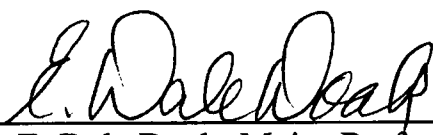
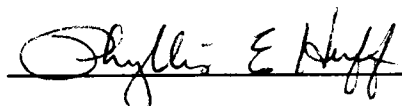


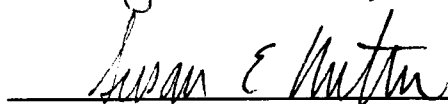
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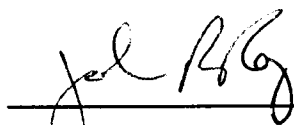
I am submitting herewith a dissertation written by M. Roger White entitled "Instructional Computer Uses Among Accomplished Computer Using Teachers: A Tennessee Sample." I have examined the final copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Education, with a major in Curriculum and Instruction.

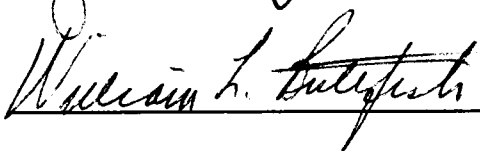

Dr. E. Dale Doak, Major Professor

We have read this dissertation
and recommend its acceptance:









Accepted for the Council:


Associate Vice Chancellor
and Dean of The Graduate School

INSTRUCTIONAL COMPUTER USES AMONG
ACCOMPLISHED COMPUTER USING TEACHERS:
A TENNESSEE SAMPLE

A Dissertation
Presented for the
Doctor of Education
Degree
The University of Tennessee, Knoxville

M. Roger White

August 1992

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Abstract

The purpose of this study was to identify ways that Tennessee public teachers accomplished in the instructional use of computers employ computers for instruction. A questionnaire was sent to 100 of these teachers who were nominated by state department of education representatives. The survey response rate was 97 percent which subsequently yielded a usable sample of 89 teacher questionnaires.

The respondents were made up of 72 (81%) female and 17 (19%) male teachers. The average age was 44 with ages ranging from 25 to 60. Sixty-two (69%) of the teachers were aged 42 through 52 and 72 (81%) of the teachers had taught for 13 or more years. There were 47 (53%) elementary (K-5) teachers, 20 (22%) middle school (6-9) teachers and 22 (25%) high school (10-12) teachers. Twelve different subject areas were represented among the teachers of the sample.

The resulting quantitative data were calculated by computer and generated into tables and graphs which revealed usage levels for the various computer applications and instructional approaches. The qualitative data were analyzed thematically and reported in narrative form.

BASIC and Logo were the computer applications the greatest number of respondents reported no longer using for instruction. The highest numbers of teachers indicated they would like to try communications applications (i.e., school to home and school to school programs) and graphic and creative arts applications (i.e., 3-D modeling, animation, scanning and photo-manipulation programs).

The computer applications the greatest number of teachers reported using for instruction were the traditional computer assisted instructional software applications of drill-and-practice and tutorial programs. The computer application used most frequently for instruction was word processing. The instructional approach employed with computers used by the most teachers and also used most frequently was practicing.

Teachers described the most productive and interesting use of the computer as a multipurpose tool which students employed for producing report related documents and class presentations, as a skill builder and instructional aid, and as a resource for data collection/processing skills. Students used multiple combinations of programs to carry out these learning activities.

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Chapter I

INTRODUCTION

The personal computer's expanding influence in our society received one of its most visible recognitions when *Time* magazine broke a 55 year tradition and instead of announcing its annual Man of the Year, proclaimed the computer as *Time's* Machine of the Year for 1982. Human candidates were passed by for the traditional title because it was explained,

There are some occasions when the most significant force in a year's news is not a single individual but a process, and a widespread recognition by a whole society that this process is changing the course of all other processes. (Friedrich, 1983, p. 16)

The use of personal computers continued to increase during the 1980's and its popularity experienced remarkable growth, particularly in education.

The U.S. Congress, Office of Technology Assessment (1988) reported that between 1981 and 1987, the percentage of American schools with one or more computers intended for instruction grew from about 18 percent to 95 percent. By 1989 the typical high school had between 40 and 50 computers and the median number for elementary schools was nearly 20 (Becker, 1990).

In 1991, President George Bush brought additional attention to the increasing role of personal computers in society and education when he announced that he planned on becoming a student again and would learn to use a computer. He decided to become computer literate after an introduction to word processing by his wife, Barbara, and the persuasive

argument of Secretary of Education, Lamar Alexander (Depke & Brandt, 1991; U.S. Department of Education, 1991).

Word processing is just one of many types of computer applications available. A variety of computer uses is currently being advocated in AMERICA 2000, an education agenda promoted at the national level. AMERICA 2000 calls for the establishment of a new generation of American schools that goes beyond traditional assumptions and limitations of schooling. This plan promotes the role of state-of-the-art technology and encourages extensive use of computers, distance learning and interactive videos (U.S. Department of Education, 1991).

AMERICA 2000 is just one of numerous restructuring efforts and discussions currently emphasizing the role of computers in changing and improving schools (Braun, Moursund, & Zinn, 1991). One focus of many of these movements is on teachers incorporating the computer into instructional strategies like active learning, cooperative learning, higher order thinking skills, problem solving and project oriented education (Ray, 1991). Studies report that already the school trend is away from teaching about computers and computer literacy courses, and towards a more visible presence of applications in the content areas and the curriculum at large (Bruder, 1988; U.S. Congress, Office of Technology Assessment, 1988).

Integration of computer applications with current instructional approaches will require well-informed teacher training programs emphasizing awareness of the numerous instructional uses of computers. A Bank Street College of Education study (Sheingold & Hadley, 1990) groups 37 of these computer-based teacher practices into the following eight categories: text processing tools, instructional software, analytical and

information tools, programming and operating systems, games and simulations, graphics and creative arts tools, communications, and multimedia. This assortment includes a full range of content-free computer tools and content-specific software programs.

Problem

The arrival of computers in schools occurred so rapidly that a broad array of teacher practices resulted. A lack of centralized planning at the national, state and local levels combined with a grassroots movement to place computers in schools produced a teacher population widely scattered in their attempts to integrate the computer into classroom instruction (Cuban, 1986).

In 1982 the state of Tennessee organized a task force to address the integration of computers into education and to develop an instructional program in computer literacy. The next year the State Board of Education approved for grades seven and eight the Computer Skills Next curriculum that consisted of instruction in basic computer functions, advanced applications and programming techniques. The state provided hardware, software and some teacher training, and by 1984 the curriculum was a state wide requirement (Dalton, 1984; "Tennessee Mandates," 1984).

In 1990 the state board of education removed the Computer Skills Next program requirement for seventh and eighth graders, and distributed the computer literacy objectives primarily throughout the elementary curriculum. This shifted the focus on incorporating the computer into instruction to the regular classroom teacher. Currently there is no specific statewide plan for accomplishing this integration into instruction.

Many claims have been made about instructional computer uses, and enthusiasm for classroom integration is readily apparent. Teacher trainers are called on to instruct a teacher population possessing varying degrees of computer experience. There is a continual need for contemporary descriptive data about the computer's instructional presence in classrooms since computer applications and teacher practices change. Planning information is needed about the range of computer applications and approaches used for instruction. While studies exist dealing with these subjects, they are not specific to computer-using teachers in Tennessee. The status of instructional computer uses and projections for these uses need to be specifically determined for this state.

Purpose

The purpose of this study was to identify ways that Tennessee public school teachers accomplished in the instructional use of computers employ computers for instruction. The study addressed the status and current range of applicational practice among these accomplished computer-using K-12 teachers in Tennessee.

This information will direct the planning of computer training and in-service programs for teachers by providing descriptive and baseline data on the prevailing computer applications and approaches these teachers incorporate into instruction. The findings will also aid school planners to more effectively predict computer hardware and software needs.

Questions

This study sought to answer the following questions about Tennessee public school teachers accomplished in their instructional use of computers at the K-12 level:

1. Which types of computer applications have been tried in the past for instruction but are no longer used? (i.e., drill-and-practice, word processing)
2. Which types of computer applications previously not tried for instruction would the teachers like to try in the near future?
3. Which types of computer applications are currently used for instruction?
4. How do the computer applications currently used for instruction differ between elementary, middle and secondary teachers?
5. Which types of computer applications are used most frequently for instruction?
6. What relationship exists between the number of years a teacher has used computers in instruction and the computer applications used most frequently?
7. How do the computer applications used most frequently differ between elementary, middle and secondary teachers?
8. What instructional approaches does the computer serve? (i.e., enrichment, remediation)
9. What instructional approaches are used most frequently?
10. How do the instructional approaches employed with computers differ between elementary, middle and secondary teachers?

11. What relationship exists between the number of years a teacher has used computers in instruction and the computer-related instructional approaches used most?
12. What instructional computing uses do teachers find most productive and interesting?

Importance of the Study

Research indicates that the way teachers use computers for instruction changes as new applications become available and as teachers become more experienced computer users. Therefore, there is a continual need for research that can provide contemporary data on the status of teacher practice.

No major studies exist on accomplished computer-using Tennessee teachers. Specifically, no regional information exists on these teachers' instructional computer use to assist state teacher trainers, educational technology coordinators, or policy makers.

Assumptions

This study was based on these assumptions:

1. Those asked to nominate reputationally expert computer using teachers did so with integrity.
2. Teachers responded with integrity to questions in the research instrument.
3. The descriptive data collected will help in planning for teacher training in computer use.

Limitations

Since the study focused on how teachers are using computers for instruction and not if they are using computers, the teachers involved in the study were selected for their known use of this technology. The study was restricted by the nominations made by the state department of education representatives and the response of the survey participants.

Delimitations

The study was restricted by the following qualifications:

1. The study did not address the effectiveness of instructional computer uses or the student response to those uses. This study was descriptive, not evaluative.
2. The study did not trace the history of the introduction of computers into public education.
3. The study did not investigate the instructional uses of computers in relation to specific subject areas.
4. The study did not consider classroom management or administrative uses of computers.

Summary

The use of computers for instruction has increased since computers were first introduced into the classroom and teachers are continually called upon to integrate the computer into instruction. No major research exists on how accomplished computer-using Tennessee public school teachers are utilizing the computer for instruction.

The purpose of this study was to identify ways that Tennessee teachers accomplished in the instructional use of computers employ computers for instruction. This study sought to answer questions about the types of computer applications used and the instructional approaches employed with the applications.

Chapter II

REVIEW OF THE LITERATURE

Introduction

Microcomputers have been used for many instructional purposes since they were first introduced to the classroom in the late 1970's. In the mid-1960's terminals networked to large mainframes were used primarily for programming and drill-and-practice. These applications carried over as the initial instructional uses practiced by teachers on the smaller desktop or personal computer. With the further development of hardware and software the instructional uses grew to include numerous applications and various approaches.

This review of the literature reports what is known about the computer applications that computer using teachers have utilized for instructional purposes. It begins by looking at how descriptive data has been collected on these uses. The focus then shifts to the range of categories used to describe specific instructional uses. Finally, attention is given to which uses have been dominant and which have changed among teacher practitioners over time.

Approaches to Data Collection

Introduction

Current research provides numerous portrayals of how teachers have used computers for instruction. Descriptive information on these computer uses was ascertained in many ways and was usually reported as part of a

larger study. Some studies used the case study approach (Sheingold, Kane, & Endreweit, 1983; Sheingold, Kane, Endreweit, & Billings, 1981) or a combination of research methods (Plomp, Pelgrum, & Steerneman, 1990; U.S. Congress, OTA, 1988). The most common approach for determining how computers were used for instruction has been to survey school systems, principals and teachers.

Survey Populations

Numerous groups were called on to report the instructional uses of computers in the classroom. Educational periodicals solicited readers to complete and return questionnaires ("AEL-TEA Survey," 1991; "Bits, Bytes, and Barriers," 1992; "Instructor's National," 1990; "Teachers Speak Out," 1991). Teacher attendants at computer workshops were targeted for studies (Stieglitz & Costa, 1988). Most researchers however, pursued a sample more closely identified with the school setting.

The broadest samples included a selection of schools or teachers within a geographic region. Surveys were distributed to a random selection of districts or schools within a geographic region and completed by the superintendent, principal, or primary computer using teacher (Goor, Melmed, & Farris, 1980; Hermann, 1989; Lamon, 1986) or a combination of these (Becker, 1985, 1986a, 1990; Center for Education Statistics, 1986; Sutherlin & Smith, 1990).

Several reputable studies were reported at the national level (Center for Education Statistics, 1986; Goor et al., 1980; Wright, Melmed, & Farris, 1982), the most widely recognized by Henry Becker of The Johns Hopkins University (1985, 1986a, 1990). There have also been regional

studies conducted about instructional computer use in Arkansas (Sutherlin & Smith, 1990), California (Stutzman, 1981), Oregon (Lamon, 1986), and Virginia (Herrmann, 1989).

Some studies defined narrower populations of teachers and concentrated on specific subject areas (Becker, 1987b) and grade levels (Johnston, Luker, & Mergendoller, 1984). For example, studies have focused on computer use specifically among industrial technology teachers of Idaho (Edmison, Heidari, & Pedras, 1987) and special education teachers of Tennessee (Symington, 1990). Accomplished or reputationally expert computer using teachers nationwide have also been targeted (Sheingold & Hadley, 1990). This sample of teachers was selected based on referrals made through state and regional directors of educational technology, hardware and software representatives, professional organizations, leading educators, and invited self-nominations.

In all the examples listed above the studies were designed and the populations targeted to provide descriptive data to individuals concerned with the role of computers in those target areas. Findings presented to curriculum planners, teacher trainers and computer vendors establish important baseline information on how computers are used in the classroom.

Determining Uses

Researchers commonly identified how computers were used for instruction through a questionnaire that listed a number of possible uses which respondents checked. Items selected indicated usage. This data yielded a report showing the percentage of school districts (Goor et al.,

1980; Stutzman, 1981), schools (Becker, 1985; Herrmann, 1989; Wright 1982), or teachers (Center for Education Statistics, 1986; Lamon, 1986; Stieglitz & Costa, 1988; Symington, 1990) that employed the specific applications or purposes listed. The resulting data reported in graph form revealed the extent to which these uses were present.

Another approach had respondents simply list uses. This approach allowed for uses to be identified which the researcher may not have predicted and included in a predefined check list. A variation had teachers list software packages used and then the researcher categorized the applications (Becker, 1990; Edmison et al., 1987). One study employed both types of open-ended questions and provided the percentage of teachers reporting 1-4 uses, 5-9 uses, 10+ uses (Sutherlin & Smith, 1990). The responses to these types of questions were categorized and reported as the percentage of teachers indicating a particular computer use.

Findings from these studies provided the percent of a population using specific computer applications or purposes in instruction. These applications and purposes may have been predefined by the researcher or supplied by the survey population.

Determining Frequency of Use

Some approaches to determining instructional uses indicated frequency of use. Respondents were asked through open-ended questions to list software packages in order of how often they were used (Becker, 1990; Edmison et al., 1987). Researchers also requested respondents to rank their selections from a list. For example, a respondent may have been asked to report if an application was used "often" or "frequently" (Stieglitz

& Costa, 1988) or to check the relative amount of computer time allotted to a use as "major," "moderate" or "little" (Wright et al., 1982) or to rank checked uses proportionately to the total time the computer was used in instruction (Becker, 1986a; Goor et al., 1980).

These approaches were variations for determining instructional computer uses. This type of data also provided the relative time each use was practiced in relation to other uses and the percent of total computer time spent on each use.

Determining Change in Use

The most direct way to identify change in computer use was to determine use at two different times and compare the results. A study of Oregon teachers (Lamon, 1986) measured how the use of major instructional functions of computers changed over a two year period. The survey was administered in the fall of 1983 and the fall of 1985. The instructional functions use for both years were reported as percentages and shown on adjacent bars of a bar graph.

Change was also identified by asking respondents to check from a list of options that indicated variations of practice over a period of time. For example, the Bank Street College of Education study of accomplished teachers (Sheingold & Hadley, 1990) asked respondents to indicate if listed computer uses were tried in the past, currently used in class or if they would like to try them in the near future.

Henry Becker looked at how teachers' anticipated use of computer applications compared with actual practice. In his first study (1985), teachers were asked if drill-and-practice and programming received more

use, the same use, or less use than anticipated when their schools first got computers. Percentages for each application and degree of use were reported in relation to how long the computers had been in the school. In his second study (1986c), teachers were asked which of three major uses of computers seemed best at the time their schools first got computers and which one seemed best at present. Findings for all three uses were reported on a bar graph with opinions initially and at present shown in parallel bars.

Change in these studies focused on teacher's selection of different applications and purposes. A teacher may employ a use for a time and later discard it or begin utilizing entirely new ones. Shifts in practice may be determined by establishing use patterns at two different times and comparing results or by asking teachers to indicate any change through a fixed-response survey question.

Descriptions of Uses

Introduction

Computers maintain a presence in the curriculum in many ways. Since the computer was first introduced into schools it has been considered an object of study. Academic courses presented the computer as subject matter and addressed computer literacy, programming skills, and the role of the computer in society.

The computer is also an instructional medium. Students can interact with software designed to address specific instructional content or use the computer as a tool for completing an assortment of educationally related

tasks. This study concentrated on its instructional uses and the description those uses have received in the literature.

Computer uses are perceived in a number of ways and their descriptions in the literature sometimes overlapped conceptually. Administrative uses may be included in the same report as instructional uses. The use of computer as an object of instruction may be combined in an analysis with its use as a means of instruction. Numerous instructional roles were identified throughout the research.

The literature addressed two facets of instructional use. These uses were described in varying terms and are characterized here as software applications and instructional purpose. Sometimes the identification of the types of uses and their instructional purpose or function overlapped in a study.

Software Applications Categories

For the purpose of analysis the large number of available software programs used for instruction were commonly grouped into categories.

The major categories identified in the literature included:

- Drill-and-practice
- Tutorial
- Word Processing
- Desktop Publishing
- Games
- Database
- Spreadsheet
- Graphics
- Programming languages
- Problem solving
- Simulation
- Videodisc
- Communication
- Music composition
- Robotics

The assortment of these categories included in a study was determined by the approach to questioning chosen and the population targeted. The number of categories included in studies has tended to increase over the last decade as more instructional applications have been developed and integrated into the classroom. A recent analysis conducted by the Bank Street College of Education (Sheingold & Hadley, 1990) included data covering 37 distinct software applications grouped into eight categories.

Instructional Approaches

Instructional uses can also be categorized according to the approach teachers take in implementing software applications. A teacher may employ a use for a number of instructional functions and purposes. Below is a sample of the descriptions found in the literature:

- Direct instruction
- Problem solving and inquiry skills
- Practicing
- Challenge use for high achievers
- Remediation
- Classroom demonstrations
- Enrichment
- Students making their own products
- Testing

Researchers incorporated a variety of these function descriptions in their work. The selection was affected by the same variables determining which software application categories were included in a study. Most studies used a predefined check list approach to gathering data that included three to six instructional approaches and an "other" option. Using this approach the Bank Street College of Education study (Sheingold & Hadley, 1990) included eight items.

Dominant Uses and Change

Findings from 1980-1985

Studies conducted between 1980 and 1985 indicated that most of the instructional use of computers occurred in courses designed to "teach computer." Computer literacy and computer science classes concentrated on general operating procedures and programming. All the studies reviewed from this period report computer literacy as the dominant instructionally related use for which computers were employed (Center for Education Statistics, 1986; Lamon, 1986).

In 1980, a nationwide study conducted by the National Center for Education Statistics (Goor, Melmed, & Farris) reported that 85 percent of school districts with computers employed them for computer literacy. A follow-up study released in 1982 (Wright, Melmed, & Farris) indicated that 33 percent of schools with computers used them the "major" amount of time for computer literacy. Computer science was listed as a separate category in the second study with 23 percent of the schools reporting it as a "major" use.

Similarly, Henry Becker (1985) of the Johns Hopkins University found in his first national study that 85 percent of secondary teacher respondents characterized their school's computer use as "regular" or "intensive" for the purpose labeled "introduction to computers" and 76 percent for the purpose labeled "programming instruction." Elementary teachers, using the same descriptors, reported 64 percent of their schools used computers for "introduction to computers" and 47 percent for "programming instruction."

Besides the computer literacy emphasis the studies also dealt with the computer in its role as an instructional medium and reported learning enrichment as the major instructional purpose particularly at the elementary level. Three studies reported enrichment as the dominant instructional approach used with computers (Becker, 1986b; Center for Education Statistics, 1986; Goor, Melmed, & Farris, 1980) and two others had it rated equally high with the teaching of basic skills (Stutzman, 1981; Wright, Melmed, & Farris, 1982). These two approaches were followed in order by challenge use for high achievers (Center for Education Statistics, 1986; Goor, Melmed, & Farris, 1980) and remedial instruction use (Wright, Melmed, & Farris, 1982). Computers were used for the purpose of regular instruction primarily at the secondary level (Becker, 1986b).

The main instructional application reported was drill-and-practice. During the 1982-83 school year Becker (1985) found that nationwide 59 percent of elementary teachers and 31 percent of secondary teachers reported their schools used this application regularly or intensively. The Center for Education Statistics (1986) studied the same school year and reported that drill-and-practice was the most available software in schools nationwide. That application was followed in availability by games, tutorials, simulation, graphics and word processing software.

In his second national study conducted in 1985, Becker (Becker & Sterling, 1987) found that instructional computer use in elementary schools involved the applications of drill-and-practice and tutorial more than half the time. Programming represented only 12 percent of the time and word processing only 9 percent. At the high school, half the computer time was spent on programming activities, while only 16 percent was spent on drill-

and-practice, and 20 percent on word processing. These findings appear to be compatible with other studies of the period and representative of the typically reported school practice.

The research indicated that as teachers gained more experience with computers they changed their opinion about the best way to use it. Use as an application tool tended to increase and use for learning about computers or for basic skills instruction tended to decrease. This appeared to be the pattern at all grade levels (Becker, 1986c).

Findings from 1986-1991

Between 1986 and 1991 computer literacy classes continued to be the dominant area in the curriculum associated with the instructional use of computers. However, the classes no longer were characterized primarily by programming. The emphasis shifts to word processing, database, and spreadsheet skills (Becker 1990). These tool-oriented uses were practiced in other content areas but to a lesser extent. A study of Arkansas secondary teachers indicates 63.2 percent of computer using teachers employed the computer for word processing and only 17 percent for teaching programming (Sutherlin & Smith, 1990).

Word processing became the most widely and frequently reported instructional application across the curriculum and at all grade levels (Sheingold & Hadley, 1990). Desktop publishing and communications software were two new types of applications increasingly used ("Teachers Speak Out," 1991). The content-specific applications of drill-and-practice, tutorial and problem solving continued to characterize the lower grades

(Sheingold & Hadley, 1990) with word processing and keyboarding uses reported as often as drill-and-practice uses (Becker 1990).

Computers continued to be used primarily for the instructional purpose of enrichment and occasionally for remediation, but they were still not used in a major way for developing thinking skills or understanding about a subject (Becker, 1990). A national study of accomplished computer using teachers by the Bank Street College of Education (Sheingold & Hadley, 1990) reported that these teachers used the computer as a multipurpose tool. Their major approach involved students' creating their own products with word processors, databases and paint programs.

Accomplished computer using teachers tended to use more applications as their experience increases. As that experience grew the use of word processing and database applications tended to increase and the use of drill-and-practice software decreased. Using the computer for enrichment and remediation purposes generally declined and these teachers used it more often for students to create their own products or explore programs individually. They also used it increasingly for explaining an idea or demonstrating a skill (Sheingold & Hadley, 1990).

Findings from Tennessee

One study from Tennessee considered special education teachers' computer use. It indicated the following percentages of software types used (Symington, 1990):

97% - drill-and-practice

81% - games

71% - tutorials

- 35% - simulations
- 32% - word processing
- 26% - direct instruction
- 10% - programming (Logo, BASIC)
- 10% - spreadsheets
- 6% - databases
- 3% - telecommunications
- 0% - robotics

These findings were representative of a preselected group of special education teachers found to use computers for instruction.

The Appalachia Educational Laboratory and Tennessee Education Association conducted an educational technology classroom survey (1991) administered through the *Tennessee Teacher* periodical. A total of 449 Tennessee educators sent in the pages containing the questionnaire and 343 were identified as classroom teachers.

Approximately 59 percent of all the survey respondents reported currently using computers for instruction. The study found that computers were used most frequently for enrichment/remediation, drill and practice, and simulation/games. More specific uses of instructional applications and approaches were not addressed in the study.

Summary

1. Most of the research describing ways teachers used computers for instruction employed a survey methodology.
2. The computer was viewed both as an object of instruction and as a means of instruction. As an instructional medium it had many

applications and served numerous instructional purposes. The applications may have been content-specific software programs or content-free productivity tools. Purposes included the functional roles an application plays in instruction and were manifested in a variety of approaches.

3. In the early 1980's the major instructional uses of computers included programming and drill-and-practice applications. Enrichment and the teaching of basic skills were the main instructional purposes which computer applications served. By the end of the decade the major use became word processing and computers were used increasingly by students to create their own products.
4. Throughout the computer's history in schools, the trend has been for elementary grades to use it for the more concrete thinking applications (e.g., drill-and-practice), while the middle grades and upper grades have tended to use it for the more abstract thinking applications (e.g., programming and word processing).
5. The way teachers used computers for instruction changed as new technological applications were developed and become available.
6. Teachers who became more experienced with the technology tended to move away from drill-and-practice and programming to more multi-use computer projects which required active learning, problem-solving skills and a combination of software applications.
7. Limited data existed describing the specific instructional applications and approaches teachers used with computers in Tennessee.

Chapter III

METHODOLOGY

Introduction

A questionnaire was administered to selected Tennessee teachers to meet the stated purpose of this study. This method was chosen to provide the appropriate descriptive data required. This chapter describes the strategies used to collect and analyze the data.

Sample

The sample in this study was made up of K-12 public school teachers in Tennessee known for their efforts to integrate computer applications into instruction. They were nominated for inclusion in the study by state department of education representatives from across the state. The representatives were the state coordinators of educational technology and administrative consultants at the district and local school level familiar with teacher computer use in the district. The researcher secured the nominations over the phone, the fax machine and by letter.

The nomination process began with the three state coordinators of educational technology representing the East, Middle and West regions of the state. They were each asked to nominate between 30 and 35 regular classroom teachers (K-12) considered to be accomplished users of computers for instruction (excluding Computer Science teachers). The coordinators were asked to limit their nominations to two nominees from a school and seven from a school system. It was also requested that each of the seven state educational districts be represented by at least 10 nominees.

No further selection criteria were defined apart from the nominees being considered reputationally expert.

The coordinators generated a number of teacher nominees and also administrative representatives to contact for further nominations. In order to secure nominees from all the state educational districts, several district level elementary and secondary consultants were also contacted. This process resulted in receiving between 9 and 20 nominees from each of the seven state educational districts.

The final population of nominees included 39 teachers from the East region of the state, 32 from the Middle region, and 29 from the West region resulting in a total of 100 teachers included in the study. This group of teachers was sent a questionnaire to complete.

Questionnaire

A review of the literature and related instruments yielded a decision to utilize portions of a questionnaire developed by the Bank Street College of Education. Martha Hadley, one of the principal researchers, granted permission to adapt the non-copywritten questionnaire. Fixed-response and open-ended questions dealing with the purpose of this study were appropriated and modified slightly. (See Appendix A for sample of questionnaire.)

The Bank Street College of Education survey provided a useful starting point for a number of reasons. Portions of the original survey clearly addressed instructional computing applications and approaches, both major concerns of the present study. In addition, a high level of expertise was brought to the questionnaire since Karen Sheingold, an established and

long time researcher in the field, was a primary designer, tester and administer of the survey. The data yielded by the Bank Street College of Education study are some of the most current available on the topic and the accompanying report is one of most frequently cited in the literature (Becker, 1990; Brady, 1991; Pollin, 1991).

Questions were revised only slightly to include additional instructional applications (e.g., CD-ROM) and to clarify and expand a list of instructional approaches used with computers (e.g., cooperative learning). The resulting questionnaire had four major items addressing the central research concerns of this study and seven questions acquiring general demographic data. The questionnaire was printed on three legal size sheets of paper on one side only.

Administering the Questionnaire

Questionnaires were mailed to the 100 teachers in the sample. A cover letter explained they were nominated for the study by a state department of education representative and that their participation was completely confidential. The letter also stated that return of the questionnaire constituted their informed consent to participate in the study. (See Appendix B for sample of cover letter.) A deadline for completion was indicated and a self-addressed hand stamped envelope was included with the survey. The surveys were coded by numbers to determine non-respondents.

A follow-up letter and replacement questionnaire were mailed to 34 non-respondents after 10 days reminding the teachers to complete and

return the questionnaire. The following week 23 non-respondents were phoned and asked to mail in the questionnaire.

Data Analysis

The basic data treatment was limited to arithmetic computations reflecting the nature of the items on the questionnaire. Results were reported typically in a "percent of total responses" format. Answers from open-ended questions were analyzed qualitatively and the responses reported thematically.

All of the quantitative data from the questionnaire were entered into a statistical computer program called JMP (version 2): Software for Statistical Visualization on the Apple Macintosh published by the SAS Institute. The program was organized like a spreadsheet program and was able to group and summarize data, execute frequency counts, and create subset spreadsheets.

Question one on the survey sought to determine the instructional computer applications the teachers used in the past, use currently, and would like to try. Respondents were provided with a list of 39 applications grouped into six general categories. Other applications could be written in and their usage status indicated. Results for each of the three usage options were tabulated and recorded in a table format. A table was also created which displayed how teachers at the elementary, middle and high school level responded to the current use option. Applications which high numbers of teachers chose were then identified.

In question two, teachers listed the two or three most frequently used instructional applications in their classroom. These applications were

selected from the list of applications used in question one. Their answers were tallied and a list of the top responses was generated. Similar lists were created based on teachers' computer experience and grade level. Examination of these lists yielded the applications most frequently used for instruction.

Question three asked teachers to indicate what general instructional approaches incorporating computers were used in class during the current year and how frequently those approaches were employed. A list of approaches was provided that respondents checked as being used never, some weeks, most weeks or every week. The percent of teachers indicating approaches at various usage levels were entered into Excel, a computer spreadsheet program, and reported in a stacked bar chart format produced by the program. Related charts were also generated reflecting teachers' computer experience and grade level. The instructional approaches used by the most teachers were determined by identifying items with the fewest "never" responses. Instructional approaches with the most "every week" responses were interpreted as those most frequently used by teachers.

The fourth question was an open-ended item which was analyzed qualitatively. It provided anecdotal information concerning what uses teachers find most productive and interesting. A number of common elements were apparent in the responses. These themes were gleaned, summarized and grouped by grade level. The information was then reported under the heading of the major themes.

The last seven questions provided demographic data on the nature of the sample and were used to create subsets of the sample reflecting grade level and years of computer experience. The demographic data also

included subject taught, years of teaching experience, nature of computer training received, and respondent's age and sex. Percentages for the fixed response answers were tabulated and the respondents age tallied.

Summary

A questionnaire was administered to a sample of 100 accomplished computer-using teachers nominated by state department of education representatives. The eleven-question survey was patterned after items from an existing instrument previously used in research conducted at the Bank Street College Of Education.

Data collected through the fixed-response items were typically reported in a "percent of total responses" format. Replies to open-ended questions were analyzed qualitatively and the responses reported thematically.

Chapter IV

ANALYSIS OF DATA

Introduction

The analysis of the data gathered through the administering of the instructional computer use survey resulted in an overview of the major findings. Major sections outline the demographics of the respondents and describe the instructional applications and approaches currently used as evidenced by the teachers' responses to the survey questions. Descriptions of these uses address the research questions of this study and are accompanied by relevant tables and graphs representing the data. Qualitative data are reported thematically in narrative form.

Demographics of Respondents

Questionnaires were sent to 100 Tennessee teachers (K-12) accomplished in the instructional use of computers. A total of 97 questionnaires were returned for a response rate of 97 percent. Seven items on the questionnaire were designed to determine the demographic makeup of the respondents. On the basis of this information eight questionnaires were not included in the study because respondents indicated that they were not classroom teachers or did not use the computer for instructional purposes. This yielded a final sample involving 89 usable questionnaires.

The sample consisted of 72 (81%) female teachers and 17 (19%) male teachers. The average age was 44 with ages ranging from 25 to 60. Sixty-two (69%) of the teachers were aged 42 through 52 (Figure 1). About half (47/53%) were elementary (K-5) teachers (Figure 2). Twenty (22%)

Figure 1

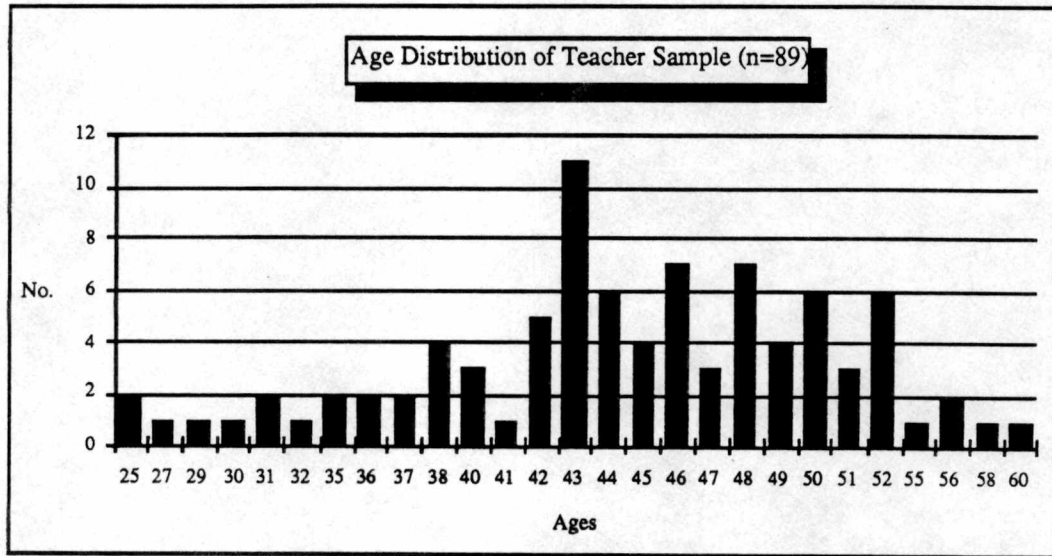
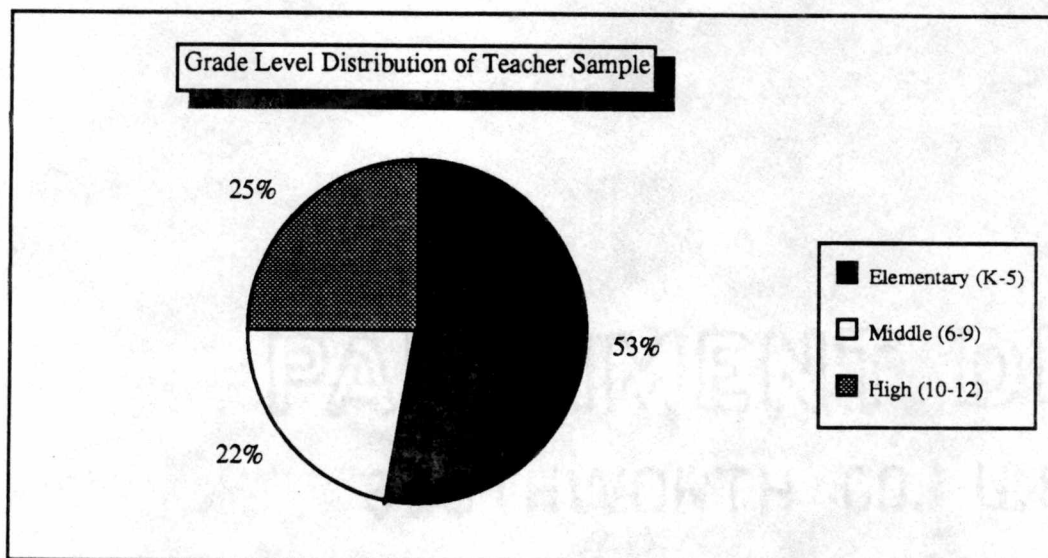


Figure 2



teachers were at the middle school level (6-9) and 22 (25%) were at the high school level (10-12).

Twelve different subject areas were represented among the teachers of the sample. There were also 4 (4%) teachers of special needs children and 2 (2%) of gifted and talented students. Ten (11%) teachers taught more than one subject. Besides computer (24/27%), the next highest concentration of teachers was in science (11/12%) and math (6/7%). Other subject areas were each represented by 2 (2%) or fewer teachers.

Computers used for instruction were located primarily in classrooms (67/75%) and computer labs (51/57%). Others were found in the library (14/16%) and on portable carts (14/16%). One teacher used computers in a hallway and had parent volunteers monitor the machines.

The sample was made up of an experienced group of teachers with over a third (32/36%) having taught more than 20 years and 72 (81%) having taught 13 or more years. Only eight teachers (8%) had taught for fewer than nine years and about half (44/49%) of all the teachers had been using computers in instruction for less than six years.

A majority of teachers in this sample indicated that they were self-taught (75/84%) in the use of computers. Conferences and workshops (64/72%) and inservice courses offered by their school or district (45/51%) were the types of formal training in which over half the teachers had been involved. Informally they also received instruction in computer use from other teachers (36/40%). (Table 1)

Table 1: Teacher Demographics
n=89

	Number	Percent
Subject		
Teacher of general elementary	40	45*
Computer teacher	24	27
Science teacher	11	12
Math teacher	6	7
Teacher of special needs students	4	4
Language arts teacher	2	2
Reading teacher	2	2
Social studies teacher	2	2
Teacher of gifted and talented students	2	2
French	2	2
Office Education	2	2
Chemistry	1	1
Home Economics	1	1
Marketing	1	1
Vocational Education	1	1
Number of Years Taught		
1-4	4	4
5-8	4	4
9-12	9	10
13-16	24	27
17-20	16	18
20+	32	36
Number of Years Used Computers In Instruction		
Less than 2 years	10**	11
3-4	22	25
5-6	12	13
7-8	26	29
9-10	10	11
10+	7	8
Location of Computers Used for Instruction		
Classroom	67	75*
Computer lab	51	57
Library	14	16
Portable Carts	14	16
Teacher Work area	1	1
Hallway	1	1
Where/How Trained in Computer Use		
Self-taught	75	84*
Conferences or workshops	64	72
Courses offered by school or district (inservice)	45	51
Instruction provided on site by consultants	39	44
Instruction from other teachers	36	40
Courses taken at local colleges/universities (non-degree)	32	36
Course offered in your undergraduate or graduate training	32	36
Courses offered by school or district on own time (not inservice)	25	28
Other: State Dept. of Education Programs	6	7

* Percents may not total 100 due to multiple response option.

** n=87

Teacher Use of Instructional Applications

The first survey item addressed the extent to which teachers employed various computer applications for instruction. Teachers were asked to indicate one of three levels of use for 39 listed applications. The levels of use were: i) tried in the past but no longer use, ii) use currently, and iii) would like to try in the near future.

Applications in the programming category received the greatest number of teachers indicating discontinued usage. BASIC (12/13%) and Logo (10/11%) received the highest percents at this level. Some teachers also ended their use of FORTRAN (5/6%). The text processing applications of keyboarding (7/8%) and outliner or idea processors (6/7%) had the next highest counts. The only other application discontinued by more than three respondents was recreational programs/games (5/6%). (Table 2)

Every application in the communications category (i.e., on-line databases and services, public bulletin boards, etc.) had at least a third of the teachers reporting an interest to try in the near future. This was one of the most popular categories for future use interest. The graphic and creative arts category also evidenced strong future interest, with 3-D modeling and animation the application rating the highest of any category (55/62%). Scanning and photo-manipulation also received high interest (41/46%). Two other applications with high ratings in the remaining categories were outliner /idea processors (42/47%) and videodiscs (38/43%). (Table 2)

The traditional computer assisted instruction applications ranked high in the number of teachers reporting current use. Drill-and-practice programs were used by 86 (97%) of the responding teachers, while tutorial programs were employed by 80 (90%). Problem solving programs (73/82%),

Table 2: Usage Levels of Instructional Applications
n=89*

Types of Uses/Applications	Tried in Past No Longer Use (no. / %)	Use Currently (no. / %)	Would Like To Try (no. / %)
Tools			
<u>Text Processing Tools</u>			
Word processor	0	77 / 87	7 / 8
Outliner, idea processor, etc.	6 / 7	10 / 11	42 / 47
Spell-checker, thesaurus, etc.	0	53 / 60	24 / 27
Keyboarding	7 / 8	60 / 67	7 / 8
<u>Analytical and Information Tools</u>			
Databases	3 / 3	51 / 57	13 / 15
Spreadsheets	1 / 1	43 / 48	21 / 24
Calculator (as part of computer)	2 / 2	37 / 42	26 / 29
Charts/graphing	3 / 3	42 / 47	23 / 26
Statistics programs	3 / 3	12 / 13	30 / 34
Science laboratory interfaces	3 / 3	14 / 16	32 / 36
<u>Graphics and Creative Arts Tools</u>			
Painting or drawing	2 / 2	51 / 57	22 / 25
3-D modeling and animation	0	6 / 7	55 / 62
Drafting, computer-aided design	1 / 1	8 / 9	31 / 35
Ready-made art like clip art	1 / 1	51 / 57	18 / 20
Scanning and photo-manipulation	0	11 / 12	41 / 46
Desktop publishing, page layout, and special printing tools	1 / 1	38 / 43	32 / 36
Music composition programs	3 / 3	7 / 8	33 / 37
Programming			
Logo	10 / 11	27 / 30	9 / 10
BASIC	12 / 13	39 / 44	5 / 6
Pascal	2 / 2	5 / 6	17 / 19
FORTTRAN	5 / 6	1 / 1	16 / 18
Hypertalk	2 / 2	12 / 13	25 / 28
Authoring programs	2 / 2	12 / 13	28 / 31

Table 2: Usage Levels of Instructional Applications (continued)
n=89*

Types of Uses/Applications	Tried in Past No Longer Use (no. / %)	Use Currently (no. / %)	Would Like To Try (no. / %)
Communications			
On-line databases, e.g. ERIC	3 / 3	6 / 7	34 / 38
On-line services, e.g., CompuServe	3 / 3	5 / 6	37 / 42
Public bulletin boards	3 / 3	9 / 10	39 / 44
Commercial mail systems	2 / 2	2 / 2	32 / 36
School <--> Home communication programs	0	9 / 10	42 / 47
School <--> Other School(s) communication programs	3 / 3	8 / 9	42 / 47
Instructional Software			
Tutorial programs	0	80 / 90	4 / 4
Drill-and-practice programs	0	86 / 97	0
Problem-solving programs	0	73 / 82	3 / 3
Conceptual tool, e.g., Geometric Supposer	1 / 1	13 / 15	20 / 22
Software accompanying textbooks (not test/worksheet generators)	3 / 3	37 / 42	29 / 33
Games and Simulations			
Microworlds, simulations, and instructional games	0	64 / 72	9 / 10
Recreational programs/games	5 / 6	62 / 70	9 / 10
Multimedia			
CD-ROM	1 / 1	28 / 31	26 / 29
Videodisc	0	15 / 17	38 / 43
Robotics (including LEGO Logo)	1 / 1	3 / 3	36 / 40

* Teachers did not always indicate a usage level for every application.

simulations (64/72%), and games (62/70%) similarly ranked high. Many teachers reported word processing (77/87%) as another major application in current use. (Table 2)

A grade level analysis of the current use responses revealed that 100 percent of the elementary teachers (n=47) used drill-and-practice programs, but only 3 (6%) reported using a videodisc application. Recreational programs/games were used by a greater percentage of teachers at the elementary level (35/74%) than the middle (1/5%) or high school level (10/45%), while databases and spreadsheets were used by a much higher percentage of middle and high school teachers than elementary teachers. (Table 3)

Most Frequently Used Instructional Applications

Teachers were asked to name the two or three most frequently used types of computer applications used for instruction. Their responses yielded information different from that collected in question one where teachers were asked only *if* an application was used. This item identified the applications a teacher used most often.

Two applications were identified by over half of the respondents as being the most frequently used applications. The word processor was the most frequently used application (48/54%), with drill-and-practice programs a close second (45/51%). Tutorial programs were the next most frequently used applications and were reported by over a third of the teachers (31/35%).

Teachers with six or fewer years of computer experience (n=44) reported drill-and-practice programs as the most frequently used application (24/55%) with word processing ranking second (18/41%) and tutorial

Table 3: Instructional Applications Used Currently

Types of Uses/Applications	Elementary n=47 (no. / %)	Middle n=20 (no. / %)	High n=22 (no. / %)
Tools			
<u>Text Processing Tools</u>			
Word processor	38 / 81	19 / 95	20 / 91
Outliner, idea processor, etc.	5 / 11	1 / 5	4 / 18
Spell-checker, thesaurus, etc.	22 / 47	13 / 65	18 / 82
Keyboarding	29 / 62	18 / 90	13 / 59
<u>Analytical and Information Tools</u>			
Databases	17 / 36	15 / 75	19 / 86
Spreadsheets	11 / 23	13 / 65	19 / 86
Calculator (as part of computer)	16 / 34	8 / 40	13 / 59
Charts/graphing	17 / 36	10 / 50	15 / 68
Statistics programs	3 / 6	3 / 15	6 / 27
Science laboratory interfaces	5 / 11	2 / 10	7 / 32
<u>Graphics and Creative Arts Tools</u>			
Painting or drawing	31 / 66	9 / 45	11 / 50
3-D modeling and animation	3 / 6	2 / 10	1 / 5
Drafting, computer-aided design	5 / 11	0	3 / 14
Ready-made art like clip art	25 / 53	11 / 55	15 / 68
Scanning and photo-manipulation	5 / 11	3 / 15	3 / 14
Desktop publishing, page layout, and special printing tools	21 / 45	10 / 50	7 / 32
Music composition programs	5 / 11	2 / 10	0
Programming			
Logo	17 / 36	8 / 40	2 / 9
BASIC	18 / 38	12 / 60	9 / 41
Pascal	0	1 / 5	4 / 18
FORTRAN	0	0	1 / 5
Hypertalk	5 / 11	2 / 10	5 / 23
Authoring programs	6 / 13	0	6 / 27

Table 3: Instructional Applications Used Currently (continued)

Types of Uses/Applications	Elementary n=47 (no. / %)	Middle n=20 (no. / %)	High n=22 (no. / %)
Communications			
On-line databases, e.g. ERIC	2 / 4	1 / 5	3 / 14
On-line services, e.g., CompuServe	4 / 9	0	1 / 5
Public bulletin boards	3 / 6	2 / 10	4 / 18
Commercial mail systems	2 / 4	0	0
School <--> Home communication programs	5 / 11	2 / 10	2 / 9
School <--> Other School(s) communication programs	4 / 9	2 / 10	2 / 9
Instructional Software			
Tutorial programs	41 / 87	18 / 90	21 / 95
Drill-and-practice programs	47 / 100	19 / 95	20 / 91
Problem-solving programs	43 / 91	15 / 75	15 / 68
Conceptual tool, e.g., Geometric Supposer	10 / 21	1 / 5	2 / 9
Software accompanying textbooks (not test/worksheet generators)	19 / 40	6 / 30	12 / 55
Games and Simulations			
Microworlds, simulations, and instructional games	36 / 77	17 / 85	11 / 50
Recreational programs/games	35 / 74	1 / 5	10 / 45
Multimedia			
CD-ROM	13 / 28	8 / 40	7 / 32
Videodisc	3 / 6	5 / 25	7 / 32
Robotics (including LEGO Logo)	2 / 4	1 / 5	0

programs third (15/34%). This ordering of applications varied slightly in teachers with seven or more years of computer experience (n=43). These teachers used word processing most frequently (29/67%), followed by drill-and-practice programs (20/47%) and tutorial programs (20/47%).

Contrasting responses from these two groups revealed applications ranking much higher in one group than the other. These applications included desktop publishing, page layout and special printing tools which ranked fifth (6/14%) among teachers having less experience, and databases which ranked fourth (9/21%) among teachers having more experience.

An analysis by grade level indicated that elementary teachers (n=47) used drill-and-practice (27/57%) and tutorial programs (20/43%) most often, followed by word processing (19/40%). Middle school teachers (n=20) reported a slightly different order to these same three applications. Word processing ranked first (12/60%), followed by drill-and-practice (9/45%) and tutorial programs (5/25%). High school teachers (n=22) likewise used word processing most (17/77%), followed by drill-and-practice programs (9/41%). However, at the high school level the use of databases (7/32%) and spreadsheets (7/32%) ranked ahead of tutorial program use (6/27%). (Table 4)

Teacher Use of Instructional Approaches

Teachers employed the computer applications for instructional purposes in many ways. Item three asked teachers how often general approaches to instruction were used with computers. Teachers responded to a list of nine instructional approaches by indicating one of four levels of use: never, some weeks, most weeks, or every week.

Table 4: Most Frequently Used Types of Applications

Types of Uses /Applications	Number	Percent*
Total Respondents (n=89)		
Word processor	48	54
Drill-and-practice programs	45	51
Tutorial programs	31	35
Problem-solving programs	19	21
Databases	14	16
Microworlds, simulations, and instructional games	11	12
Spreadsheets	8	9
Desktop publishing, page layout, and special printing tools	8	9
BASIC	7	8
Recreational programs/games	5	6
Keyboarding	4	4
Logo	4	4
Software accompanying textbooks	4	4
Painting or drawing	3	3
Videodisc	3	3
0-6 Years of Computer Experience (n=44)		
Drill-and-practice programs	24	55
Word processing	18	41
Tutorial programs	15	34
Problem-solving programs	10	23
Desktop publishing, page layout, and special printing tools	6	14
Microworlds, simulations, and instructional games	5	11
7 or More Years of Computer Experience (n=43)		
Word processing	29	67
Drill-and-practice programs	20	47
Tutorial programs	16	37
Databases	9	21
Problem-solving programs	9	21
Spreadsheets	7	16
Microworlds, simulations, and instructional games	6	14
Recreational programs/games	5	12

Table 4: Most Frequently Used Types of Applications (continued)

Types of Uses /Applications	Number	Percent*
Elementary (n=47)		
Drill-and-practice programs	27	57
Tutorial programs	20	43
Word processor	19	40
Problem-solving programs	13	28
Microworlds, simulations, and instructional games	7	15
Desktop publishing, page layout, and special printing tools	5	11
Logo	4	9
BASIC	3	6
Middle School (n=20)		
Word processor	12	60
Drill-and-practice programs	9	45
Tutorial programs	5	25
Databases	5	25
Problem-solving programs	5	25
Microworlds, simulations, and instructional games	4	20
Recreational programs/games	4	20
Keyboarding	3	15
High School (n=22)		
Word Processor	17	77
Drill-and-practice	9	41
Databases	7	32
Spreadsheets	7	32
Tutorials program	6	27
Basic	3	14

* Percents may not total 100 due to multiple response option.

Practicing with drills was the most commonly reported instructional purpose at every grade level for which computers are used. This approach was followed by tutorial and then remediation purposes (Figure 3). At the elementary level however, more teachers used the computer for remediation purposes than for tutorial purposes (Figure 4). Following practicing and tutorial uses, middle school teachers most frequently reported productivity and reward purposes (Figure 5), while high school teachers most frequently reported productivity, remediation and cooperative learning uses (Figure 6).

The most frequently used approach, the one most teachers indicated using every week, was practicing. This was followed in frequency by tutorial and then productivity uses. Elementary teachers most frequently used computers for practicing, remediation and tutorial aims. Middle and high school teachers used the computer most frequently for productivity purposes. The high school teachers reported the use of computers for instructional presentations as the second most frequent use. (Figures 3-6)

Teachers with six or less years of computer experience used self-directed learning and reward approaches more often than teachers with more experience (Figure 7). Those with seven or more years of computer experience used the computer more often for cooperative learning than teachers with less experience (Figure 8).

Most Interesting and Productive Uses

Item four on the survey asked for an example of the most productive and interesting use of computers in the teacher's curriculum. The teachers described uses in terms of what they and their students do, the hardware and

Figure 3

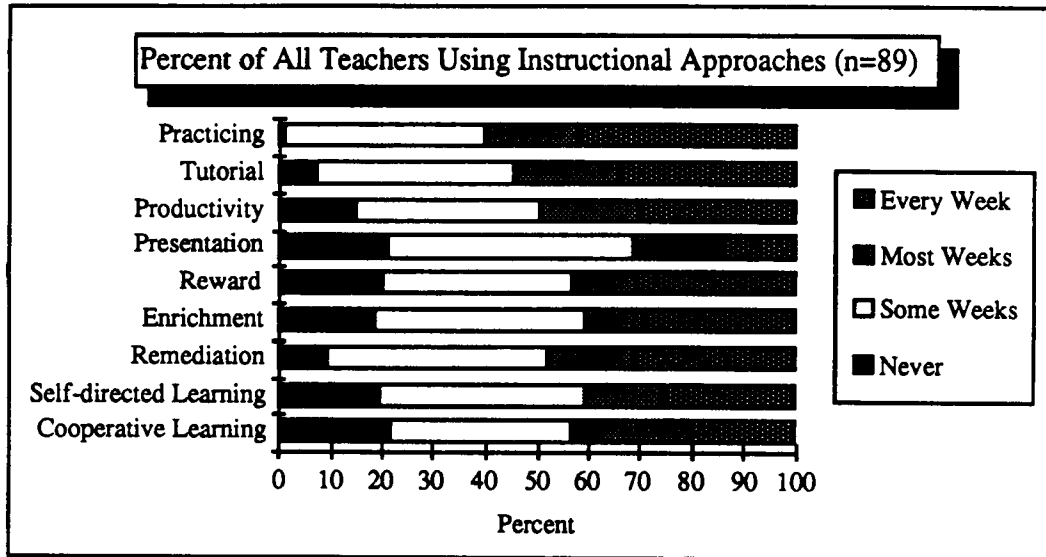


Figure 4

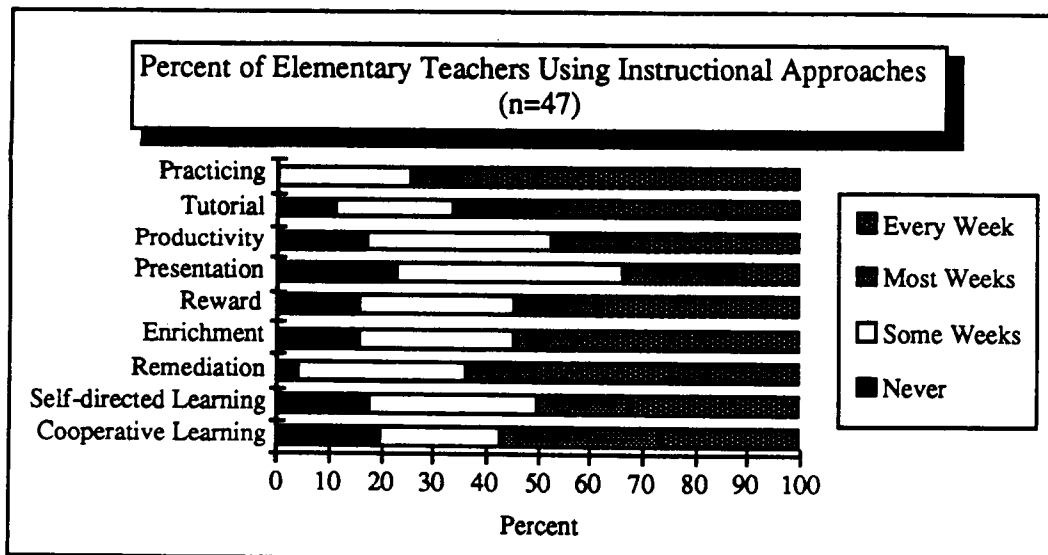


Figure 5

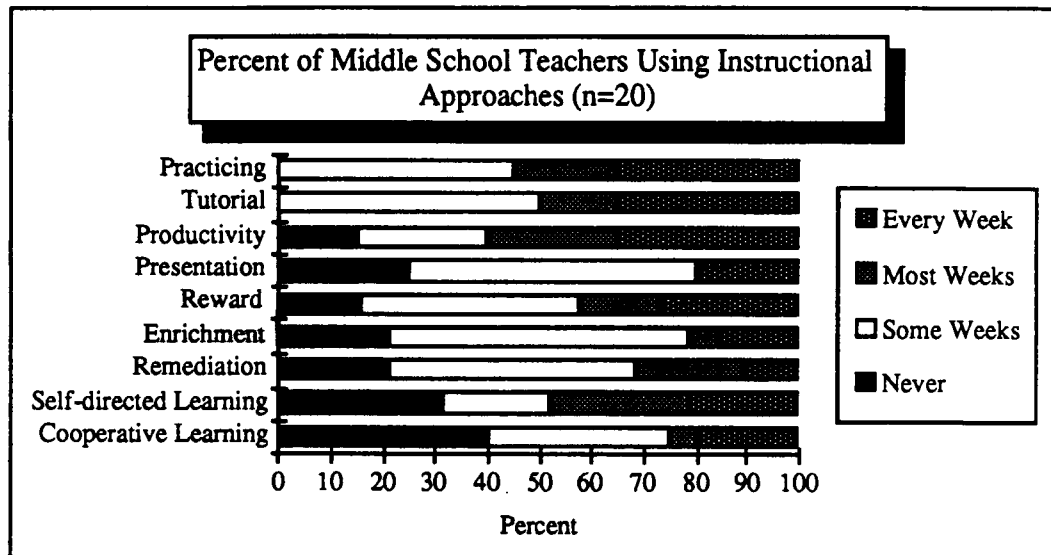


Figure 6

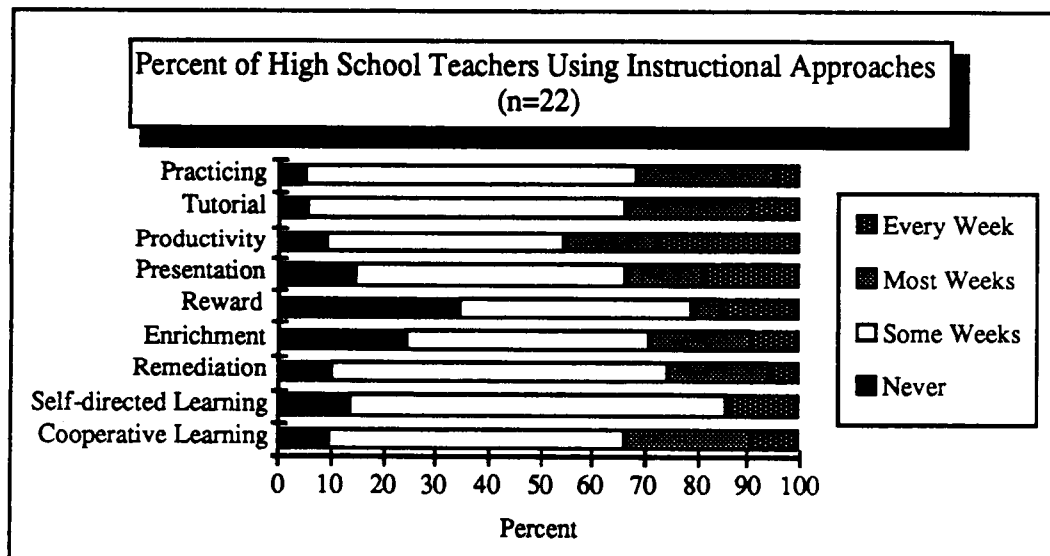


Figure 7

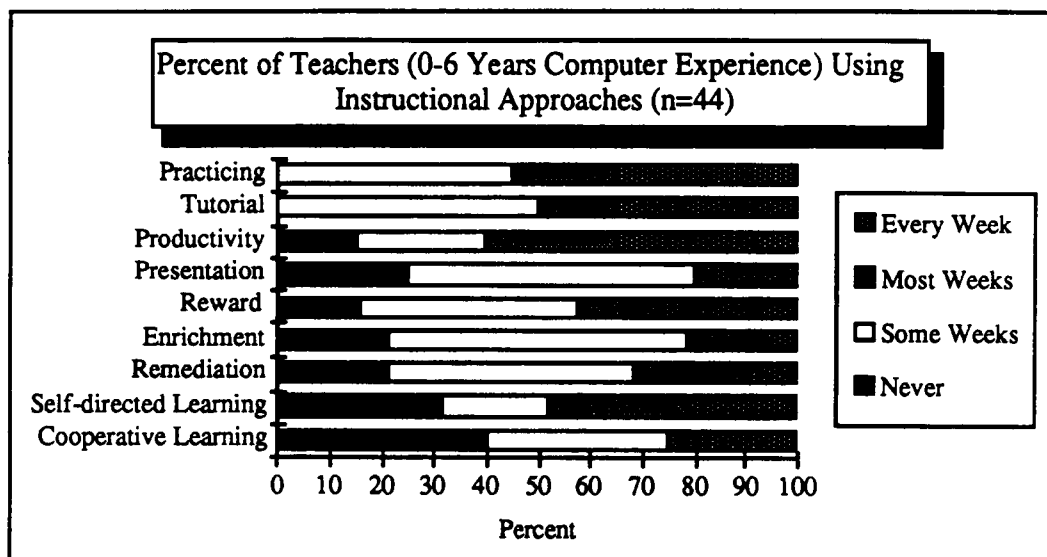
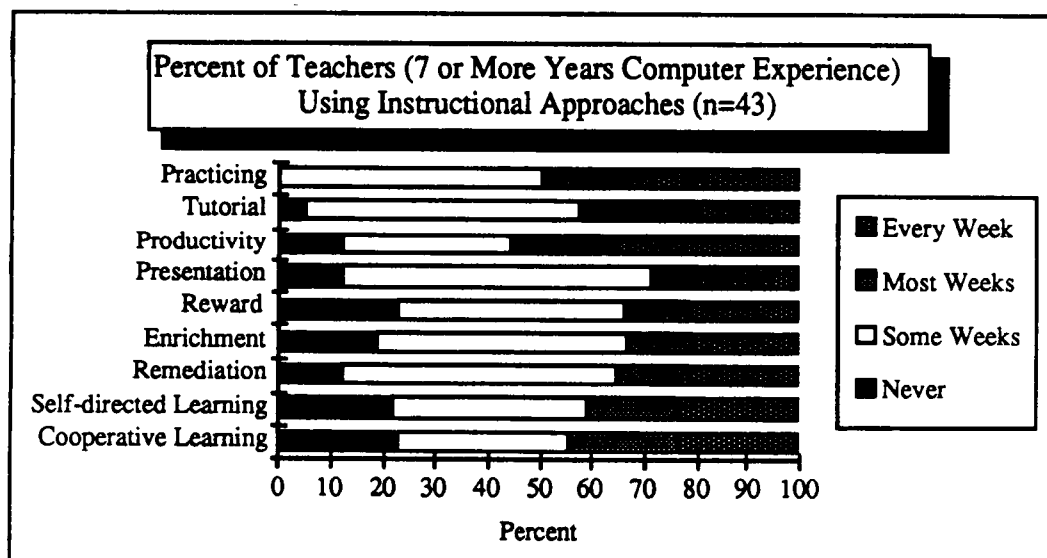


Figure 8



software employed, and the learner outcomes and products produced. Seven of 89 teachers did not answer question number four.

Teachers related a number of ways computer uses enhance learning. The benefits observed included positive student feelings, increased creativity and interest, improved basic skills grades and ACT/SAT scores, parental excitement, and student cooperation. A number of teachers indicated that their major goal was the continued integration of the technology and software with the subject matter of the curriculum. A high school teacher related,

My goal is to incorporate all feasible technology at my disposal to "juice up" the curriculum and make it relevant to the Life Sciences that I teach.

The interesting and productive uses detailed by the teachers involved a number of computer peripherals. Teachers mentioned the following types of hardware used with various applications:

- CD-ROM
- Lab probeware and interface tools
- Large monitor
- LCD projection pad
- MacRecorder
- Modem
- Network
- Scanner
- Videodisc Player
- Video equipment and overlay card

Teachers also referred to a number of types of software and mentioned almost ninety different products specifically by name (see Appendix C for

product list). All of the major categories of applications used in item one of the survey (e.g., tools, programming, communication, etc.) were represented in the products mentioned.

The most commonly described uses at all grade levels involved the computer as a resource tool for student products. While this involved primarily word processing related products, it also included computer generated artwork, self-authored computer programs, and integrated multimedia presentations. Secondly, the computer was described in the traditional computer assisted instruction roles of drill-and-practice, tutorial, simulation and games. Finally, teachers reported a variety of data collection and data processing activities.

The Computer as a Resource Tool for Student Products

Students produced a large variety of word processed items and dealt with text in a number of ways. They composed, wrote, typed, revised, edited, and published many kinds of products. Even younger students who could not read or write, dictated captions for their computer drawn pictures or recited stories of classroom events for a parent newsletter. Said one teacher of her kindergartners, "They see instantly that print is 'talk' written down."

Teacher responses indicated that word processing was used by students for an array of assignments, essays, homework, letters, reports and term papers. These included articles, book reports, business letters, historical fiction, newsletters, original plays, poetry, stories, or even whole books. Teachers told of classes that created cookbooks, dictionaries of vocabulary words, and yearbooks and remembrance books for graduation.

Students not only printed the books, they also illustrated them and designed covers with the aid of the computer.

In some instances increased interest was generated when teachers from different classes worked with a computer-using teacher on combination assignments. In one school a reading teacher originated an assignment and graded students on the writing of a children's book while the computer teacher assisted in the student's production of the book and gave a grade for computer usage.

Students also used the computer as a creative arts tool to enhance their book projects, illustrate reports, and make original pictures. The LOGO language was also used to study and create designs. One elementary teacher combined a unit on dinosaurs with a program that allowed students to design, create and print out pictures of dinosaurs. Another teacher combined a number of computer applications and had students research and then report on their city's bicentennial using a word processing program. A timeline depicting key events of the time period was developed and illustrated using a draw program. The illustrations were printed with a heat transfer ribbon, ironed on to cloth quilt pieces and hand painted. The resulting quilt top portrayed the finished bicentennial timeline.

Students also developed projects using traditional computer programming languages like BASIC and Pascal. One class involved in a cooperative learning activity developed a car loan repayment program and a dating or match making program with these languages. Others used authoring programs like HyperScreen and HyperCard to create interactive, multimedia presentations and instructional programs for other students.

One high school drafting class assignment involved creating a product, company logo/name, brochure and multimedia sales presentation. This project involved a number of content areas, kinds of media and types of applications. Students incorporated CD-ROM, HyperCard, Hypertalk, MacDraft, Mac-Recorder, PageMaker, a projector system, and videodiscs.

Traditional Computer Assisted Instruction

The second major area of use that teachers described as the most productive and interesting was the computer in the traditional computer assisted instruction roles of drill-and-practice, tutorial, simulation and games. Problem solving and higher order thinking skills were further accompanying benefits attested. One teacher reported that, "My computers are extra teachers in the classroom."

Many elementary teachers reported skill development as a dominant outcome of these type programs. Younger children learned to tell time using a computer. Students were taught multiplication, subtraction and regrouping in math class. In reading class they learned letter sounds, parts of speech, and phonetics.

An elementary teacher recounted the following story on the benefits of these type applications,

I remember a placement test one year. Several students were puzzled and frustrated with putting words in alphabetical order until I said "Remember, *Play Ball, Kate* (a Troll program)?" Then everyone's face lit up and they answered the problem correctly!

Reading practice and writing skill development on computers were also being incorporated into whole language activities. Computer programs

provided story starters for creative writing. An elementary teacher commented on these language arts uses,

Students want their work to look good and strive for perfection. Revising and proofreading are carried out religiously and it is student choice.

Keyboarding was a computer based skill related to the word processing emphasis mentioned above. Teachers reported of third through sixth graders typing between 20 and 40 WPM, and one sixth grader typing at an amazing 83 WPM! A middle school teacher affirmed, "Keyboarding is a must."

Middle and high school teachers also reported the importance of skill development. Computers were used to reinforce map skills in social studies, to teach inference in the reading curriculum, and to enhance office skills and recreate employee roles in business simulations. Some students reportedly obtained part-time jobs with their newly learned word processing skills.

Data Collection/Processing Skills

A third major area of use related by teachers as productive and interesting was the computer as a resource for research. Students used the computer for a number of stages in the research process. Sometimes this involved simply reviewing and studying class notes from lectures that a teacher stored in word processing files or gathering data from databases and electronic encyclopedias for inclusion in reports. Often this information was made available through CD-ROM, modems or videodiscs.

Students learned how to follow the scientific method. With the aid of laboratory interfaces and probeware they conducted experiments where various kinds of data were collected, measured, and recorded. The

information was evaluated and discussed. With the help of computers the results were then charted and graphed. Often at this point the findings were put in the form of computer produced reports and presentations.

Besides involving the practical skills of problem-solving, research was exploratory in nature and addressed information networking skills. Individual investigations and self-directed learning characterized some of the classroom computer use. Entire classes were also involved in distance learning activities, piloting new software products, and browsing classroom software collections without teacher assistance.

Summary

An analysis of the data collected in this study yielded the following findings:

- The survey response rate was 97 percent which subsequently yielded a usable sample of 89 teacher questionnaires. The sample was made up of 72 (81%) female and 17 (19%) male teachers. Sixty-two (69%) of the teachers were aged 42 through 52. There were 47 (53%) elementary (K-5) teachers, 20 (22%) middle school (6-9) teachers and 22 (25%) high school (10-12) teachers. Twelve different subject areas were represented among the teachers of the sample and 72 (81%) of the teachers had taught for 13 or more years.
- The computer applications most teachers reported no longer using for instruction were the programming applications of BASIC and Logo.
- The types of computer applications most teachers reported they would like to try in the near future were communications applications and graphic and creative arts applications.

- The computer applications most teachers reported using for instruction were the traditional computer assisted instructional software applications, especially drill-and-practice and tutorial programs. Recreational games were used by more elementary teachers, while databases and spreadsheets were used by more middle and high school teachers.
- The computer application used most frequently for instruction was word processing. However, elementary teachers and teachers with six or fewer years of experience used drill-and-practice applications more frequently.
- The instructional approach employed with computers that most teachers reported using and also reported using most frequently was practicing. The tutorial approach tied practicing as the instructional approach most middle and high school teachers reported using. The most frequently used approaches by the middle school teachers were practicing, tutorial and productivity. The high school teachers most frequently used the instructional approach labeled productivity.
- Teachers described the most productive and interesting use of the computer as a multipurpose tool which students employed for producing report related documents and class presentations, as a skill builder and instructional aid, and as a resource for data collection/processing skills.

Chapter V

SUMMARY AND RECOMMENDATIONS

Summary

Computers have played an ever growing role in our society and especially in our schools. In educational settings computers were employed for a variety of purposes, a central one being instruction. Teachers utilized numerous computer applications in an array of instructional approaches to accomplish classroom goals.

A review of the literature revealed that in the early 1980's the major instructional uses of computers included programming and drill-and-practice applications. Enrichment and the teaching of basic skills were the main instructional purposes which computer applications served. At the elementary level the trend was to use the computer for more concrete thinking applications (e.g., drill-and-practice), while the middle grades and upper grades tended to use it for the more abstract thinking applications (e.g., programming and word processing). By the end of the decade the major instructional use became word processing and computers were used increasingly by students to create their own products.

The purpose of this study was to identify ways that Tennessee public teachers accomplished in the instructional use of computers employ computers for instruction. A questionnaire was sent to 100 of these teachers who were nominated by state department of education representatives. The survey response rate was 97 percent which subsequently yielded a usable sample of 89 teacher questionnaires. The respondents were made up of 72 (81%) female and 17 (19%) male teachers. There were 47 (53%) elementary

(K-5) teachers, 20 (22%) middle school (6-9) teachers and 22 (25%) high school (10-12) teachers. Twelve different subject areas were represented among the teachers of the sample.

Of special note was the age and experience level of these teachers. They were primarily an older group. The average age was 44 with ages ranging from 25 to 60. Sixty-two (69%) of the teachers were aged 42 through 52. In terms of experience 72 (81%) of the teachers had taught for 13 or more years and only eight teachers (8%) had taught for fewer than nine years.

The resulting quantitative data were calculated with JMP (version 2): Software for Statistical Visualization on the Apple Macintosh. The results were generated into tables and graphs which revealed usage levels for the various computer applications and instructional approaches. The qualitative data were analyzed thematically, evaluated by grade level and grouped according to common elements evident in the responses. The resulting information was reported in narrative form.

BASIC and Logo were the computer applications the greatest number of respondents reported no longer using for instruction. On the other hand the highest numbers of teachers indicated they would like to try communications applications (i.e., school to home and school to school programs) and graphic and creative arts applications (i.e., 3-D modeling, animation, scanning and photo-manipulation programs).

The computer applications most teachers reported using for instruction were the traditional computer assisted instructional software applications, especially drill-and-practice and tutorial programs. In fact, every elementary level teacher reported using drill-and-practice programs. Word processing

also ranked high among all teachers. Recreational games were used by more elementary teachers, while databases and spreadsheets were used by more middle and high school teachers.

The computer application used most frequently for instruction was word processing, followed closely by drill-and-practice. However, elementary teachers and teachers with six or fewer years of experience used drill-and-practice applications more frequently. Teachers with less experience used desktop publishing, page layout and special printing tools more frequently than teachers with more experience, while the more experienced group used database programs more often.

The instructional approach employed with computers that most teachers reported using and also reported using most frequently was practicing. The tutorial approach tied practicing as the instructional approach most middle and high school teachers report using. The most frequently used approaches by the middle school teachers were practicing, tutorial and productivity. The high school teachers most frequently used the instructional approach labeled productivity.

Teachers described the most productive and interesting use of the computer as a multipurpose tool which students employed for producing report related documents and class presentations, as a skill builder and instructional aid, and as a resource for data collection/processing skills. Students used multiple combinations of programs to carry out these learning activities.

Finally, this study produced a number of findings which substantiated past research. It found a decline in teacher use of programming for instructional purposes, especially BASIC. It also found widespread use of

drill-and-practice, tutorial, and word processing applications, as well as high teacher interest in using the computer as a multipurpose tool for students to create their own products.

Recommendations

Pertaining to Teacher Training

On the basis of the findings of this study the following recommendations are made to those who train teachers (preservice and inservice) to use computers for instruction:

- Continue or add training in graphic and creative arts tools applications since teachers expressed a high interest in trying these in the near future. This should include an introduction to desktop publishing and page layout programs, and the incorporation of clip-art, painting and drawing programs. The training should especially address scanning, photo-manipulation, 3-D modeling and animation programs. Instruction should also be provided on how to integrate these applications into the curriculum.
- Continue or add training in communications applications since teachers expressed a high interest in trying these in the near future. This should include introduction to on-line services and databases, and particularly electronic mail applications from school to home and school to school. Instruction should also be provided on how to integrate these applications into the curriculum.
- Continue or add instruction in how various applications can be used in productivity, presentation and cooperative learning instructional

approaches. These are the approaches that accompanied descriptions of the most interesting and productive uses teachers reported using.

- Discontinue training in BASIC and replace with or continue instruction in authoring programs and presentation programs (e.g., outliner , idea processors, etc.). This instruction should include how to integrate the applications into the curriculum and how to use them with videodiscs.
- Use the conference or workshop format for reaching practicing teachers.
- Don't discount the interest or the ability of older and more experienced teachers to learn and utilize instructional computer uses. This study found a majority of accomplished users were largely self taught, over 40 and had 13 or more years of experience.

Pertaining to Future Research

The following recommendations are made for further research:

- Periodically repeat the study to include the latest computer applications and instructional approaches as they are developed.
- Conduct qualitative research (i.e., case studies and ethnographies) to learn how teachers use the computer applications and instructional approaches.
- Investigate the effectiveness of using the computer as a multipurpose productivity tool for whole language learning activities.
- Determine teacher's perceptions on the effectiveness of various training approaches for improving the instructional use of computers.
- Examine known users to determine developmental patterns in their learning to use the computer.

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APPENDIXES

APPENDIX A
Sample of Questionnaire

Instructional Computer Use Survey

1. Looking back over your experience using computers as part of instruction, which of the uses listed below apply to you: (I) tried in the past but no longer use; (II) currently use in class; and (III) would like to try in the near future. (Circle all answers that apply)

<u>Types of Uses/Applications</u>	(I) <u>Tried in Past</u> <u>No Longer Use</u>	(II) <u>Use</u> <u>Currently</u>	(III) <u>Would Like</u> <u>To Try</u>
Tools			
<u>Text Processing Tools</u>			
a) Word processor	1	2	3
b) Outliner, idea processor, etc.	1	2	3
c) Spell-checker, thesaurus, etc.	1	2	3
d) Keyboarding	1	2	3
<u>Analytical and Information Tools</u>			
e) Databases	1	2	3
f) Spreadsheets	1	2	3
g) Calculator (as part of computer)	1	2	3
h) Charts/graphing	1	2	3
i) Statistics programs	1	2	3
j) Science laboratory interfaces	1	2	3
<u>Graphics and Creative Arts Tools</u>			
k) Painting or drawing	1	2	3
l) 3-D modeling and animation	1	2	3
m) Drafting, computer-aided design	1	2	3
n) Ready-made art like clip art	1	2	3
o) Scanning and photo-manipulation	1	2	3
p) Desktop publishing, page layout, and special printing tools	1	2	3
q) Music composition programs	1	2	3
Programming			
r) Logo	1	2	3
s) BASIC	1	2	3
t) Pascal	1	2	3
u) FORTRAN	1	2	3
v) Hypertalk	1	2	3
w) Authoring programs	1	2	3
Communications			
x) On-line databases, e.g. ERIC	1	2	3
y) On-line services, e.g., CompuServe	1	2	3
z) Public bulletin boards	1	2	3
aa) Commercial mail systems	1	2	3
bb) School <--> Home communication programs	1	2	3
cc) School <--> Other School(s) communication programs	1	2	3
Instructional Software			
dd) Tutorial programs	1	2	3
ee) Drill-and-practice programs	1	2	3
ff) Problem-solving programs	1	2	3
gg) Conceptual tool, e.g., Geometric Supposer	1	2	3
hh) Software accompanying textbooks (not test or worksheet generators)	1	2	3
Games and Simulations			
ii) Microworlds, simulations, and instructional games	1	2	3
jj) Recreational programs/games	1	2	3
Multimedia			
kk) CD-ROM	1	2	3
ll) Videodisc	1	2	3
mm) Robotics (including LEGO Logo)	1	2	3
Others			
_____	1	2	3
_____	1	2	3

2. Considering the different educational uses of computers by students in your class, which two or three are the most frequently used? (Write in letters from list in Question 1 or specify others not mentioned.)

Three most frequent types of computer uses/applications:

- 1) _____
 2) _____
 3) _____

3. With your class, how often this year have you used the following general approaches to using computers? (Check one choice for each)

	<u>Never</u>	<u>Some Weeks</u>	<u>Most Weeks</u>	<u>Every Week</u>
a) Practicing: students doing drills or game-like drills on a computer	_____	_____	_____	_____
b) Tutorial: students receiving individual direct instruction by the computer	_____	_____	_____	_____
c) Productivity: students using computers individually to create their own products (e.g., word processors, databases, paint programs)	_____	_____	_____	_____
d) Presentation: teacher explaining or demonstrating an idea or skills using the computer in front of the class	_____	_____	_____	_____
e) Reward: students getting time to use computer as motivation for completion of other work	_____	_____	_____	_____
f) Enrichment: faster students getting additional time to use computers when they complete their other work	_____	_____	_____	_____
g) Remediation: slower students getting additional instruction or exercises on the computer	_____	_____	_____	_____
h) Self directed learning: students exploring instructional computer programs on their own during class time	_____	_____	_____	_____
i) Cooperative learning: students working together using the computer as a tool to accomplish a group task	_____	_____	_____	_____
j) Other (describe)	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

4. Please give an example of what you consider the most productive and interesting use of computers in the curriculum you teach. Be as specific as you can about what was done, the software used, how it was done, with what level or type of class, and your own goals.

5. What do you currently teach? (Check one)

- ☐ a) Teacher of general elementary
- ☐ b) Teacher of special needs students
- ☐ c) Teacher of gifted and talented students
- ☐ d) Computer teacher
- ☐ e) Science teacher
- ☐ f) Math teacher
- ☐ g) Language arts teacher
- ☐ h) Reading teacher
- ☐ i) Social studies teacher
- ☐ j) Art or music teacher
- ☐ k) Other (specify) _____

6. What grade level(s) do you teach? (Check all that apply)

- | | |
|---------------------------------------|-------------------------------------|
| ☐ Kindergarten | ☐ 7th grade |
| ☐ 1st grade | ☐ 8th grade |
| ☐ 2nd grade | ☐ 9th grade |
| ☐ 3rd grade | ☐ 10th grade |
| ☐ 4th grade | ☐ 11th grade |
| ☐ 5th grade | ☐ 12th grade |
| ☐ 6th grade | |

7. How many years have you taught? (Check one)

- | | |
|--|---|
| ☐ 1 to 4 years | ☐ 13 to 16 years |
| ☐ 5 to 8 years | ☐ 17 to 20 years |
| ☐ 9 to 12 years | ☐ more than 20 years |

8. How many years have you personally used computers in instruction? (Check one)

- | | |
|--|---|
| ☐ less than 2 years | ☐ 7 to 8 years |
| ☐ 3 to 4 years | ☐ 9 to 10 years |
| ☐ 5 to 6 years | ☐ more than 10 years |

9. Where are the computers you use for instruction located? (Check all that apply)

- | | |
|---------------------------------------|--|
| ☐ Computer lab | ☐ Portable Carts |
| ☐ Classroom | ☐ Other (specify) _____ |
| ☐ Library | |

10. Where/how have you been trained in the use of the computer? (Check all that apply)

- ☐ a. Courses offered by school or district (inservice)
- ☐ b. Courses offered by school or district on own time (not inservice)
- ☐ c. Courses taken at local colleges/universities (non-degree)
- ☐ d. Course offered in your undergraduate or graduate training
- ☐ e. Instruction provided on site by consultants
- ☐ f. Instruction from other teachers
- ☐ g. Conferences or workshops
- ☐ h. Self-taught
- ☐ i. Other (specify) _____

11. Please indicate your year of birth and whether you are male or female.

Year of Birth: 19 _____

Sex: M _____ F _____

Thank you!

Check here if you would like to receive a summary of the findings: _____
Mailout code: _____

Please note: All information that you supply will be kept confidential. No individual school or person will ever be identified.

Instructional Computer Use Survey
Curriculum Laboratory
302 Claxton Addition
College of Education
University of Tennessee
Knoxville, Tennessee 37996

APPENDIX B
Sample of Cover Letter

April 20, 1992

Teacher Name
School Name
Street Address
City, State 00000

Dear Teacher Name,

Based on your reputation as an expert instructional computer user you have been nominated by a representative of your school or school system to participate in a study examining how accomplished computer using teachers in Tennessee use computers for instruction. Your participation is very important to the success of this study and will assist in both the education of computer-using teachers and the planning for instructional computer use in Tennessee schools. Your involvement will consist of simply completing and returning the enclosed questionnaire by April 30.

The purpose of the enclosed questionnaire is to determine the computer applications and approaches you use in instruction. It consists primarily of fixed-response items to indicate level of use or nonuse. The eleven questions should take you no more than ten to fifteen minutes to complete. Please fill out and return the questionnaire today in the postpaid return envelope.

Individual questionnaires have been coded for the purpose of coordinating mailouts. The results will be tabulated and analyzed only in aggregate form, so that anonymity is assured. Your return of the questionnaire constitutes your informed consent to participate in this study.

Thank you for your cooperation and interest in the future of technology in schools. Upon completion of the survey you may request a summary of the findings that will be sent to you when the research is completed. If you have any questions about the study please call me collect at (615) 974-8143.

Sincerely,

(signature)

Roger White
Research Director

APPENDIX C

Product Lists

Products Mentioned by Elementary Teachers:

Appleworks (2)
BASIC
Bouncy Bee Learns Letters & Words (IBM)
Classmate (Hypercard Stack)
Clockworks (MECC)
Communikeys (MECC)
Design-a-Saurus
Discus Storybooks (CD-ROM)
Dr. Peet's TalkWriter (Hartley)
Grammar Toy Shop
Groliers Electronic Encyclopedia
GTV
FrEdWriter
HyperScreen
IBM Software
Josten's Learning Corp. software program (2)
LOGO (3)
MacDraw
MacWord
MacWrite
Magic Slate (2)
Math Blaster
MECC Programs (6)
Muppet Slate
Micrograms Software
Number Muncher (MECC)
Oregon Trail (MECC) (2)
Paint with Words
Play Ball, Kate (Troll)
Scholastic Super Print II (2)
Space Shuttle
Spellavator
Spelling Workout Programs (MECC)
The Children's Writing and Publishing Center (The Learning Co.) (3)
Time & Measurement (IBM)
Visual Almanac
Wetlands
Where in the USA is Carmen Sandiego?
Where in the World is Carmen Sandiego?
Where in Time is Carmen Sandiego?
WICAT System (2)
Writing Center
Writing to Read (IBM) (2)

Products Mention by Middle School Teachers:

Appleworks (4)
Applesoft Basic
Carmen Sandiego Series
Computer Eyes
CSN Software (state developed Computer Skills Next software)
Electronic Bookshelf
Electronic Encyclopedia
FrEdMail
FrEdWriter (3)
GTV
HBJ software that accompanied textbooks
Hypercard
Living Textbook
MacProof
MacWrite II
Mathematics Exploration Toolkit
MECC Software
Microsoft Works
National Geographic Kids Network
Number Muncher (MECC)
Professional Write
The Presidents-It all Started With George
Word Muncher (MECC)
Zork Series of games

Products Mentioned by High School Teachers:

BASIC
BASICA
Choices and Decisions (VISA)
Desk
Electronic Encyclopedia
Evolution of Life
Excel
Gadgetronics (South-Western)
Hypercard (3)
LabNet Geiger Interface (Vernier Software)
LEAP System
Living Textbook Videodisc
MacDraft
MacRecorder
MECC Writer
Microsoft Word
National Geographic Kidsnet
Newsroom
Office of the Future
PASCAL
Pagemaker
PSI-NET
QuickBASIC
Quicken
Science Vision
Smart Pulley with Infrared Sensor (Pasco Scientific)
Smart Pulley Timer (Vernier Software)
South-Western Software that accompanies textbooks
Voyageur
World Classroom
WordPerfect (2)

VITA

Roger White was born in Maryville, Tennessee on February 16, 1957. He attended elementary schools in Decatur, Georgia, Oak Ridge, Tennessee and New Providence, New Jersey. In Chattanooga, Tennessee, he attended Hixson Junior and Senior High Schools where he was graduated in 1975. In 1978 he graduated from East Tennessee State University with a Bachelor of Science degree majoring in Speech (Broadcasting) and English, and minoring in Art.

His graduate studies were completed at Reformed Theological Seminary in Jackson, Mississippi where he received a Masters of Christian Education in 1982 and a Masters of Education in 1986. Following teacher certification studies at the University of Tennessee of Chattanooga, he also taught Bible History for five years in the Chattanooga public school system.

In June of 1988 he began fulltime doctoral studies at the University of Tennessee at Knoxville. While there he was a graduate assistant supervising the Curriculum Laboratory and teaching instructional computing courses for teachers. He received his Doctor of Education degree in August of 1992.

Presently he is an assistant professor at Azusa Pacific University in Azusa, California where he serves on the faculty of the Graduate School of Education in the department of educational computing.