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ABSTRACT

This report presents the results of a study conducted with 449 Tennessee educators that investigated the use of educational technology in the state's classrooms. The Tennessee Education Association, as part of its Tennessee Teachers' Technology Initiative, funded in part by a grant from BellSouth, collaborated with the Appalachia Educational Laboratory in the design of the study. The study results are intended to benefit teachers interested in or involved with technology, and to provide data that will help in local and state policy formation. The report is organized to convey the findings of the survey while describing the predominant condition of educational technology in Tennessee classrooms and teacher recommendations for improvements in policy and practice. The preface presents the design and methodology of the study as well as an introduction to the report. Based on a review of the literature, the rationale provides an overview of the use of educational technology for instruction and discusses the findings of additional studies on teachers' knowledge of, attitudes toward, and use of computers and other forms of educational technology. The findings of this study are presented in the following clusters: Demographic Summary of Respondents; Current Knowledge about Training in Technology; Use of Technology and Effects on Students; Benefits of and Obstacles to Technology Use in Instruction; Recommendations for School Policy on Educational Technology; Extent and Types of Instructional Use of Microcomputers; Location, Frequency, and Purpose of Instructional Use of Microcomputers; and Additional Comments about Educational Technology Use. The findings of this study are then compared with the findings of national surveys. Recommendations for policy and practice for teachers, administrators, policymakers, and association personnel conclude the report. An executive summary of the report, a copy of the study questionnaire, and a 40-item bibliography are also provided. (DB)

BITS, BYTES, AND BARRIERS: Tennessee Teachers' Use of Technology

December 1991

A Publication of the TEA-AEL Study Group

AEL

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and

TEA

Tennessee Education Association

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Executive Summary

Distance learning, CD ROM, microcomputers, videodiscs—How well informed do you feel about these types of technology? Would you describe yourself as a technology-using teacher? When, where, and how do you use educational technology? What types of training, resources, and support have assisted you in incorporating technology into your teaching? What are the barriers to more extensive and effective use of educational technology? These questions were posed to Tennessee teachers in the "TEA-AEL Survey of Educational Technology in the Classroom," distributed statewide in the March 1991 issue of the Tennessee Education Association's journal, *Tennessee Teacher.* Their responses were comparable to teacher responses on national surveys conducted during the past few years. From data gathered from teachers in Tennessee and across the country, several conclusions may be drawn about the conditions that promote effective instructional use of technology:

- there should be enough technology (and, in particular, enough technology for teachers to have unrestricted access);
- there should be ample support and time for teachers to learn how to use technology and plan for its use; and
- there should be a school structure and culture in which teachers are encouraged and expected to take a professional and experimental approach to their work (Sheingold & Hadley, 1990, p. ix).

Because these conditions do not prevail in Tennessee nor in most of our nation's schools, instruction continues to be dominated by lectures, textbooks, and work sheets almost everywhere. Yet, the students of today must live and work in the 21st century—the Age of Technology. This paradox has led to initiatives from business and from education to determine the current status of teachers' use of technology, to examine ways technology can enhance teacher effectiveness, and to recommend policy and practice in the use of educational technology. The Tennessee Teachers' Technology Initiative (TTTI), supported by a grant from the BellSouth Foundation, is an effort of the Tennessee Education Association (TEA) to enhance the role teachers play in encouraging and developing policies and practices that promote instructional use of technology to enhance student learning. TTTI Steering Committee members also served during 1991 as members of the TEA-AEL Educational Technology Study Group. As study group members, they developed a survey on educational technology use by Tennessee teachers, analyzed and reported survey findings, and made recommendations for policy and practice that encourage technology use in the classroom.

Results of this study conducted with 449 Tennessee educators are reported in *Bits, Bytes, and Barriers: Tennessee Teachers' Use of Technology.* Following is a summary of key findings:

- Fifty-nine percent of the respondents described themselves as "computer-using."
- Teachers generally relied on two types of educational technology—microcomputers and instructional television. Overall, teachers did not indicate they felt well informed about technology.
- More than 95 percent of the respondents reported positive effects of educational technology on their

students—most frequently on motivation and subject interest.

- Although teachers listed a number of benefits of instructional use of technology, mostly related to student learning, they reported obstacles to more effective use of technology including lack of funding, time, and training.

- Respondents indicated that the types of training/support/resources that would assist them most in using educational technology are funding for hardware/software, summer workshops, and during-school-day workshops.

- Respondents most frequently reported using technology for instruction in mathematics, reading, and thinking skills.

- Few of the respondents indicated that they or their students had access to computers in their classroom, computer lab, or media center. Elementary teachers most often had access to computers in their classroom, while middle school teachers reported more use of computers in a lab setting.

- Although survey respondents reported using computers for a range of instructional and management purposes, they most frequently said they used computers for enrichment/remediation, drill and practice, and simulations/games. A majority of the computer-using teachers reported that their students use computers for instruction daily or weekly.

To describe current use of educational technology in Tennessee schools was a major goal of this study. However, the authors of *Bits, Bytes, and Barriers: Tennessee Teachers' Use of Technology* also intend that this publication inform teachers, administrators, school board members, policymakers, education association personnel, and other education stakeholders who may act to encourage and enhance the use of educational technology. Therefore, they developed suggestions based upon survey findings for policy and practice. Study group members recommend that:

- Teachers well versed in the use of educational technology serve as role models and peer tutors for others who want to learn about instructional technology.

- District and building administrators provide training and planning for instructional use of technology during the school day.

- State policymakers provide equitable funding for hardware, software, and teacher training to enhance and promote the use of technology in the classroom.

- Association personnel encourage and support teacher participation in workshops, conferences, and seminars at the local, state, and national level.

Findings from this study indicate that the potential for the instructional use of technology has not yet been realized in Tennessee schools. *Bits, Bytes, and Barriers: Tennessee Teachers' Use of Technology* can inform and assist local and state efforts to promote the conditions that enhance teachers' use of educational technology in the classroom and maximize students' preparation for the 21st century.

Preface

The Tennessee Education Association, as part of its Tennessee Teachers' Technology Initiative (TTTI) funded in part by a grant from BellSouth, collaborated with the Appalachia Educational Laboratory on a study group of teachers investigating educational technology use in Tennessee classrooms. *Bits, Bytes, and Barriers: Tennessee Teachers' Use of Technology* summarizes their methods and findings. The group's goals and purposes of this document were to:

- describe the extent and forms of educational technology used by Tennessee teachers, and to
- recommend policies to local school administrators and legislators that would encourage and support the expansion of educational technology to assist Tennessee students in preparing for careers in the 21st century.

Planning the Study

In December 1990, Al Mance, assistant executive director of the Tennessee Education Association (TEA); Gloria Dailey and Peggy Smith, IPD coordinators for TEA; and Jane Hange, director of AEL's Classroom Instruction program, met to discuss the formation of the sixth TEA-AEL study group. TEA had been awarded a $10,000 grant from the BellSouth Foundatio to begin the Tennessee Teachers' Technology Initiative, with the stated purpose of encouraging "the development of policies and practices that promote the effective use of educational technology to enhance student learning" (TEA news release, October 4, 1990). TEA and AEL staff viewed the formation of a study group as an action research opportunity for select Tennessee teachers with experience in technology. They noted the importance of the study was to describe the current status of technology in Tennessee schools. The organizations intend that the product of the study group benefit teachers interested in or involved with technology, as well as provide data that may be helpful in the development of local and state policy.

Conducting the Study

The eight educators, invited as study group members, met initially on January 11, 1991, with TEA and AEL staff to outline the group's tasks and products. Study group members selected survey methodology, reviewed related literature and similar studies, developed a draft survey of Tennessee teachers, and discussed survey dissemination. AEL staff, including the research and evaluation specialist, worked with TEA staff to refine the survey prior to its review by study group members. The four-page survey (see Appendix A) was then typeset by AEL and provided to TEA for inclusion in the March issue of *Tennessee Teacher*. Since this TEA journal reaches over 40,000 TEA members, primarily teachers, it was viewed as an effective means of conducting a large sample survey. Study group members and local TEA affiliate presidents also assisted in disseminating and collecting additional copies of the survey, and surveys were distributed at a TEA conference. The number of usable surveys returned in time to be included in the data analysis was 449.

Study group members conducted a preliminary emergent category analysis of the frequency of qualitative question responses and met to discuss their findings. At this meeting, members determined that computer entry and analysis of the quantitative data from the survey would provide the most accurate and expedient form of analysis. Dr. J. Jackson Barnette, College of Education, University of Alabama, devel-

oped the computer program to analyze descriptive statistics for the survey questions. Following AEL staff data entry from the 449 surveys returned, Barnette ran the program using total group and three levels of analysis of responses--elementary, middle school, and high school teacher respondents. AEL staff shared print-outs of the findings at the group's spring 1991 meeting.

Study group members and TEA and AEL staff then assumed responsibility for summarizing and reporting data for specific clusters of responses. During the summer of 1991, study group members and TEA and AEL staff worked individually on this task, mailing their initial drafts to AEL for copying and dissemination to the other authors.

Following peer editing, changes were incorporated by AEL staff in the editing process needed to meld the report to "one voice." Study group members, involved TEA staff and the TEA president, and an external survey research expert then reviewed the second draft prior to AEL staff inclusion of final editing changes. AEL staff typeset the final publication and provided camera-ready masters for dissemination by TEA and by AEL's Resource Center.

Document Organization

Bits, Bytes, and Barriers: Tennessee Teachers' Use of Technology is organized to convey survey findings in a concise manner while describing the predominant condition of educational technology in Tennessee classrooms and teacher recommendations for improvements in policy and practice. Following this Preface, a Rationale describes current literature related to educational technology use for instruction and discusses the findings of additional surveys or other studies regarding teachers' knowledge of, attitudes toward, and use of computers and other forms of educational technology such as CD-ROM, videodiscs, electronic bulletin boards, local area networks, etc..

The authors suggest that readers initially read the Rationale to more fully understand the Findings and Comparison of Survey Findings sections, review the Recommendations for Policy and Practice developed by study group members following data analysis, and refer to the Bibliography for further reading on educational technology.

RATIONALE

Virtually every instructional application of educational technology is in use *somewhere* in a U.S. classroom. Yet, chalkboards, lectures, textbooks, and worksheets continue to dominate instruction in most classrooms. For a nation demanding a 21st century education system, the availability of technology to a small percentage of the system's clients and employees is not enough. In a nation committed to educational equity for all students, the distribution of opportunities for electronic learning is crucial. Making this happen is an important educational restructuring task of the 1990s (Mecklenburger, 1990).

To approach the task of incorporating technology in the classrooms of the 1990s, it is helpful to examine some facts about technology use in schools today. Although there is a paucity of literature on teachers' use of technology, several national studies have been conducted on the use of computers in the classroom. These studies produced findings relevant to the extent and type of computer use in instruction, barriers and incentives to using computers in instruction, and ways the use of computers affects teaching and learning.

Despite the presence of computers in almost all American public schools, only half of the nation's teachers reported ever having used computers, and the number who used computers regularly was much smaller (Wiske, Zodhiates, Wilson, Gordon, Harvey, Krensky, Lord, Watt, and Williams, U.S. Congress Office of Technology Assessment, 1988). This may be due in part to lack of equipment, as Becker (1990, p.2) reported: "In spite of the growing numbers of computers in American schools, high schools in 1989 typically had between 40 and 50 computers and the median elementary school had nearly 20." Becker's study also related the priority expressed by survey respondents for acquiring *more* computers. Similarly, Sheingold and Hadley (1990) reported that the teachers they surveyed, who were experienced and accomplished at integrating computers into their teaching, cited inadequate amounts of hardware as a barrier to instruction.

Findings regarding the ways in which computers are used in the classroom indicate that, in general, teachers are moving away from teaching *about* computers and are moving toward teaching *with* computers. The use of computers frequently tends to reinforce or parallel other traditional instructional practices, such as workbook drill and practice, rather than to provide a learning environment for motivating higher-order thinking, problem solving, and deep understanding (NEA, 1983; Becker, 1990). Yet, accomplished computer-using teachers identified by Sheingold and Hadley (1990) reported using the computer as a multipurpose tool. The approach most frequently used by 60 percent of this group of respondents was having students make their own products with the computer. These studies seem to imply that as teachers become more experienced and confident in their ability to use technology for instruction, new patterns of teaching and learning emerge. This conclusion is reinforced by the findings of a study conducted with 32 teachers in the Apple Classrooms of Tomorrow (ACOT), a consortium of researchers, educators, students, and parents who have collaborated to study innovative learning environments and implement educational change since 1985.

Although the sheer number of computers in ACOT classrooms radically transformed the physical environment, for the most part student learning tasks remained unchanged. Gradually, however, new patterns of teaching and learning emerged at all sites.

Teachers' struggles to accommodate the new technology seemed to abate during their first year. During the second year of the project, teachers' roles began to shift noticeably, and new instructional patterns emerged (Dwyer, Ringstaff, and Sandholtz, 1991, pp.46-47).

Many barriers and obstacles to integrating computers and other forms of technology into their classrooms have been reported by teachers responding to national surveys. Although 85 percent of the respondents in the Wirthlin Group survey (1989) indicated that the use of computers in the classroom has had a positive affect on education, they cited several obstacles including lack of resources/funding, teachers/training, and curriculum/software. Similarly, teacher respondents to the Office of Technology Assessment (OTA) survey (1988) cited lack of equipment, inadequate or inappropriate training, and anxiety about new technology as barriers to greater use. Two-thirds of the administrators of state educational technology programs who responded to the OTA survey cited lack of funds as a serious barrier to increased use of technology. Also, Becker (1990) concluded that the paucity of computer stations in elementary classrooms and laboratories (most teachers have only one or two available) indicates that computers are not yet the major medium through which students learn. Finally, Sheingold and Hadley (1990) concluded that three outstanding factors contribute to teacher achievements in the use of computers: 1) teachers' motivation and commitment to their students' learning and to their own development as teachers; 2) the support and collegiality they experience in their schools and districts; and 3) access to sufficient quantities of technology.

Efforts to assist educators with the use of technology are evident in the contributions of business. For example, since 1989, IBM has initiated more than a dozen programs to help improve K-12 education. The IBM support includes grants of money, equipment, and human resources to schools, school districts, and professional educator organizations. IBM's People Sharing Information Network (PSINet) enables thousands of educators to build dialogue and support communities. User groups such as the NEA/IBM School Renewal Network, the Mathematical Sciences Educational Leadership Network, and Learning Initiatives International share information on technology use, curriculum and instruction, school restructuring, and other educator concerns. Recently, IBM announced its commitment to provide educational software to the Alliance for Technology Access on a no-cost loan basis to support services to special education students across the country. Business initiatives such as those by IBM and Apple described in this Rationale have helped alleviate teacher-cited obstacles to technology use—lack of equipment, training, and support—and have contributed to teacher achievements in the use of computers.

Although barriers to the use of instructional technology prevail, Mecklenburger, Levinson, and other observers advocate the expanded use of technology as *the* method to respond to the many changes evident in students, teachers, school structure, and the American economy that affect the public schools. Likewise, the National Education Association has recognized the potential benefits of integrating technology as a method of responding to the many changes taking place in schools today. However, what reforms are prerequisite to the expanded use of technology?

From the experiences of Dwyer, Ringstaff, and Sandholtz (1991) in working with teachers in the ACOT project, two conditions seem essential in educational programs set on reform: 1) teachers must be given an opportunity to reflect on their own beliefs about learning and instruction and to understand alternative belief systems; and 2) administrators must be willing to implement structural or programmatic changes to support teachers' instructional innovations (p. 51).

Conclusions drawn from responses to the surveys cited in this Rationale reiterated these ideas. The following conditions that promote effective instructional use of technology, offered by Sheingold and Hadley (1990), are representative of conclusions and recommendations in the other survey reports:

- there should be enough technology (and, in particular, enough technology for teachers to have unrestricted access);
- there should be ample support and time for teachers to learn how to use technology and plan for its use; and

- there should be a school structure and culture in which teachers are encouraged and expected to take a professional and experimental approach to their work (p. ix).

These statements emphasize teachers' centrality to the full development of technology's use in schools today.

Similarly, the Tennessee Education Association (TEA) recognized the need to enhance the role teachers play in encouraging the development of policies and practices that promote the effective use of educational technology to enhance student learning. The Tennessee Teachers' Technology Initiative (TTTI) is a part of the commitment of TEA to examine ways educational technology can enhance teacher effectiveness. TTTI's Technology Steering Committee also served as a study group cosponsored by TEA and AEL, whose task was to assess the extent and type of use of educational technology in the classrooms of Tennessee through a survey of TEA members, to analyze and report the findings, and to make recommendations for policy and practice in the use of educational technology. Following is their report.

FINDINGS OF THE STUDY

Following computer analysis for descriptive statistics of the data, study group members clustered responses from 449 Tennessee Education Association member respondents to the TEA-AEL Survey of Educational Technology in the Classroom to report frequency of responses and commonalities, exceptions, and differences across grade levels emerging from the data. The purposes and methods of survey analysis are described in the Introduction section. The survey is included as Appendix A. The following clusters were based upon question similarities:

Questions 1, 2, 3, 4, 5
Demographic Summary of Respondents (analysis by region of state—questions 1, 2, 3; occupation and grade level of students assisted—questions 4 and 5)

Questions 6, 7, 8
Current Knowledge about Training in Technology

Questions 9, 10, 11
Use of Technology and Effects on Students

Questions 12, 13
Benefits and Obstacles of Technology Use in Instruction

Question 14
Recommendations for School Policy on Educational Technology

Questions 15, 16
Instructional Use of Microcomputers—Extent and Types

Questions 17, 18, 19
Instructional Use of Microcomputers—Location, Frequency, and Purpose

Question 20
Additional Comments about Educational Technology Use

The following subsections discuss the findings within the above clusters. The questions for each cluster are included here in abbreviated form for reference (see Appendix A for the complete survey).

Demographic Summary of Respondents

This topic examines data gathered in response to questions 1, 2, 3, 4, and 5 of the survey relating to demographic data on respondents. Responses provided information on geographic location by region of the state, occupation, and grade level of students assisted.

1. Name (optional)
2. School system
3. School name
4. Which of the following best describes your job: classroom teacher, librarian/media specialist, counselor, resource person, administrator, other (please specify)?
5. With which grade(s) or level(s) do you work?

Responses to one or more of the first three ques-

tions indicated the following regional distribution for 429 of the 449 survey respondents.

	Frequency	Percent
Western Tennessee	113	25.2
Middle Tennessee	54	12.0
Eastern Tennessee	262	58.4
Unknown	20	4.5

Responses to question 4 indicated that a large majority (78%) of the survey respondents were classroom teachers. Figure 1 illustrates the percentage of responses for each job description.

The "Other" category included the following personnel: 11 special education teachers, 8 Chapter I teachers, 5 speech therapists, 3 vocational education teachers, 2 physical education teachers, and 1 each of the following: learning disabilities specialist, computer teacher, media specialist, itinerant teacher, music teacher, university professor, school psychologist, attendance supervisor, and homebound teacher.

Of the 343 respondents who indicated they taught at a specific grade level, 49.9% taught at the elementary level, 23.3% taught at the middle school level, 26.5% taught at the high school level, and 0.3% taught at the postsecondary level." Figure 2 illustrates the percentage of response for each grade level group.

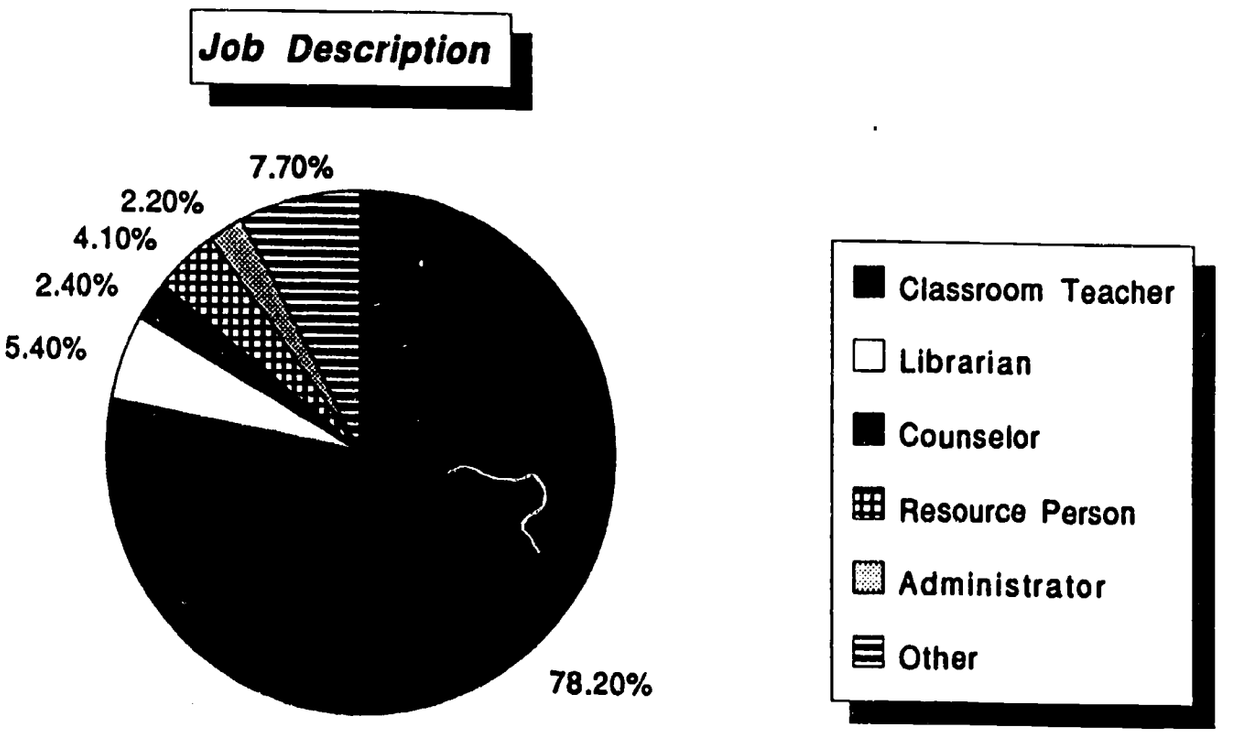

Figure 1
Job Descriptions of Respondents

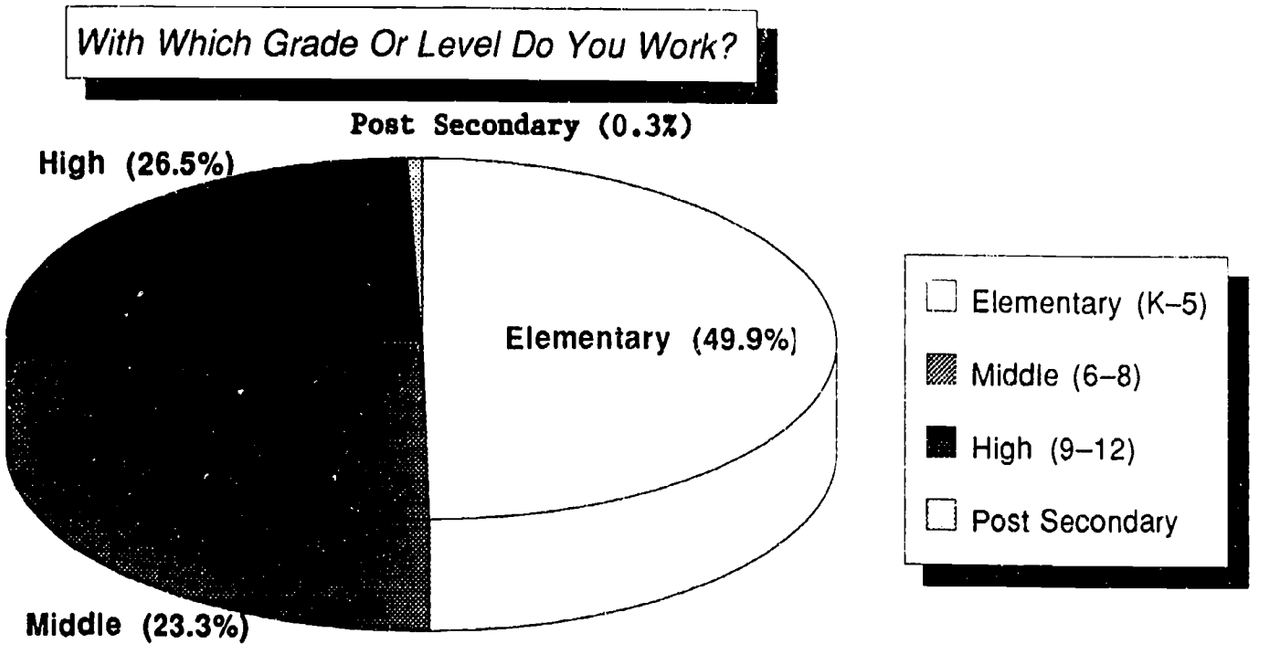

Figure 2
Grade/Level Distribution of Respondents

Current Knowledge about Training in Technology

Questions 6, 7, and 8 of the survey focused on respondents' perceptions of their technological knowledge and training, their desire for additional training/assistance, and the types of training/support/resources that have assisted or would assist them in using educational technology.

6. On a scale of 1 to 4, with 1 representing "not well informed" and 4 representing "very well informed," how well informed do you feel about each of the following types of educational technology: microcomputers, videodiscs, CD ROM, instructional television, satellite/distance learning, online information services, local area networks, computer bulletin boards, integrated learning systems.

7. Are you interested in receiving training in the use of educational technology for instructional purposes?

8. What kinds of training, support, resources, etc., (1) have assisted or (2) would assist you most in using educational technology?

Data from question 6, illustrated in Figure 3, indicate that overall respondents did not feel very well informed about educational technology. This is evident in the fact that higher percentages are indicated in Figure 3 for "not well informed" than "well informed" for all categories except instructional television. Approximately eight times as many respondents indicated they were "not well informed" compared with those responding "well informed" in reference to the nine types of technology listed in question 6. However, results indicate that respondents were most well informed about instructional television and microcomputers, technologies that have been available longer, than they were about more recently available technologies such as online information services and CD ROM.

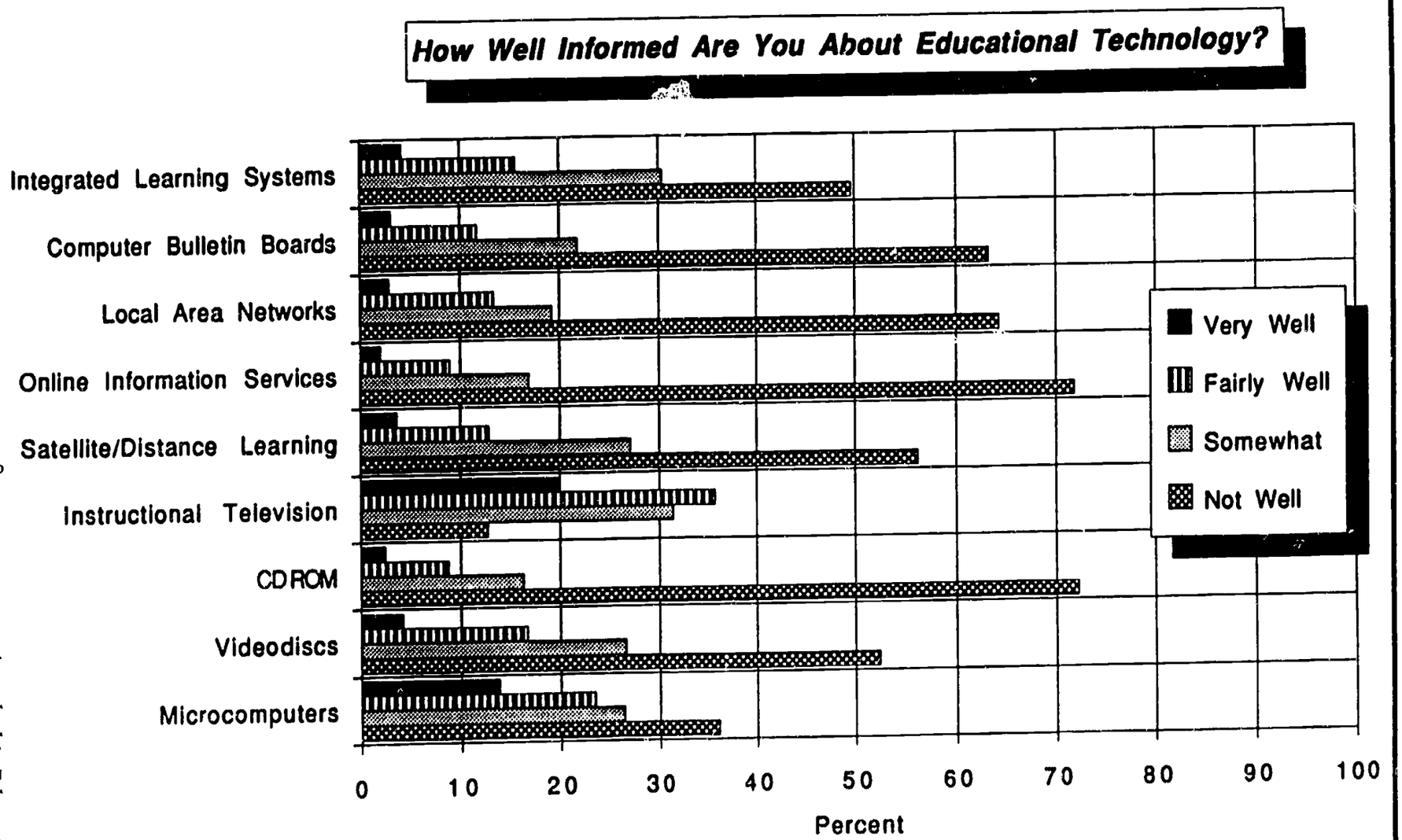

Figure 3
Information Levels about Types of Educational Technology

In a comparison of responses from elementary, middle, and high school teachers, elementary and middle school teachers reported being most well informed about instructional television while high school teachers indicated they were most well informed about microcomputers. In fact, more than twice as many high school teacher respondents reported being well informed about microcomputers than did elementary and middle school respondents. More high school teachers also judged themselves to be well informed about online information services, local area networks, satellite/distance learning, and CD ROM. For all other types of technology listed in question 6, there were no major differences in responses across grade levels.

Responses to question 7 illustrate broad respondent desire to receive training in the use of educational technology in the classroom. Of the 433 responses to this question, 92.6 percent were "yes" while only 7.4 percent were "no."

Question 8 focused on the kinds of training, support, and resources that (1) have assisted or (2) would assist teachers most in using educational technology. Table 1 displays the rank order and percentage of the total number of respondents checking each of 13 categories for "have assisted," "would assist," or "both."

In indicating what types of training/support/resources **have assisted** them most in using educational technology, 31.2 percent of the respondents (rank 1) reported summer workshops were most helpful. The second most helpful resources reported were after-school workshops (30.7%) and instruction/training manuals (29.8%). The least frequent responses were for school/school system technology policy (7.1%) and videodisc directories (9.1%). However, when asked what types of training/support/resources **would assist** them most, respondents most frequently indicated funding for equipment/software (61.5%) followed by summer workshops (50.8%), and during school day workshops (48.3%).

Variation in responses was minimal across grade

Table 1
Training/Support/Resources for Educational Technology

Training/Support/Resources	Have Assisted rank/percent	Would Assist rank/percent
1. Summer workshop(s)	(1) 31.2	(2) 50.8
2. After school workshop(s)	(2) 30.7	(6) 38.3
3. During school day workshop(s)	(4.5) 20.9	(3) 48.3
4. College/university course(s)	(6.5) 25.6	(9) 24.1
5. Instruction/training manuals	(3) 29.8	(10) 23.8
6. Software catalogs	(6.5) 25.6	(12) 11.1
7. Videodisc directories	(11) 9.1	(11) 18.5
8. School system technical specialist	(8) 14.7	(4) 39.6
9. Support network of teacher technology users	(10) 12.2	(5) 38.8
10. School administrator support/assistance	(9) 14.3	(7) 27.4
11. School/school system technology policy	(12) 7.1	(8) 24.3
12. Funding for equipment/software	(4.5) 20.9	(1) 61.5
13. Other	(13) 3.3	(13) 3.6

levels. Middle school teachers reported slightly more frequently than did elementary and high school teachers that instructional manuals and software catalogs had assisted them in using educational technology. Funding, the lowest ranked category of support that "has assisted" teachers, was ranked lowest by elementary teacher respondents. Elementary teachers also reported assistance from a support network of teacher technology users less frequently than did high school or middle school teachers.

Responses to question 8 seem to indicate that more funding for equipment/software and expanded training opportunities are most important in expanding Tennessee teachers' use of technology for instruction.

Use of Technology and Its Effect on Students

This section examines data gathered in response to questions 9, 10, and 11 of the survey relating to the use of educational technology and its effect on students. Responses provided information on the instructional subjects in which technology is used, the types of technology used, and respondents' perceptions of technology's effect on students.

9. For which instructional subjects or skill areas do you use educational technology?
10. How frequently do you use the following types of technology: microcomputers, videodiscs, CD ROM, instructional television, satellite/distance learning, online information services, local area networks, computer bulletin boards, integrated learning systems?
11. What effect has educational technology had on your students?

Mathematics (39%), reading (37%), and thinking skills (29%) were the instructional areas for which educational technology was most frequently used overall by respondents. However, responses differed across grade levels. For example, elementary teachers more frequently reported using technology in all three areas than did middle school or secondary teachers. The use of technology in mathematics instruction received the highest percentage of responses from elementary teachers (56%), followed by reading (50.7%) and thinking skills (32.1%). Middle school teachers most often reported using technology in reading instruction (32.3%), followed closely by mathematics (30.8%) and thinking skills (29.2%). Conversely, responses from secondary teachers indicated technology was used most frequently in mathematics, computer courses, and "other" courses not listed, with each of these areas receiving 18.1 percent of the responses. Educational technology was least frequently used by survey respondents in art, business education, music, and foreign language. Table 2 ranks subjects by percent of use of technology for each instructional level.

The data indicate that educational technology was most frequently used in core subjects such as mathematics and reading.

In their teaching, respondents most frequently reported using two types of educational technology—microcomputers and instructional television. Microcomputers were used "always" or "often" by 60 percent of the teachers, while instructional television was used "always" or "often" by 26 percent of those responding. The frequency of response for using microcomputers was slightly higher from secondary teachers (68%) than for middle school and elementary teachers (both 50%). Also, only 14 percent of the secondary respondents said they "never" used computers, as compared to 27 percent of the elementary and 33 percent of the middle school respondents. However, elementary and middle school teachers reported more frequent use of instructional television than did secondary teachers.

More than 80 percent of the 449 respondents said they "never" used online information services, CD ROM, satellite/distance learning, or computer bulletin boards. However, the percentage of non-users of these types of technology was highest at the elementary level and lowest at the secondary level. This may be due to the fact that information provided through these particular technologies, such as databases and advanced courses, are more applicable at the secondary level.

Figure 4 illustrates the frequency of use of nine

Table 2
Use of Technology in Subjects Taught Across School Levels

Elementary School (n=134)		Middle School (n=65)		Secondary School (n=72)	
Subject	**Percent of Response**	**Subject**	**Percent of Response**	**Subject**	**Percent of Response**
1. Mathematics	56.0%	1. Reading	32.3%	1. Mathematics	18.1%
2. Reading	50.7%	2. Mathematics	30.8%	2. Computer courses	18.1%
3. Thinking skills	32.1%	3. Thinking skills	29.2%	3. Other courses	18.1%
4. Writing	19.4%	4. Social studies	27.7%	4. Thinking skills	16.7%
5. Social studies	19.4%	5. Writing	18.5%	5. Science	15.3%
6. Science	17.2%	6. Science	18.5%	6. Business education	11.1%
7. Computer courses	9.7%	7. Computer courses	18.5%	7. Reading	9.7%
8. Art	3.7%	8. Other	16.9%	8. Writing	9.7%
9. Other	3.7%	9. Art	4.6%	9. Foreign language	6.9%
10. Music	1.4%	10. Music	4.6%	10. Social studies	4.2%
11. Business education	0.7%	11. Business education	1.5%	11. Art	1.4%
12. Foreign language	0.0%	12. Foreign language	0.0%	12. Music	0.0%

types of educational technology based on data gathered from 449 respondents to the survey.

When asked what effect educational technology has had on their students' social behavior, self-discipline, cognitive learning, self-confidence, attention span, subject interest, and motivation, teachers' responses were uniformly positive as shown in Figure 5. Across grade levels, respondents most frequently indicated a positive effect on students' motivation and subject interest. Secondary teachers led all other respondents with a 98 percent frequency of response on the positive effect of technology on these two aspects of student performance. Because motivation and interest often wane as students progress through school, secondary teachers may be more likely to note positive effects in these areas.

Across grade levels, respondents reported the least positive effect of technology on student' self-discipline and social behavior. However, in regard to technology's effect on self-discipline, approximately 70 percent were positive. Although 27 percent of the teachers indicated technology had no effect on their students' self-discipline, only three percent responded that technology had a negative effect. Similarly, 66 percent of the teachers perceived a positive effect of technology on their students' social behavior, while 32 percent indicated no effect and two percent perceived a negative effect. Although the types of technology used were frequently limited to microcomputers and instructional television, teachers reported positive effects on their students' performance.

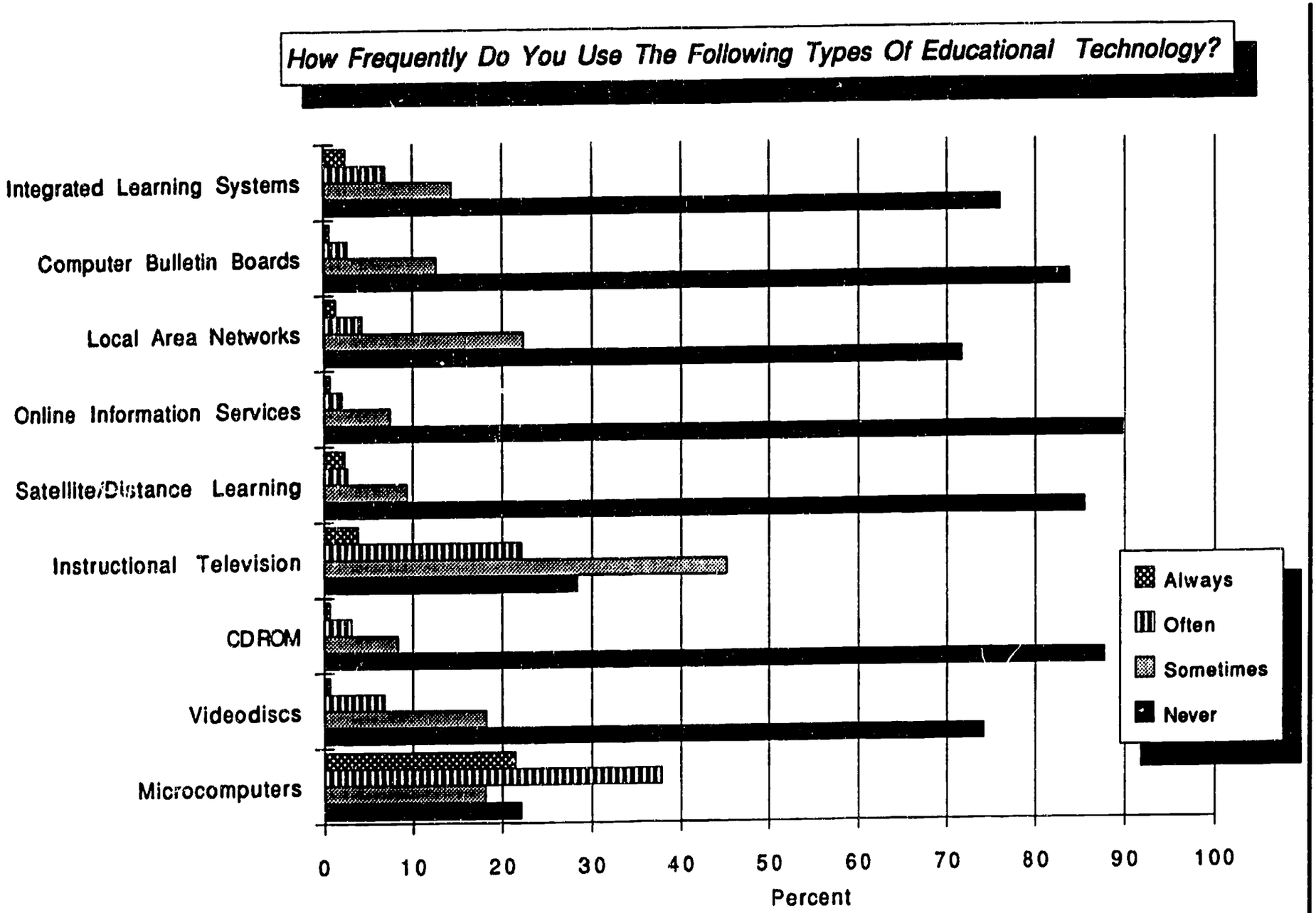

Figure 4
Respondents' Use of Nine Types of Educational Technology

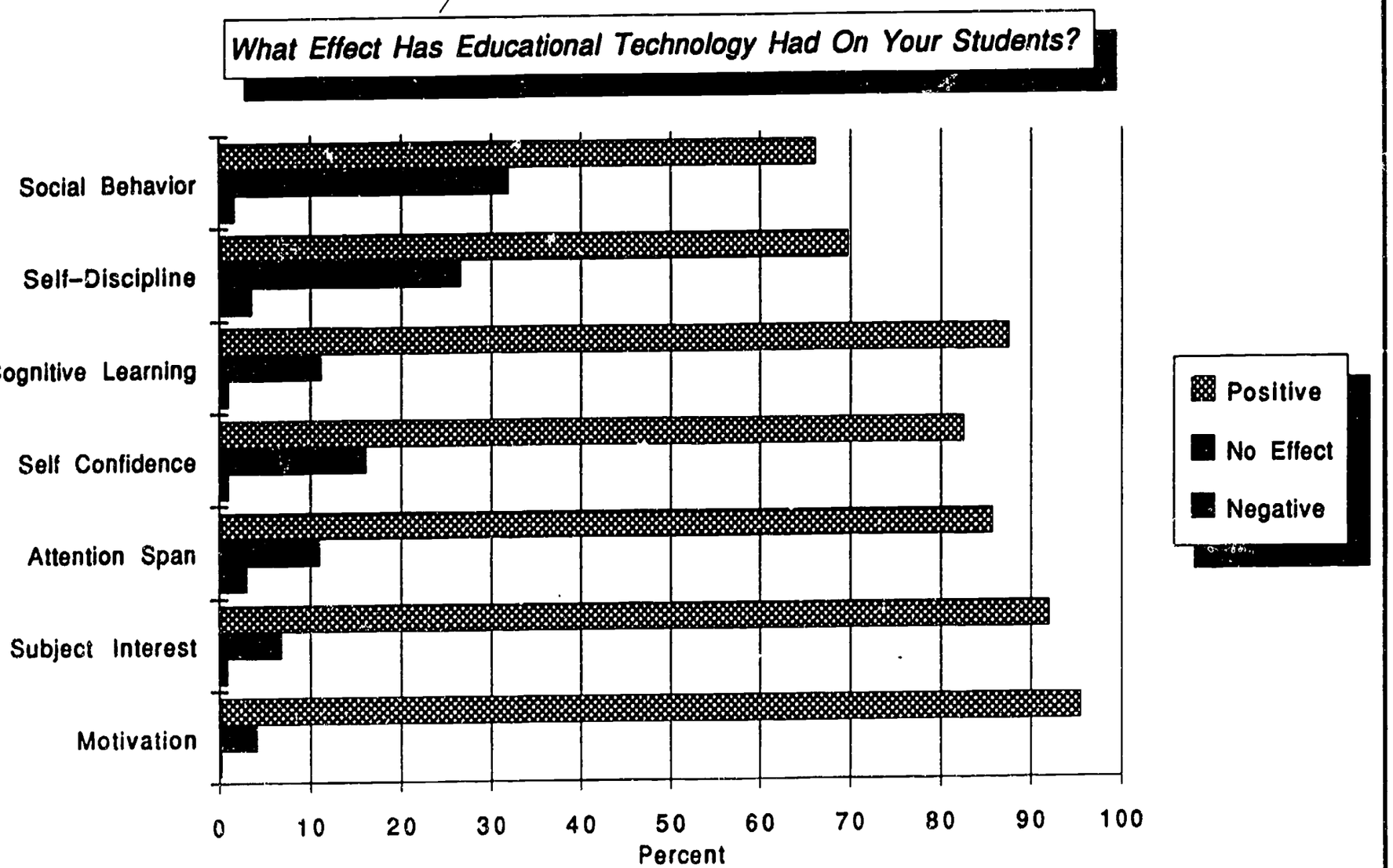

Figure 5
Effects of Educational Technology on Students

Benefits and Obstacles of Technology Use in Instruction

In addition to identifying the extent of technology use, its effects on students, and the level of teachers' knowledge about and training in technology, Parts A and B of the "TEA-AEL Survey of Educational Technology in the Classroom" were designed to assess respondents' opinions about technology use for instruction. Perceived benefits and obstacles to instructional use of educational technology were recorded in response to questions 12 and 13 of the survey.

12. What are the greatest benefits of instructional use of technology?

13. What are the greatest obstacles to more effective instructional use of educational technology?

One hundred thirty-nine respondents listed benefits of instructional use of technology. Their responses can be grouped in five categories—four of them related to student learning. The most frequent response was **motivation**. Forty-seven percent of the teachers reported that students are motivated to work with technology. The second most frequent response (23%) was **individualization**. Respondents reported that using educational technology allows for greater **individualization** in working with students. Twenty percent of the respondents cited "**keeping students on task** for a longer period of time" as a benefit, while nine percent felt the greatest benefit of instructional use of technology was **remediation and reinforcement**. One percent of the respondents listed **record keeping** for teachers as the greatest benefit.

In contrast, the 123 respondents to question 13 reported obstacles to more effective instructional use of technology that were not related to student performance. Their responses fit into three categories. Fifty-seven percent of the respondents indicated **lack of funding** as the greatest obstacle. **Lack of sufficient time** to use educational technology was mentioned by 30 percent of the teachers. The remaining 13 percent of the respondents reported obstacles such as **lack of training, lack of software,** and **outdated equipment**.

Data on teacher perceptions of the use of technology for instruction reported in questions 12 and 13 appear to indicate that teaching is enhanced by educational technology. However, obstacles that, for the most part, are beyond the teacher's control hinder its use in the classroom.

Recommendations for School Policy on Educational Technology

In response to question 14, survey respondents were asked to recommend ideas for public school policies on the use of educational technology.

14. Please list below some ideas you feel should be included in public school policy concerning the use of educational technology.

One hundred seventy-four (39%) of the 449 survey respondents answered this question. They suggested that policies for the use of educational technology should address funding, equipment, and teacher training/support.

The most frequent response related to equipment. Forty-two percent (73) of the respondents to question 14 suggested that more and better equipment should be available for every teacher and for students. Twenty-three of these respondents said that computers should be located in each classroom rather than in labs. Five teachers mentioned the need for a computer on every teacher's desk. Additionally, eight teachers recommended that adequate and updated software be made available. Finally, the need for educational technology other than computers (e.g., videodiscs, satellite learning) was reported by eight respondents.

Closely related to suggestions about equipment were responses concerning funding. Seventeen percent of the respondents stated the need for adequate funding for equipment purchases, maintenance and repairs, and teacher training. Also, one respondent

suggested that a computer coordinator should be employed to oversee the effective use of funds and equipment. One teacher's comment summarized the feelings expressed by respondents who addressed funding: "Those in power should fund the program and train the teachers."

A third category of responses emerging to question 14 specifically addressed the need for teacher training. Approximately 29 percent of the teachers responding to this question perceived that teachers need training in order to make better use of available equipment. Most respondents also expressed the concern that training be appropriately and equitably funded. For example, four teachers felt that specialists were needed to provide in-depth, ongoing training for teachers and students. Another respondent suggested that an on-site facilitator be responsible for equipment care and proper use.

Finally, 19 respondents offered suggestions related to other educational technology issues. These responses included: the need for more computer time for special needs students, concerns about more effective use of technology in the school library, and the need for local networks in the schools. One comment summarized these responses: "School policy should be to plan the work and work the plan."

Instructional Use of Computers: Extent and Types

Part C of the survey (questions 15-19) was designed for teachers who use computers. Questions 15 and 16 reported data on the extent of computer use and the brands of hardware used by respondents.

15. Do you currently use a computer for instructional purposes?

16. What brand of microcomputer do you use in your school?

Of those responding to item 15, 88.1 percent indicated they used a computer for instructional purposes while 11.9 percent indicated they did not. Of the three groups of teachers responding (elementary, middle school, and high school), the largest percentage of computer-using teachers was found in the elementary group (64.2%), followed by high school teachers (63.9%) and middle school teachers (53.8%).

Data from responses to question 16 regarding brands of hardware used in schools indicate that the most commonly used hardware is the Apple II family (84.4%) followed by IBM (12.6%). See Table 3 for complete analysis of findings on hardware use. The total number of responses for brands used is greater than the total number of respondents to the question. This may be attributed to the fact that some respondents reported using more than one brand of computer. This was most common at the high school level, where 64.2 percent of the respondents reported using Apple II, 34 percent said they used IBM, and 25 percent indicated they used other brands of hardware. Also, some respondents reported using computers, but not for instructional purposes.

Instructional Use of Computers: Location, Frequency, and Purpose

The questions in this cluster focused on three topics: the location and number of computers available for teacher and student use, the frequency of student use of computers for instruction, and the instructional purposes for which teachers use computers. An abbreviated version of the questions is included below. The complete questions can be found in Appendix A.

17. What is the location and number of computers available for your use and for student use?

18. How frequently do your students use the school's computers for instructional purposes?

19. How often do you use computers for the following purposes: drill and practice, enrichment/remediation, assessment/monitoring progress, composing/desk-top publishing, record keeping, visual-technical aid?

Six of the 25 teachers responding to question 17 reported having access to one or more computers in their classroom, eight said they had access to one or

Table 3
Types of Computers Used

Total Respondents (n=302)			Elementary School (n=96)		
Brand	**Number**	**Percent**	**Brand**	**Number**	**Percent**
Apple II	255	84.4	Apple II	83	86.5
Macintosh	20	6.6	Macintosh	1	1.0
IBM	38	12.6	IBM	3	3.1
Tandy	4	1.3	Tandy	0	0.0
Commodore	10	3.3	Commodore	0	0.0
Amiga	2	0.7	Amiga	0	0.0
Apple comp.	19	6.3	Apple comp.	10	10.4
IBM comp.	6	2.0	IBM comp.	5	5.2
Texas Inst.	10	3.3	Texas Inst.	0	0.0
Middle School (n=40)			**Secondary School (n=53)**		
Brand	**Number**	**Percent**	**Brand**	**Number**	**Percent**
Apple II	38	95.0	Apple II	34	64.2
Macintosh	1	2.5	Macintosh	3	5.7
IBM	4	10.0	IBM	18	34.0
Tandy	0	0.0	Tandy	0	0.0
Commodore	0	0.0	Commodore	2	3.8
Amiga	0	0.0	Amiga	0	0.0
Apple comp.	2	5.0	Apple comp.	0	0.0
IBM comp.	1	2.5	IBM comp.	1	1.9
Texas Inst.	0	0.0	Texas Inst.	10	18.9

more computers in a lab setting, six indicated they used a computer in the library/media center, five reported using one or more computers in the school office, and only one teacher reported access to a computer in the teacher workroom.

Access to computers for student use was reported in classrooms and computer labs. Six of the 25 teachers reported that students have access to between one and 21 computers in their classroom, while 11 reported a range of one to 26 computers for student use in a lab setting. Middle school teachers more frequently reported student use of computers in labs. This may be due to Tennessee state funding for Computer Skills Next labs for middle schools. In contrast, elementary teachers reported more computers in individual classrooms than did middle or high school respondents.

The majority (72%) of the respondents to question 18 said their students use the school computers daily or weekly. More than 20 percent of the teachers responding reported that their students use computers in six-week or semester blocks in labs. Figure 6 illustrates the frequency of response for daily, weekly, monthly, or other use.

Survey respondents reported using computers "always," "sometimes," or "often" for a range of instructional and management purposes (see Figure 7). Most frequently, teachers reported using computers for enrichment and remediation (75%). The second most frequent use was for drill and practice (72%) and simulations/games (72%). Teachers in this survey least frequently reported using computers as a visual-technical aid for a presentation (39%) and for record keeping (40%).

A comparison of responses across grade levels indicates there was a greater tendency to use computers for assessment/monitoring student progress and

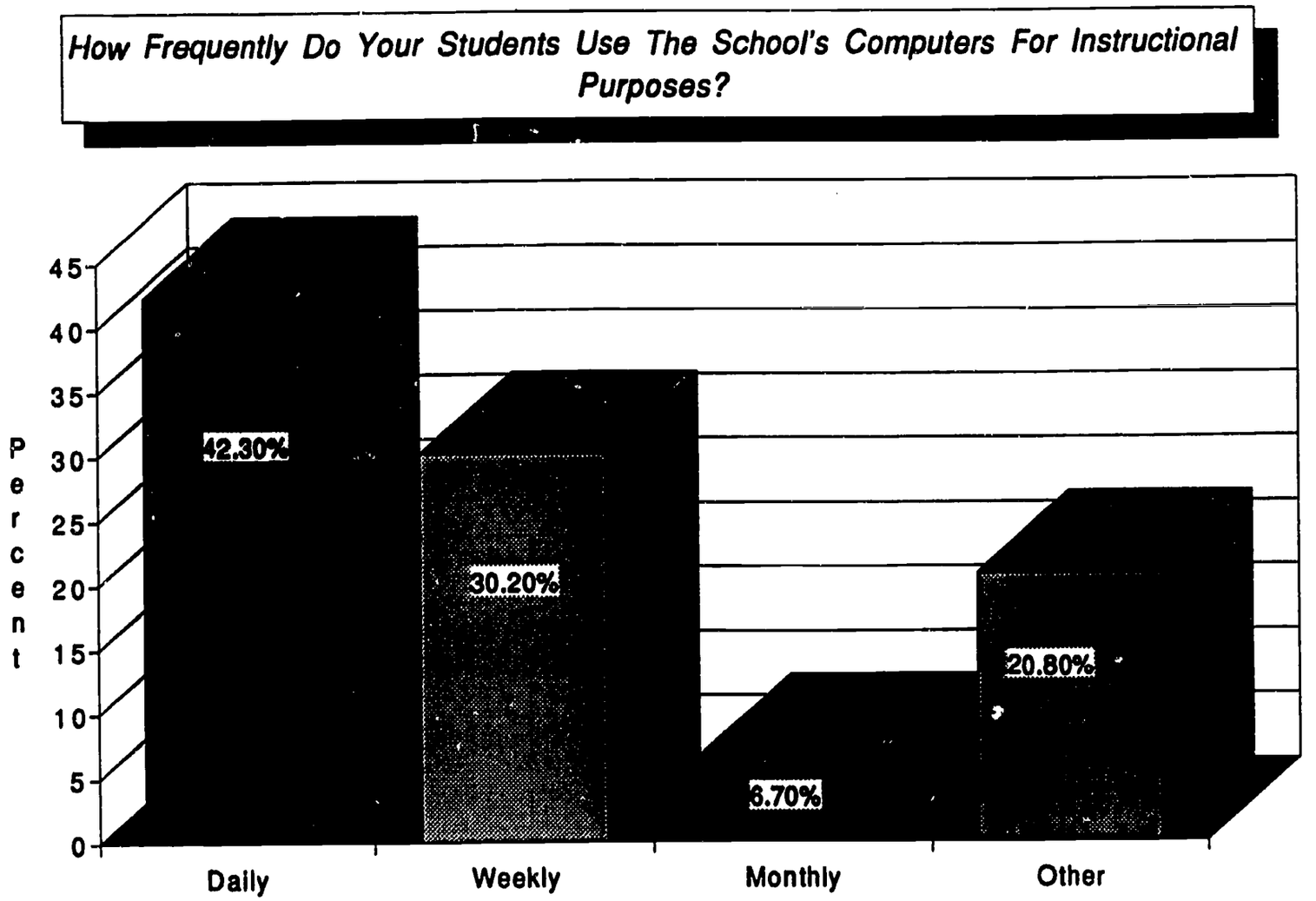

Figure 6
Students' Use of Computers for Instruction

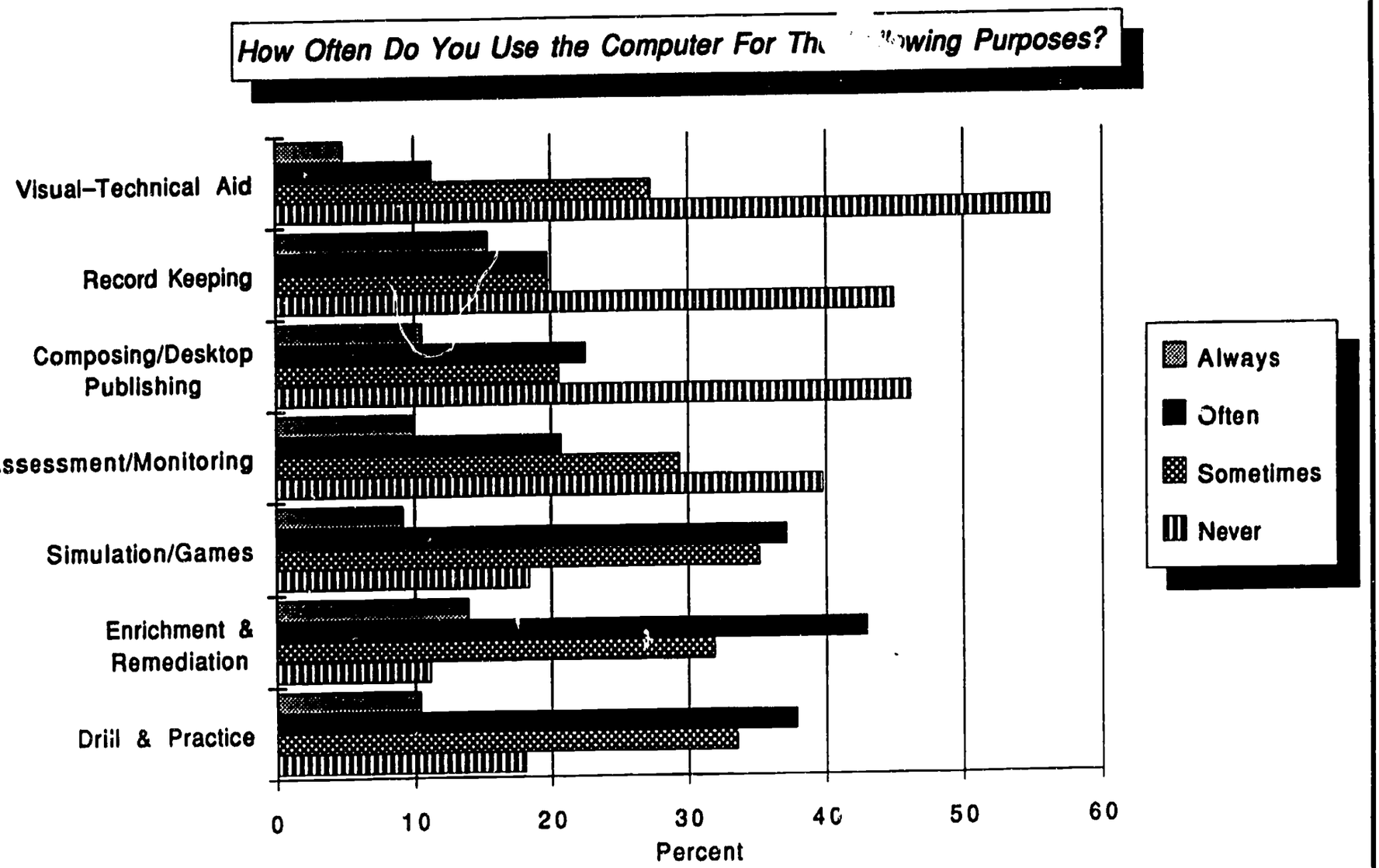

Figure 7
Students' Use of Computers for Instruction

composing/desk-top publishing at the higher grade levels.

Additional Comments about Educational Technology Use

Question 20 of the survey asked teachers to add any additional comments concerning educational technology use. Findings reported in this subsection closely parallel findings reported for question 14 regarding policy for educational technology use.

20. Please use the space below to make comments concerning the topics addressed by this survey.

Fifty teachers (11% of the total number of survey respondents) responded to question 20. Their comments were focused on three concerns: availability of technology, training in the use of technology, and funding to support educational technology use.

The most frequently mentioned concern was the need for both teachers and students to have access to available technologies. Thirty-two (64%) of the 50 teachers who responded to this item felt that every student, teacher, and school must have access to computers and other technology. Many of the respondents said they needed more equipment or equipment upgraded. Several respondents expressed the need for equal access to technology across school systems. One comment summarizes these concerns: "All systems should be treated the same with proper resources."

Forty-six percent of the teachers who responded to question 20 felt that teachers need training in order to use technology well. The following comments illustrate their responses:

- "Teachers need help and suggestions from those who have had success in implementing new ideas and technologies in their classrooms."
- "I have no information. This makes me wonder how much in the Dark Ages our system is."
- "Any classroom teacher (who is) not using computers on a daily basis is outdated and behind the time and needs to get with the program immediately."

Fourteen (28%) of the teachers responding specifically cited funding as the primary obstacle to the use of educational technology. Also, other comments regarding the need for training, updated equipment/software, and access to equipment implied the need for additional funding. Two comments summarize respondents' concerns about funding:

- "The problem is money. We really use our one computer in the teacher work area. We need at least five more, and we have the space."
- "Tennessee needs to move forward in the use of technology because the state appears to be at least ten years behind the nation in using computers."

INSTRUCTIONAL USE OF COMPUTERS:
A COMPARISON OF TEA-AEL SURVEY FINDINGS WITH NATIONAL SURVEY FINDINGS

Extent of Instructional Use of Computers

Teachers who currently use computers were asked to respond to Part C, questions 15-19, of the "TEA-AEL Survey of Educational Technology in the Classroom." In response to question 15 in the TEA-AEL survey (see Appendix A and Findings section for question and analysis of data), more than 59 percent of all survey respondents reported currently using a computer for instructional purposes. Slightly more elementary teachers (64.2%) reported computer usage for instructional purposes than did high school teachers (63.9%) or middle school teachers (53.8%). These findings are comparable to the findings reported in several national surveys.

Sheingold and Hadley (1990) conducted a survey of teachers who were experienced and accomplished at using instructional technology. Respondents included teachers in grades 4 through 12 from all 50 states in both public and private schools. Almost half (42%) of these experienced/accomplished teachers reported using computers for instructional purposes. Becker (1990) found that of the 3,000 United States teacher respondents to the "Computers in Education" survey, a survey conducted in 20 countries by the International Association for the Evaluation of Education that focused on teacher and school practices, two-thirds described themselves as "computer-using." Also, data from a survey conducted by *Instructor* magazine and reported in the April 1991 issue indicated that 86 percent of the respondents used computers for instruction or class management at least one or more times per week.

Also, student instructional use of computers is growing. According to Census Bureau data reported in *Education Week*, April 3, 1991, 46 percent of all 3 to 17 year olds used computers in school in 1989, up from only 30 percent in 1984. Also, conclusions from the findings of "Power On! New Tools for Teaching and Learning" (OTA, 1988) state that generally teachers are moving away from teaching about computers and toward integrating computers into the curriculum. These conclusions are supported by the National Foundation for the Improvement of Education (NFIE) study, "Technology and Restructuring: A Glimpse into Today's Classrooms" (Kane and Legters, 1990). Two-thirds of the technology projects in elementary, middle, and high schools incorporated in this study involved the use of computers as a tool for students to apply their knowledge in purposeful activities. Similar to findings of the TEA-AEL survey, these projects were more frequently found in elementary (38%) or high school (38%) programs. Middle schools were represented by 21 percent of the entries.

In summary, most studies, including the "TEA-AEL Survey of Educational Technology in the Classroom," report the percentage of teachers using computers in instruction at or above 60 percent.

Computer Hardware Used in Instruction

Responses to question 16 of the TEA-AEL survey regarding types of hardware indicated that 84.4 percent of the 255 teachers who answered this question used the Apple II family of computers. Some teachers

also reported using more than one brand of hardware. For example, 64.2 percent of the high school teacher respondents reported using Apple II, while 34 percent reported using IBM. Smaller percentages of the high school teachers also reported using other brands listed in the question (see Findings section, question 16, for data analysis). These findings parallel findings of one national survey, "When Powerful Tools Meet Conventional Beliefs and Institutional Restraints: National Findings on Computer Use by American Teachers" (Becker, 1990), that included a question on hardware.

Becker found that Apple II and other eight-bit computers represented nearly 90 percent of elementary school computers and 60 percent of the computers used in high schools. Also, elementary teacher respondents to Becker's survey reported that most computers to be purchased in the future would be Apple II's. However, at the high school level, new purchases were expected to be primarily IBM compatible MS-DOS or Macintosh.

Location of Computers

Question 17 asked respondents to list the number of computers available for teacher use and for student use in five different school locations. Twenty-five of the responding teachers reported having access to a computer for their use either in the classroom, school office, teacher workroom, or media center. Six of the teachers reported that students have access to one or more computers in their classroom, while 11 reported that students used computers in a lab. According to the survey data, middle schools have more computer labs than elementary schools, but elementary schools have a larger number of computers in individual classrooms. Similar findings were reported in national surveys.

The 1988 OTA study, "How Technology Affects Teaching," did not deal with the specific location of computers (classroom or lab setting), but concluded that location of hardware could be an impediment to the use of educational technology if teachers perceived lack of access to appropriate hardware and software. Also, the OTA study showed that the presence of computers in a school does not necessarily guarantee convenient access by teachers and students. Rather, teachers reported two factors that affect their use of technology—location of computers and scheduling of their use. A single computer in a classroom was viewed by most teachers in the OTA study as a more effective instructional tool than a laboratory of computers intended for other uses.

Several national studies indicated that the availability of classroom computers has increased significantly. Eleven percent of the respondents to "A Teacher Survey NEA Report: Computers in the Classroom" (National Education Association, 1982) reported having computers in their classrooms. Data from "The Computer Report Card: How Teachers Grade Computers in the Classroom" (Wirthlin Group, 1989) indicated that 23 percent of the respondents had computers in their classrooms and 18 percent used computers both in their classrooms and labs. A survey by *Instructor* magazine (April, 1991) revealed that 76 percent of the respondents had a classroom computer, slightly lower than that reported by respondents to the TEA-AEL survey, and the average number of classroom computers reported was two. Sheingold and Hadley (1990) found that in 62 percent of the schools where respondents worked, students had access to computers in both labs and classrooms, while in 25 percent of the schools students had access in labs only, and 13 percent in classrooms only. The percentage of schools in the Sheingold and Hadley study with both lab and classroom computers is comparable to the 50 to 60 percent range reported by respondents in the TEA-AEL survey. However, the percentage of respondents to the TEA-AEL survey who reported student access to computers in the classroom (79%) is higher than that reported in the four national surveys mentioned above.

Frequency of Student Use of School Computers for Instructional Purposes

Daily student use of computers in instruction was reported by 43 percent of the TEA-AEL survey respondents, while 30 percent reported weekly use, and

7 percent reported their students use computers monthly. Twenty percent of the teachers reported that their students use computers in semester or six-week blocks in a computer lab setting. The frequency of student use of computers in instruction reported by TEA-AEL survey respondents is generally comparable to that reported in national studies. However, not all reviewed studies distinguished between teacher use and student use of computers in instruction.

For example, the Wirthlin Group survey (1989) produced the following data on teachers' use of computers for instruction and classroom management: 33 percent of the respondents reported using computers fewer than two hours per week; 30 percent reported two to five hours per week of computer use; 14 percent indicated they used computers for instruction more than five hours but fewer than 10 hours per week; and 22 percent of the teachers reported using computers 10 or more hours per week. Also, findings from the *Instructor* magazine survey (April, 1991) indicated that 86 percent of the teacher respondents used a computer for instruction/classroom management one or more times per week. If student use can be correlated with teacher use of computers for instruction, then the findings from these two studies are comparable to those of the TEA-AEL survey.

Although the 1988 study conducted by the Office of Technology Assessment did not produce data on the frequency of computer use by students, it did determine that easy access to computers by teachers and students directly affects the extent to which computers influence curriculum. Also, teacher respondents to the study indicated they would be more likely to incorporate computer technology in instruction if computers were located in their classroom.

Other information related to student use of computers was reported in *Education Week*, April 3, 1991. Census Bureau data revealed racial differences in computer use. In schools, 48 percent of white students, but only 35 percent of black students said they used computers. Approximately 38 percent of Hispanic students reported using computers in schools. Also, students in private schools reported having greater access to computers than did those in public schools.

Purpose of Instructional Use of Computers

Teachers who responded to the "TEA-AEL Survey of Educational Technology in the Classroom" reported using computers for a range of instructional and management purposes. The most frequent response was for enrichment and remediation (75%), followed closely by drill and practice (72%) and simulations/games (72%). The least frequent response was for a visual-technical aid to accompany presentations (see Findings section, question 19, for complete analysis of data). Similar findings were reported in national studies.

In "How Technology Affects Teaching" (OTA, 1988), the authors distinguished two ways in which teachers use computers in the classroom: 1) as an object of study and 2) as a tool for teaching and learning. Further, findings from this study indicated that computer-using teachers were as likely to use computers to support open-ended problem solving as they were to use them for drill and practice. If one may conclude that responses to the enrichment/remediation category in question 19 of the TEA-AEL survey encompass problem solving activities, then Tennessee teachers responding to the survey also used computers almost equally as often for drill and practice (72%) and enrichment/remediation (75%).

Other studies support the findings from the TEA-AEL survey regarding instructional purposes for teachers' use of computers. Data from the Sheingold and Hadley study (1990) of accomplished computer-using teachers indicated that software programs for problem solving, tutorials, and drill and practice were used about equally by 72-75 percent of the respondents. As in the TEA-AEL study, the least frequent response on the purpose of computer use was for multimedia presentations (25%). The Wirthlin Group study (1989) produced similar results: 75 percent of the respondents reported using computers for drill and practice, followed by higher order thinking skills (66%), teach subject matter (65%), and record keeping (48%). Finally, both the NEA (1982) and the *Instructor* (April, 1991) surveys revealed that 86 percent of the teachers responding used computers most frequently for drill

and practice. However, other studies illustrated that as teachers become more experienced in computer use, they use computers less frequently for drill and practice and more often as a tool for students to accomplish an academic task (Becker, 1990; Sheingold & Hadley, 1989).

In a review of successive national surveys of computer-using teachers, Becker (1990) found the most significant instructional change to be that word processing and keyboarding skills have replaced programming as the most common element in computer education classes. Teacher respondents to Becker's study also reported utilizing a greater variety of software in traditional academic classes. Over the last several years, types of software used in academic classes have moved from drill and practice to elaborate simulations; games that require problem solving and information analysis; and a variety of mathematics tool kits, prewriting/writing activities, and science labs. However, the largest number of software programs used by teachers remains focused on recall of facts rather than on motivating higher order thinking skills, problem solving, and deeper understanding of subject matter. Becker concluded that most students still use "tool-oriented" programs such as databases, spreadsheets, and word processing in computer education classes rather than in academic classes. His study further revealed that computers are still not the major medium through which students learn.

Similar conclusions resulted from the "Technology and Restructuring" study (Kane and Legters, 1990).

1. "Teachers have effectively used technology as a tool to restructure the learning environment.

2. However, the majority of teachers demonstrate little knowledge about how to combine creative restructuring ideas with the potential of technology. Most fell into two categories: they either used technology without challenging the methods and results of traditional education, or they were working with innovative ideas but demonstrated little knowledge of how technology could enhance and broaden the possibility of those ideas" (p. 6).

In conclusion, findings from the "TEA-AEL Survey of Educational Technology in the Classroom" closely parallel findings from national studies on teachers' use of technology. Most notable among the similarities are the following:

1. Most studies placed the percentage of teachers using computers as an instructional tool in the 60 to 70 percent range. Of these computer-using teachers, the largest number were elementary teachers, followed by high school teachers, and then middle school teachers.

2. The higher incidence of computer use among elementary teachers may be a result of the fact that more elementary teachers reported having computers in their classroom. Several studies found that teachers view a single computer in the classroom as a more effective instructional tool than a computer lab, due to problems of distance and scheduling of labs. In view of this finding, it is interesting to note that Tennessee middle schools teachers (lowest frequency of computer use) responding to the TEA-AEL survey reported a higher percentage of computers located in labs than did elementary or high school teachers, and a higher percentage than was reported in other studies.

3. While not all studies distinguished between teacher and student use of computers for instruction, there was a correlation between higher percentages of teacher use and higher percentages of student use. When respondents reported having access to computers in their classroom, the percentage of student use was generally higher.

4. Although more experienced and accomplished computer-using teachers tended to view the computer as a multipurpose tool, the majority of teachers reported using computers most often for drill and practice. The potential of the computer to enhance curriculum has not yet been fully realized.

Recommendations for Policy and Practice

To describe current use of educational technology in Tennessee classrooms was a major goal of this study. However, the authors also intend that this publication inform teachers, administrators, policymakers, and educator association personnel who may act to encourage and enhance the use of educational technology. Therefore, the following recommendations are included to stimulate discussion at the local and state levels about the adequacy of funding, hardware, software, and teacher training to support instructional use of technology in Tennessee schools. Based upon their analysis of survey data, the authors of *Bits, Bytes, and Barriers: Tennessee Teachers' Use of Technology* make the following recommendations:

Technology-Using Teachers

1. Serve as role models and peer tutors for others in your building and school system who want to learn about instructional uses of technology.
2. Plan and lead inservice sessions at the building level to encourage use of technology in the classroom.
3. Write about your personal use of and readings on instructional technology for professional journals and school/division newsletters.
4. Develop local clearinghouses for hardware and software resources.

District and Building Administrators

1. Provide sufficient quantities of appropriate hardware and software for classroom use. Set short- and long-range goals for equipment acquisition.
2. Provide time for training and planning for instructional use of technology during the regular school day. Provide stipends to educators for training in summer workshops.
3. Foster an atmosphere of innovation, experimentation, and collegiality that encourages professional educators to go beyond traditional modes of instruction.

State Policymakers

1. Provide priority funding for hardware, software, and teacher training to enhance and promote the use of technology in the classroom. Provide for continued acquisition of hardware, maintenance and upgrading of existing hardware, and the continued acquisition of upgraded software.
2. Develop and sustain business partnerships that help support equipping, training, and networking for school systems.

Association Personnel

1. Encourage and support teacher participation in workshops, conferences, and seminars at the local, state, and national levels.
2. Continue to seek corporate sponsorship for pilot programs in educational technology.
3. Increase lobbying efforts for funding for educational technology in Tennessee schools.
4. Work with local association affiliates and boards

of education to promote technology instruction for teachers and students.

5. Highlight innovative uses of educational technology in each issue of *Tennessee Teacher* and or *TEA News*. For example, initiate a "technology news and notes" column.

6. Work with school systems to investigate options for teachers to have access to computers in their homes for training, development of instructional materials, and research purposes.

7. Work with school systems toward the provision for each teacher to have a work station incorporating audio, video, and voice/data communication equipment. Such equipment would include a freestanding microcomputer, printer, television monitor, VCR, and overhead LCD projection unit.

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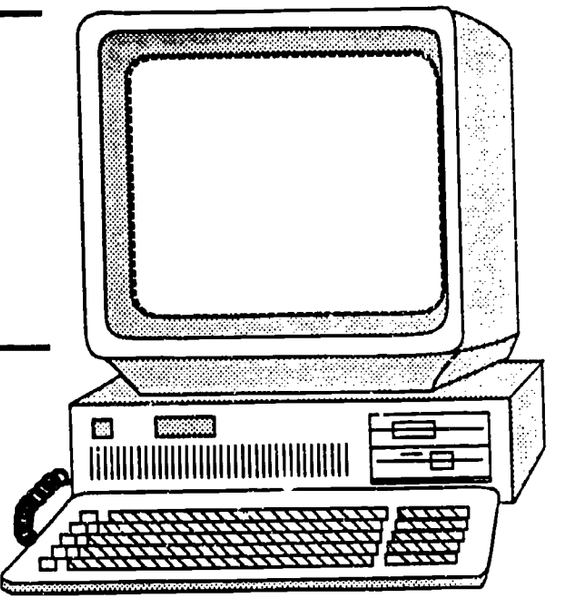
APPENDIX

TEA-AEL Survey of Educational Technology in the Classroom



Are you into CD ROMs and ILSs? Do you know a byte from a LAN? Or are you currently baffled by your VCR, but highly motivated to learn about your TV's remote control? Whether you are high tech or low tech, educators in a study group of TEA members sponsored by TEA and the Appalachia Educational Laboratory (AEL) are interested in your opinions about and use of educational technology in instruction. The TEA-AEL Educational Technology Study Group invites every Tennessee teacher in grades K-12 instruction to respond to the brief survey that follows.

By completing the survey and returning it to TEA, you'll be contributing to the Study Group's final product, a publication describing the current use of educational technology in Tennessee schools, highlighting model practices, and recommending policies for the implementation of educational technology. This status report and guide for technology adopters will be disseminated widely by TEA and AEL beginning later this year.

Please take the ten minutes required to read, complete, and return your responses to the following questions. Your responses will be grouped with those of teachers from around Tennessee and will be used anonymously. If you have questions regarding the study or survey, contact Peggy Smith, TEA (800/342-8367 or 8262) or Jane Hange or Becky Burns, AEL (800/624-9120). The survey may be copied and distributed for completion by other Tennessee teachers. **Please mail the completed survey by April 19 to Peggy Smith, TEA, 598 James Robertson Parkway, Nashville, TN 37219.** Thank you for your help.

SURVEY INSTRUCTIONS

Please respond to the survey items from the perspectives of your role and experience in the classroom or school. For this survey, consider your opinions about and instructional use of the following educational technology forms: television, microcomputers, videodiscs, Integrated Learning Systems, CD ROM (Computer Disc Read Only Memory), and/or distance learning systems (including satellite downlink broadcasts, audio and video interactive teleconferencing, and audiographics). Please respond to each question.

PART A: FOR ALL RESPONDENTS

1. Name (optional)

   _____

2. School system

   _____

3. School name

   _____

4. Which of the following best describes your job? (Check below.)

- ☐ Classroom teacher
- ☐ Librarian/media specialist
- ☐ Counselor
- ☐ Resource person
- ☐ Administrator
- ☐ Other (Please specify.)

_____

5. With which grade(s) or level(s) do you work?

_____

6. How well **informed** do you feel about each of the following types of educational technology? Check one number for each and use this scale: 1 = not well informed; 2 = somewhat informed; 3 = fairly well informed; 4 = very well informed.

a. Microcomputers
☐ 1 ☐ 2 ☐ 3 ☐ 4

b. Videodiscs
☐ 1 ☐ 2 ☐ 3 ☐ 4

c. CD ROM
☐ 1 ☐ 2 ☐ 3 ☐ 4

d. Instructional television
☐ 1 ☐ 2 ☐ 3 ☐ 4

e. Satellite/distance learning
☐ 1 ☐ 2 ☐ 3 ☐ 4

f. Online information services
☐ 1 ☐ 2 ☐ 3 ☐ 4

g. Local area networks (networked computers within a school or district)
☐ 1 ☐ 2 ☐ 3 ☐ 4

h. Computer bulletin boards
☐ 1 ☐ 2 ☐ 3 ☐ 4

i. Integrated Learning Systems (custom packages of computers, data storage services, and instructional software)
☐ 1 ☐ 2 ☐ 3 ☐ 4

7. Are you interested in receiving training in the use of educational technology for instructional purposes?
☐ Yes ☐ No

8. What kinds of training, support, resources, etc. **(1) have assisted** or **(2) would assist you most** in using educational technology? Place the appropriate number(s) for your responses in the blanks of all that apply.

- ____ Summer workshop(s)
- ____ After school workshop(s)
- ____ During school day workshop(s)
- ____ College/university course(s)
- ____ Instruction/training manuals
- ____ Software catalogs
- ____ Videodisc directories
- ____ School system technology specialist
- ____ Support network of teacher technology users
- ____ School administrator support/assistance
- ____ School/school system technology policy
- ____ Funding for equipment/software
- ____ Other (Please describe.)

_____

For nonusers of educational technology, stop here and mail your responses.

PART B:
FOR TEACHERS WHO USE EDUCATIONAL TECHNOLOGY

9. For which instructional subjects or skill areas do you use educational technology? Check all that apply.

- ☐ None
- ☐ Reading
- ☐ Writing
- ☐ Thinking skills
- ☐ Foreign language
- ☐ Social studies
- ☐ Science
- ☐ Mathematics
- ☐ Business education
- ☐ Computer courses
- ☐ Music
- ☐ Art
- ☐ Other (Please specify.)

_____

10. How frequently do you **use** the following types of educational technology? Check one number for each and use this scale: 1 = never; 2 = sometimes; 3 = often; 4 = always

a. Microcomputers
☐ 1 ☐ 2 ☐ 3 ☐ 4

b. Videodiscs
☐ 1 ☐ 2 ☐ 3 ☐ 4

c. CD ROM
☐ 1 ☐ 2 ☐ 3 ☐ 4

d. Instructional television
☐ 1 ☐ 2 ☐ 3 ☐ 4

e. Satellite/distance learning
☐ 1 ☐ 2 ☐ 3 ☐ 4

f. Online information services
☐ 1 ☐ 2 ☐ 3 ☐ 4

g. Local area networks
☐ 1 ☐ 2 ☐ 3 ☐ 4

h. Computer bulletin boards
☐ 1 ☐ 2 ☐ 3 ☐ 4

i. Integrated learning systems
☐ 1 ☐ 2 ☐ 3 ☐ 4

11. What effect has educational technology had on your students? Check one number for each and use this scale: 1= negative effect; 2 = positive effect; 3 = no effect

a. Motivation
☐ 1 ☐ 2 ☐ 3

b. Subject interest
☐ 1 ☐ 2 ☐ 3

c. Attention span
☐ 1 ☐ 2 ☐ 3

d. Self confidence
☐ 1 ☐ 2 ☐ 3

e. Cognitive learning
☐ 1 ☐ 2 ☐ 3

f. Self-discipline
☐ 1 ☐ 2 ☐ 3

g. Social behavior
☐ 1 ☐ 2 ☐ 3

12. What are the greatest benefits of instructional use of educational technology?

13. What are the greatest obstacles to more effective instructional use of educational technology?

14. Please list below some ideas you feel should be included in public school policy concerning the use of educational technology?

PART C:
FOR TEACHERS WHO USE COMPUTERS

15. Do you currently use a computer for instructional purposes?
☐ Yes ☐ No

16. What brand and model of microcomputer(s) do you use in school (i.e., Apple IIe; Apple Macintosh; IBM PS 2, Model 25; other)? Please specify.

17. Please indicate for each location the number of computers available for your use and for student use.

LOCATION	NUMBER (Teacher Use)	NUMBER (Student Use)
a. Your classroom	_____	_____
b. Lab setting	_____	_____
c. School office	_____	_____
d. Library/media center	_____	_____
e. Teacher work room	_____	_____

18. How frequently do your students use the school's computers for instructional purposes?

- ☐ Daily
- ☐ Weekly
- ☐ Monthly
- ☐ Other (Please explain.)

_____

19. How often do you use the computer for the following purposes? Check one number for each and use this scale: 1 = never; 2 = sometimes; 3 = often; 4 = always

a. Drill and practice
☐ 1 ☐ 2 ☐ 3 ☐ 4

b. Enrichment and remediation activities
☐ 1 ☐ 2 ☐ 3 ☐ 4

c. Simulations/games to promote student understanding
☐ 1 ☐ 2 ☐ 3 ☐ 4

d. Assessment/monitoring student progress
☐ 1 ☐ 2 ☐ 3 ☐ 4

e. Composing/desk-top publishing
☐ 1 ☐ 2 ☐ 3 ☐ 4

f. Record keeping
☐ 1 ☐ 2 ☐ 3 ☐ 4

g. Visual-technical aid to accompany presentation
☐ 1 ☐ 2 ☐ 3 ☐ 4

20. Please use the space below to make any comments concerning the topics addressed by this survey.

_____
_____
_____
_____
_____
_____
_____

Some of the above questions were excerpted or adapted from the "Computers in the Classroom" survey developed by the National Education Association. They are used with permission. Thank you for completing the "TEA-AEL Survey of Educational Technology in the Classroom." **Please return this form by April 19 to:**

TEA, attn.: Peggy Smith
598 James Robertson Parkway
Nashville, TN 32719

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