% of Chi-square	3.7	1.48	--	--	--	5.19
Frequency	5	2	0	0	0	7
Expected Frequency	2.75	2.18	0.78	0.47	0.83	7
Column Margin -- % of Access	39.26	31.11	11.11	6.67	11.85	100
% of Frequency of Use	100	100	100	100	100	100
% of Chi-square	39.26	31.11	11.11	6.67	11.85	100
Frequency	53	42	15	9	16	135
Expected Frequency	53	42	15	9	16	135

Chi-Square = 9.252, DF 8
* WARNING * 3 cells with expected counts less than 1.0
* Chi-Square approximation probably invalid
8 cells with expected counts less than 5.0

(table continues)

Recreational and Educational Games

Rows: Frequency of Use Columns: Planning	15 Min.	30 Min.	45 Min.	60 Min.	> 60 Min	Row Margin
Weekly or Less Than Weekly -- % of Access	38.2	30.34	6.74	7.87	16.85	100
% of Frequency of Use	61.82	65.85	37.5	77.78	93.75	64.96
% of Chi-square	24.82	19.71	4.38	5.11	10.95	64.96
Frequency	34	27	6	7	15	89
Expected Frequency	35.73	26.64	10.39	5.85	10.39	89
More Than Weekly -- % of Access	48.39	29.03	19.35	3.23	--	100
% of Frequency of Use	27.27	21.95	37.5	11.11	--	22.63
% of Chi-square	10.95	6.57	4.38	0.73	--	22.63
Frequency	15	9	6	1	0	31
Expected Frequency	12.45	9.28	3.62	2.04	3.62	31
Never -- % of Access	35.29	29.41	23.53	5.88	5.88	100
% of Frequency of Use	10.91	12.2	25	11.11	6.25	12.41
% of Chi-square	4.38	3.65	2.92	0.73	0.73	12.41
Frequency	6	5	4	1	1	17
Expected Frequency	6.82	5.09	1.99	1.12	1.99	17
Column Margin -- % of Access	40.15	29.93	11.68	6.57	11.68	100
% of Frequency of Use	100	100	100	100	100	100
% of Chi-square	40.15	29.93	11.68	6.57	11.68	100
Frequency	55	41	16	9	16	137
Expected Frequency	55	41	16	9	16	137

Chi-Square = 13.106, DF = 8, P-Value = 0.108
6 cells with expected counts less than 5.0

(table continues)

Enrichment Activities

Rows: Frequency of Use Columns: Planning	15 Min.	30 Min.	45 Min.	60 Min.	> 60 Min	Row Margin
Weekly or Less Than Weekly -- % of Access	37.89	31.58	7.37	7.37	15.79	100
% of Frequency of Use	66.67	73.17	46.67	77.78	93.75	70.37
% of Chi-square	26.67	22.22	5.19	5.19	11.11	70.37
Frequency	36	30	7	7	15	95
Expected Frequency	38	28.85	10.56	6.33	11.26	95
More Than Weekly -- % of Access	39.29	25	25	7.14	3.57	100
% of Frequency of Use	20.37	17.07	46.67	22.22	6.25	20.74
% of Chi-square	8.15	5.19	5.19	1.48	0.74	20.74
Frequency	11	7	7	2	1	28
Expected Frequency	11.2	8.5	3.11	1.87	3.32	28
Never -- % of Access	58.33	33.33	8.33	--	--	100
% of Frequency of Use	12.96	9.76	6.67	--	--	8.89
% of Chi-square	5.19	2.96	0.74	--	--	8.89
Frequency	7	4	1	0	0	12
Expected Frequency	4.8	3.64	1.33	0.8	1.42	12
Column Margin -- % of Access	40	30.37	11.11	6.67	11.85	100
% of Frequency of Use	100	100	100	100	100	100
% of Chi-square	40	30.37	11.11	6.67	11.85	100
Frequency	54	41	15	9	16	135
Expected Frequency	54	41	15	9	16	135

Chi-Square = 12.770, DF = 8
* WARNING * 1 cells with expected counts less than 1.0
* Chi-Square approximation probably invalid
8 cells with expected counts less than 5.0

(table continues)

Experimentations/Simulations

Rows: Frequency of Use Columns: Planning	15 Min.	30 Min.	45 Min.	60 Min.	> 60 Min	Row Margin
Weekly or Less Than Weekly -- % of Access	22.73	22.73	18.18	4.55	31.82	100
% of Frequency of Use	9.43	13.89	28.57	11.11	50	17.46
% of Chi-square	3.97	3.97	3.17	0.79	5.56	17.46
Frequency	5	5	4	1	7	22
Expected Frequency	9.25	6.29	2.44	1.57	2.44	22
More Than Weekly -- % of Access	26.92	38.46	23.08	3.85	7.69	100
% of Frequency of Use	13.21	27.78	42.86	11.11	14.29	20.63
% of Chi-square	5.56	7.94	4.76	0.79	1.59	20.63
Frequency	7	10	6	1	2	26
Expected Frequency	10.94	7.43	2.89	1.86	2.89	26
Never -- % of Access	52.56	26.92	5.13	8.97	6.41	100
% of Frequency of Use	77.36	58.33	28.57	77.78	35.71	61.9
% of Chi-square	32.54	16.67	3.17	5.56	3.97	61.9
Frequency	41	21	4	7	5	78
Expected Frequency	32.81	22.29	8.67	5.57	8.67	78
Column Margin -- % of Access	42.06	28.57	11.11	7.14	11.11	100
% of Frequency of Use	100	100	100	100	100	100
% of Chi-square	42.06	28.57	11.11	7.14	11.11	100
Frequency	53	36	14	9	14	126
Expected Frequency	53	36	14	9	14	126

Chi-Square = 24.782, DF = 8, P-Value = 0.002
6 cells with expected counts less than 5.0

(table continues)

Information Access via CD-ROMs

Rows: Frequency of Use Columns: Planning	15 Min.	30 Min.	45 Min.	60 Min.	> 60 Min	Row Margin
Weekly or Less Than Weekly -- % of Access	21.62	37.84	13.51	5.41	21.62	100
% of Frequency of Use	15.09	38.89	41.67	22.22	50	29.37
% of Chi-square	6.35	11.11	3.97	1.59	6.35	29.37
Frequency	8	14	5	2	8	37
Expected Frequency	15.56	10.57	3.52	2.64	4.7	37
More Than Weekly -- % of Access	50	27.78	5.56	16.67	--	100
% of Frequency of Use	16.98	13.89	8.33	33.33	--	14.29
% of Chi-square	7.14	3.97	0.79	2.38	--	14.29
Frequency	9	5	1	3	0	18
Expected Frequency	7.57	5.14	1.71	1.29	2.29	18
Never -- % of Access	50.7	23.94	8.45	5.63	11.27	100
% of Frequency of Use	67.92	47.22	50	44.44	50	56.35
% of Chi-square	28.57	13.49	4.76	3.17	6.35	56.35
Frequency	36	17	6	4	8	71
Expected Frequency	29.87	20.29	6.76	5.07	9.02	71
Column Margin -- % of Access	42.06	28.57	9.52	7.14	12.7	100
% of Frequency of Use	100	100	100	100	100	100
% of Chi-square	42.06	28.57	9.52	7.14	12.7	100
Frequency	53	36	12	9	16	126
Expected Frequency	53	36	12	9	16	126

Chi-Square = 15.244, DF = 8, P-Value = 0.055
6 cells with expected counts less than 5.0

(table continues)

Information Access via the Internet

Rows: Frequency of Use Columns: Planning	15 Min.	30 Min.	45 Min.	60 Min.	> 60 Min	Row Margin
Weekly or Less Than Weekly -- % of Access	28.57	35.71	7.14	7.14	21.43	100
% of Frequency of Use	7.55	13.89	8.33	11.11	21.43	11.29
% of Chi-square	3.23	4.03	0.81	0.81	2.42	11.29
Frequency	4	5	1	1	3	14
Expected Frequency	5.98	4.06	1.35	1.02	1.58	14
More Than Weekly -- % of Access	50	16.67	25	8.33	--	100
% of Frequency of Use	11.32	5.56	25	11.11	--	9.68
% of Chi-square	4.84	1.61	2.42	0.81	--	9.68
Frequency	6	2	3	1	0	12
Expected Frequency	5.13	3.48	1.16	0.87	1.35	12
Never -- % of Access	43.88	29.59	8.16	7.14	11.22	100
% of Frequency of Use	81.13	80.56	66.67	77.78	78.57	79.03
% of Chi-square	34.68	23.39	6.45	5.65	8.87	79.03
Frequency	43	29	8	7	11	98
Expected Frequency	41.89	28.45	9.48	7.11	11.06	98
Column Margin -- % of Access	42.74	29.03	9.68	7.26	11.29	100
% of Frequency of Use	100	100	100	100	100	100
% of Chi-square	42.74	29.03	9.68	7.26	11.29	100
Frequency	53	36	12	9	14	124
Expected Frequency	53	36	12	9	14	124

Chi-Square = 7.580, DF 8
* WARNING * 1 cells with expected counts less than 1.0
* Chi-Square approximation probably invalid
8 cells with expected counts less than 5.0

(table continues)

Word Processing

Rows: Frequency of Use Columns: Planning	15 Min.	30 Min.	45 Min.	60 Min.	> 60 Min	Row Margin
Weekly or Less Than Weekly -- % of Access	28.57	37.5	14.29	3.57	16.07	100
% of Frequency of Use	29.09	56.76	53.33	22.22	60	42.75
% of Chi-square	12.21	16.03	6.11	1.53	6.87	42.75
Frequency	16	21	8	2	9	56
Expected Frequency	23.51	15.82	6.41	3.85	6.41	56
More Than Weekly -- % of Access	42.86	17.86	17.86	10.71	10.71	100
% of Frequency of Use	21.82	13.51	33.33	33.33	20	21.37
% of Chi-square	9.16	3.82	3.82	2.29	2.29	21.37
Frequency	12	5	5	3	3	28
Expected Frequency	11.76	7.91	3.21	1.92	3.21	28
Never -- % of Access	57.45	23.4	4.26	8.51	6.38	100
% of Frequency of Use	49.09	29.73	13.33	44.44	20	35.88
% of Chi-square	20.61	8.4	1.53	3.05	2.29	35.88
Frequency	27	11	2	4	3	47
Expected Frequency	19.73	13.27	5.38	3.23	5.38	47
Column Margin -- % of Access	41.98	28.24	11.45	6.87	11.45	100
% of Frequency of Use	100	100	100	100	100	100
% of Chi-square	41.98	28.24	11.45	6.87	11.45	100
Frequency	55	37	15	9	15	131
Expected Frequency	55	37	15	9	15	131

Chi-Square = 15.546, DF = 8, P-Value = 0.049
5 cells with expected counts less than 5.0

(table continues)

Authoring

Rows: Frequency of Use Columns: Planning	15 Min.	30 Min.	45 Min.	60 Min.	> 60 Min	Row Margin
Weekly or Less Than Weekly -- % of Access	38.71	35.48	9.68	6.45	9.68	100
% of Frequency of Use	22.64	31.43	21.43	22.22	20	24.6
% of Chi-square	9.52	8.73	2.38	1.59	2.38	24.6
Frequency	12	11	3	2	3	31
Expected Frequency	13.04	8.61	3.44	2.21	3.69	31
More Than Weekly -- % of Access	37.5	25	20.83	4.17	12.5	100
% of Frequency of Use	16.98	17.14	35.71	11.11	20	19.05
% of Chi-square	7.14	4.76	3.97	0.79	2.38	19.05
Frequency	9	6	5	1	3	24
Expected Frequency	10.1	6.67	2.67	1.71	2.86	24
Never -- % of Access	45.07	25.35	8.45	8.45	12.68	100
% of Frequency of Use	60.38	51.43	42.86	66.67	60	56.35
% of Chi-square	25.4	14.29	4.76	4.76	7.14	56.35
Frequency	32	18	6	6	9	71
Expected Frequency	29.87	19.72	7.89	5.07	8.45	71
Column Margin -- % of Access	42.06	27.78	11.11	7.14	11.9	100
% of Frequency of Use	100	100	100	100	100	100
% of Chi-square	42.06	27.78	11.11	7.14	11.9	100
Frequency	53	35	14	9	15	126
Expected Frequency	53	35	14	9	15	126

Chi-Square = 4.446, DF = 8, P-Value = 0.815
6 cells with expected counts less than 5.0

(table continues)

Multimedia Applications

Rows: Frequency of Use Columns: Planning	15 Min.	30 Min.	45 Min.	60 Min.	> 60 Min	Row Margin
Weekly or Less Than Weekly -- % of Access	34.37	31.25	9.37	6.25	18.75	100
% of Frequency of Use	20.37	26.32	27.27	22.22	40	25.2
% of Chi-square	8.66	7.87	2.36	1.57	4.72	25.2
Frequency	11	10	3	2	6	32
Expected Frequency	13.61	9.57	2.77	2.27	3.78	32
More Than Weekly -- % of Access	32.14	39.29	14.29	7.14	7.14	100
% of Frequency of Use	16.67	28.95	36.36	22.22	13.33	22.05
% of Chi-square	7.09	8.66	3.15	1.57	1.57	22.05
Frequency	9	11	4	2	2	28
Expected Frequency	11.91	8.38	2.43	1.98	3.31	28
Never -- % of Access	50.75	25.37	5.97	7.46	10.45	100
% of Frequency of Use	62.96	44.74	36.36	55.56	46.67	52.76
% of Chi-square	26.77	13.39	3.15	3.94	5.51	52.76
Frequency	34	17	4	5	7	67
Expected Frequency	28.49	20.05	5.8	4.75	7.91	67
Column Margin -- % of Access	42.52	29.92	8.66	7.09	11.81	100
% of Frequency of Use	100	100	100	100	100	100
% of Chi-square	42.52	29.92	8.66	7.09	11.81	100
Frequency	54	38	11	9	15	127
Expected Frequency	54	38	11	9	15	127

Chi-Square = 7.151, DF = 8, P-Value = 0.520
7 cells with expected counts less than 5.0

(table continues)

Problem Solving

Rows: Frequency of Use Columns: Planning	15 Min.	30 Min.	45 Min.	60 Min.	> 60 Min	Row Margin
Weekly or Less Than Weekly -- % of Access	30.59	36.47	9.41	8.24	15.29	100
% of Frequency of Use	50.98	75.61	50	77.78	81.25	63.91
% of Chi-square	19.55	23.31	6.02	5.26	9.77	63.91
Frequency	26	31	8	7	13	85
Expected Frequency	32.59	26.2	10.23	5.75	10.23	85
More Than Weekly -- % of Access	41.18	17.65	35.29	--	5.88	100
% of Frequency of Use	13.73	7.32	37.5	--	6.25	12.78
% of Chi-square	5.26	2.26	4.51	--	0.75	12.78
Frequency	7	3	6	0	1	17
Expected Frequency	6.52	5.24	2.05	1.15	2.05	17
Never -- % of Access	58.06	22.58	6.45	6.45	6.45	100
% of Frequency of Use	35.29	17.07	12.5	22.22	12.5	23.31
% of Chi-square	13.53	5.26	1.5	1.5	1.5	23.31
Frequency	18	7	2	2	2	31
Expected Frequency	11.89	9.56	3.73	2.1	3.73	31
Column Margin -- % of Access	38.35	30.83	12.03	6.77	12.03	100
% of Frequency of Use	100	100	100	100	100	100
% of Chi-square	38.35	30.83	12.03	6.77	12.03	100
Frequency	51	41	16	9	16	133
Expected Frequency	51	41	16	9	16	133

Chi-Square = 19.482, DF = 8, P-Value = 0.012
6 cells with expected counts less than 5.0

(table continues)

Collaborative Learning

Rows: Frequency of Use Columns: Planning	15 Min.	30 Min.	45 Min.	60 Min.	> 60 Min	Row Margin
Weekly or Less Than Weekly -- % of Access	29.49	34.62	10.26	8.97	16.67	100
% of Frequency of Use	44.23	67.5	53.33	77.78	81.25	59.09
% of Chi-square	17.42	20.45	6.06	5.3	9.85	59.09
Frequency	23	27	8	7	13	78
Expected Frequency	30.73	23.64	8.86	5.32	9.45	78
More Than Weekly -- % of Access	43.48	34.78	17.39	4.35	--	100
% of Frequency of Use	19.23	20	26.67	11.11	--	17.42
% of Chi-square	7.58	6.06	3.03	0.76	--	17.42
Frequency	10	8	4	1	0	23
Expected Frequency	9.06	6.97	2.61	1.57	2.79	23
Never -- % of Access	61.29	16.13	9.68	3.23	9.68	100
% of Frequency of Use	36.54	12.5	20	11.11	18.75	23.48
% of Chi-square	14.39	3.79	2.27	0.76	2.27	23.48
Frequency	19	5	3	1	3	31
Expected Frequency	12.21	9.39	3.52	2.11	3.76	31
Column Margin -- % of Access	39.39	30.3	11.36	6.82	12.12	100
% of Frequency of Use	100	100	100	100	100	100
% of Chi-square	39.39	30.3	11.36	6.82	12.12	100
Frequency	52	40	15	9	16	132
Expected Frequency	52	40	15	9	16	132

Chi-Square = 14.991, DF = 8, P-Value = 0.059
6 cells with expected counts less than 5.0

Appendix K
Vita

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EDUCATIONAL BACKGROUND:

Ph.D. in Curriculum and Instruction
Instructional Systems Development
Virginia Tech (Blacksburg), July 22, 1997

M.A. in Educational Administration
Secondary Administration
West Virginia College Of Graduate Studies (Institute), 1982

B.S. in Business
Lee College (Cleveland, TN), 1972

PROFESSIONAL EXPERIENCE:

1992-Present: Virginia Tech

Graduate Teaching Assistant: 1996-1997
Graduate Teaching Assistant, working under the direction of Dr. Chris Eustus, Chairman, Department of Foreign Languages and Literature. Responsible for developing Web pages, troubleshooting hardware and software problems, and staff development.

Graduate Assistant: 1996-1997
Graduate Assistant, working under the direction of Dr. John Burton, Chairman, Department of Teaching and Learning, College of Human Resources and Education. Reponsible for troubleshooting and problem solving hardware and software problems for the College of Human Resources and Education

Graduate Assistant: 1993-1996
Student Lab director, working under the Lab Director, Dr. Norman Dodl. Responsible for coordinating LAN activities, telecommunication (e-mail, World Wide Web server, FTP, & etc.) activities, with other activities and software in the Education Technology Lab;

maintaining lab equipment: computers, printers, etc., installing software, diagnosing problems (hardware and software),scheduling GA lab assistants for staffing the lab and faculty development seminars; Observed, videotaped and evaluated Graduate Teaching Assistants in the GTA Training Program.

Graduate Assistant: 1992-1993
Co-Developed a database for the College of Education, to track graduates from the College of Education
Research assistant for Dr. Robert Smith, collected research on violence in schools.

1995-November: Educorp Consultants Corporation of Roanoke, VA
Researcher: 1995-November
Researching marketing trends for software usage in the home and school.

1995-July-September: Vista Technologies, Inc. of Arlington, VA
Researcher: 1995-July-September
Reviewing and summarizing literature.

1986-1992: Mountain View Christian School
Principal: 1986-1992
Classroom Teacher: 1986-1991
Principal: Duties included supervising teachers and staff, scheduling athletic events, academic events, discipline, fund raising, interviewing prospective students and faculty;
Teacher: Taught Math, Bible, Social Studies, Science, and Grammar

1991-1992 &1992 (Summer): College of West Virginia (Beckley)
Adjunct Instructor: Business Law

1978-1986: McDowell (West Virginia) Public Schools:
Classroom Teacher: Duties included teaching Typing I, Business Law, Business Math, General Business, Computers, Big Creek High School. Duties in addition to regular classroom teaching, taught a ABE class in computers.

1974-1977: McDowell (West Virginia) Public Schools:
Classroom Teacher: Substitute teacher in ninth grade math and business.

1972-1973: McDowell (West Virginia) Public Schools:
Classroom Teacher: Duties included teaching fifth and sixth grade math, science and reading, War Elementary Annex.

HONORS:

Virginia State Graduate Scholarship:
Virginia Tech, 1996-1997
Virginia Tech, 1995-1996
Virginia Tech, 1994-1995
Virginia Tech, 1993-1994
Virginia Tech, 1992-1993

PRINCIPAL COURSES TAUGHT:

Undergraduate Courses:
Business Law

Secondary Courses:
Math (ninth grade), Vocational Math, Business Law, Business Math, Business Computers, General Business, and Typing

Elementary Courses:
Math, WV History, Social Studies, Bible, Grammar, Spelling, Reading, and Science

Professional Organizations
International Visual Literacy Association (IVLA)
Eastern Educational Research Association (EERA)
Association for Educational Communications and Technology (AECT)

Publications

Jaber, W.E. & Hou, F. (1995). Visual resources on the internet, Imagery and visual literacy. International Visual Literacy Association, Blacksburg, VA.

Myers, R.J., Purcell, S.L., Little, J.O. & Jaber, W.E. (1994). A middle school's experience with hypermedia and problem-based learning, Visual literacy in the digital age. Proceedings of the International Visual Literacy Association, Blacksburg, VA.

Presentations at Professional Meetings

National/International:

Purcell, S., & Jaber, W.E. (1995). Transferring files across the internet: The ABCs of FTP. A paper presented at the conference for the Association for Educational Communications and Technology, Anaheim, CA.

Jaber, W.E., & Holmes, G. (1995). Censorship and the internet: Results of an on-line forum discussion. A paper presented at the conference for the Association for Educational Communications and Technology, Anaheim, CA.

Jaber, W.E., and Hou, F. (1994). Visual Resources on the Internet. A paper presented at the conference for the International Visual Literacy Association, Tempe, AZ.

Myers, R., Purcell, S., Little, J., & Jaber, W. (1994). Hypermedia and problem-based learning. A paper presented at the conference for the International Visual Literacy Association, Rochester, NY.

Regional, State, and Local

Jaber, W.E. (1995). Building effective preschool programs. Virginia Department of Education. A paper presented at the conference for Virginia Administrators, Principals, and Teachers of Early Childhood, Roanoke, VA.

Jaber, W.E. (1995). Using Word Perfect. A paper presented for the Montgomery County Public Schools Faculty Development Seminar, Christiansburg, VA.

Jaber, W.E. (1995). Selecting and Using CD-ROM. A paper presented for the Montgomery County Public Schools Faculty Development Seminar, Christiansburg, VA.

Jaber, W.E., & Hou, F. (1994). Internet Resources. A paper presented at the conference for the Virginia Educational Media Association, Richmond, VA.

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