NATIONAL CENTER FOR EDUCATION STATISTICS
Statistical Analysis Report

Teachers' Tools for the 21st Century

A Report on Teachers' Use of Technology

September 2000

U.S. Department of Education • Office of Educational Research and Improvement

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Teachers' Tools for the 21st Century: A Report on Teachers' Use of Technology

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Executive Summary

Background

As the availability of computers and the Internet in schools and classrooms has grown (e.g., Williams, 2000), so has interest in the extent to which these technologies are being used and for what purposes. Using the Fast Response Survey System (FRSS), NCES administered a short survey of public school teachers in 1999 that included items on teachers' use of computers and the Internet. This report draws on that survey to describe teachers' use of education technology in their classrooms and schools, the availability of this technology in their classrooms and schools, their training and preparation for their use, and the barriers to technology use they encounter. Additional data sources (e.g., National Assessment of Educational Progress [NAEP], Current Population Survey [CPS]) are used throughout the report to provide background information on these topics.

Key Findings

Technology and Instruction

Over the past ten years, NCES has administered surveys focusing primarily on technology (e.g., computers, connections to the Internet) infrastructure in schools and classrooms. The 1999 FRSS survey focused on availability of technology and the way in which these technologies are used. According to this survey:

- Approximately half of the public school teachers who had computers or the Internet available in their schools used them for classroom instruction (table 2.3). Teachers assigned students to use these technologies for word processing or creating spreadsheets most frequently (61 percent did this to some extent), followed by Internet research (51 percent), practicing drills (50 percent), and solving problems and analyzing data (50 percent—figure 2.6). Moreover, many teachers used computers or the Internet to conduct a number of preparatory and administrative tasks (e.g., creating instructional materials, gathering information for planning lessons) and communicative (e.g., communication with colleagues) tasks.

- Among those with technology available in their schools, teachers in low minority and low poverty schools were generally more likely than teachers in high minority and high poverty schools to use computers or the Internet for a wide range of activities, including gathering information at school, creating instructional materials at school, communicating with colleagues at school, and instructing students. For example, 57 percent of teachers in schools with less than 6 percent minority enrollments used computers or the Internet for Internet research compared with 41 percent of teachers in schools with 50 percent or more minority enrollments (table 2.4).

- Among teachers with computers available at home, teachers with the fewest years of experience were more likely than teachers with the most years of experience to use computers or the Internet at home to gather information for planning lessons (76 percent compared with 63 percent) and creating instructional materials (91 percent compared with 82 percent—table 2.1). They were also generally more likely than more experienced teachers to use these technologies to access model lesson plans at school and at home.

Availability and Use of Technology

On a most basic level, teachers may be more likely to integrate computers and the Internet into classroom instruction if they have access to adequate equipment and connections. The 1999 FRSS survey on teachers' use of technology provides teachers' perspectives on the availability of computers and the Internet in their schools and classrooms and the general frequency with which these technologies are used. Results of this survey indicate that:

- Nearly all public school teachers (99 percent) reported having computers available somewhere in their schools in 1999 (table A-3.9); 84 percent had computers available in their classrooms, and 95 percent had computers available elsewhere in the school (table 3.1). Teachers were generally more likely to use computers and the Internet when located in their classrooms than elsewhere in the school (figure 4.3), while their students were more likely to use computers and the Internet outside the classroom than inside (figure 4.8). Additionally, teachers and students with computers or Internet connections *in their classrooms* used these technologies *elsewhere in the school* more often than teachers and students without such tools in their classrooms (figures 4.5 & 4.10).

- Most public school teachers (84 percent) reported having at least one computer in their classrooms in 1999 (table 3.1). Thirty-six percent of teachers had one computer in their classrooms, 38 percent reported having two to five computers in their classrooms, and 10 percent reported having more than five computers in their classrooms (table 3.2). Teachers and students with more computers or computers connected to the Internet in their classrooms generally used these technologies more often than teachers with fewer computers or Internet connections.

- In 1999, computer and Internet availability was not equally distributed among schools. For example, teachers in schools with the lower minority enrollments (less than 6 percent or 6 to 20 percent) were more likely to have the Internet available in the classroom than

teachers in schools with the highest minority enrollments (50 percent or more minority enrollments—69 percent and 71 percent compared with 51 percent—table 3.3). Moreover, teachers in schools with the lowest minority enrollments (less than 6 percent) were more likely to report having two to five computers connected to the Internet than teachers in schools with the highest minority enrollments (19 percent compared with 9 percent—table 3.4).

- Eighty-two percent of public school teachers reported having a computer available at home, 63 percent of public school teachers had the Internet available at home, and 27 percent reported that their school had a network that they could use to access the Internet from home (table 3.6).

Teacher Preparation and Training

Teachers' preparation and training to use education technology is a key factor to consider when examining their use of computers and the Internet for instructional purposes. The 1999 FRSS survey indicates that:

- In 1999, approximately one-third of teachers reported feeling well prepared or very well prepared to use computers and the Internet for classroom instruction (table A-5.5), with less experienced teachers indicating they felt better prepared to use technology than their more experienced colleagues (figure 5.1). For many instructional activities, teachers who reported feeling better prepared to use technology were generally more likely to use it than teachers who indicated that they felt unprepared (table 5.1).

- Teachers cited independent learning most frequently as preparing them for technology use (93 percent), followed by professional development activities (88 percent) and their colleagues (87 percent—figure 5.2). Whereas half of all teachers reported that college and graduate work prepared them to use technology, less experienced teachers were generally much more likely than their more experienced colleagues to indicate that this education prepared them to use computers and the Internet (figures 5.2 and 5.3).

- Most teachers indicated that professional development activities on a number of topics were available to them, including training on software applications, the use of the Internet, and the use of computers and basic computer training (ranging from 96 percent to 87 percent—figure 5.4). Among teachers reporting these activities available, participation was relatively high (ranging from 83 to 75 percent—figure 5.6), with more experienced teachers generally more likely to participate than less experienced teachers (table 5.3). Teachers indicated that follow-up and advanced training and use of other advanced telecommunications were available less frequently (67 percent and 54 percent, respectively), and approximately half of the teachers reporting that these two activities were available to them participated in them.

- Over a 3-year time period, most teachers (77 percent) participated in professional development activities in the use of computers or the Internet that lasted the equivalent of 4 days

or less (i.e., 32 or fewer hours—figure 5.7). Teachers who spent more time in professional development activities were generally more likely than teachers who spent less time in such activities to indicate they felt well prepared or very well prepared to use computers and the Internet for instruction (table 5.4).

Barriers to Teachers' Use of Technology

Certain characteristics of classrooms and schools, such as equipment, time, technical assistance, and leadership, may act as either barriers to or facilitators of technology use. The 1999 FRSS survey indicates that:

- In 1999, the barriers to the use of computers and the Internet for instruction most frequently reported by public school teachers were not enough computers (78 percent), lack of release time for teachers to learn how to use computers or the Internet (82 percent), and lack of time in schedule for students to use computers in class (80 percent—figure 6.1). Among the barriers most frequently reported by teachers to be "great" barriers to their use of computers or the Internet for instruction in 1999 were not enough computers (38 percent) and lack of release time for teachers to learn how to use computers or the Internet (37 percent).

- Teachers' perceptions of barriers to technology use varied by a number of teacher and school characteristics. For example, secondary teachers, teachers in large schools, and teachers in city schools were more likely than elementary teachers, teachers in small schools, and teachers in rural schools, respectively, to report that not enough computers was a great barrier (table 6.1). Additionally, teachers in schools with more than 50 percent minority enrollments were more likely to cite outdated, incompatible, or unreliable computers as a great barrier than teachers in schools with less than 6 percent minority enrollments (32 percent compared with 22 percent).

- Generally, teachers' who perceived lacking computers and time for students to use computers as great barriers were less likely than those who did not perceive these conditions as barriers to assign students to use computers or the Internet for some instructional activities. For example, teachers who reported insufficient numbers of computers as a great barrier were less likely than teachers reporting that this was not a barrier to assign students to use computers or the Internet to a "large extent" for practicing drills (9 percent compared with 19 percent), word processing or creating spreadsheets (14 percent compared with 25 percent), and solving problems and analyzing data (6 percent compared with 13 percent—table 6.2).

Summary

The primary focus of this report is teachers' use of computers or the Internet for instructional purposes. Findings presented in this report indicate that about half of the teachers with computers available in their schools used them for classroom instruction. Moreover, teachers' use

of technology was related to their training and preparation and work environments. As described in detail in the report, teachers were more likely to use these technologies when the technologies were available to them, available in their classrooms as opposed to computer labs, and available in greater numbers. Moreover, teachers who reported feeling better prepared were more likely to use these technologies than their less prepared colleagues. (Teachers who spent more time in professional development reported feeling better prepared than their colleagues.) Finally, teachers who perceived that lacking computers and time for students to use computers as great barriers were less likely than their colleagues to assign students to use computers or the Internet for some instructional activities.

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CHAPTER 1

Introduction

Over the past two decades, modern technologies have transformed many aspects of American life, including how we communicate, how we spend our free time, and especially how we work. As American life and workplace demands have changed as a result of this "technological revolution," so have conceptions of the skills and knowledge children will need to become successful adults and the relevant educational experiences they should encounter while attending school. As a result, technology, specifically in the form of computers and the Internet, has become a major focus of education policy and reform in recent years. National, state, and local initiatives have provided schools with computer hardware and software, allowed schools and classrooms to connect to the Internet, and supported technology-focused professional opportunities for teachers (Coley, 1997; U.S. Department of Education, 1996).

To date, most research on this topic has focused on the availability of education technology (i.e., computer hardware, software, and equipment and Internet connections) in schools and classrooms. Over the past decade, the National Center for Education Statistics (NCES) of the U.S. Department of Education has collected such data and shown that availability has grown dramatically. For example, Internet access in public schools increased by 60 percentage points between 1994 and 1999, from 3 percent in 1994 to 63 percent in 1999 (Williams, 2000). By 1999, 95 percent of public schools were connected to the Internet, with one instructional computer with an Internet connection for every 9 students (Williams, 2000).

As the numbers of computers and access to the Internet in schools have grown, so have the number of questions being asked about the extent to which these technologies are being used in schools and classrooms and for what purposes. Using the Fast Response Survey System (FRSS), NCES administered a short survey of public school teachers in 1999 that included items on teachers' use of computers and the Internet. This report draws on that survey, along with additional data sources (e.g.,

National Assessment of Educational Progress [NAEP], Current Population Survey [CPS])[1], to describe teachers' use of education technology in their classrooms and schools, their training and preparation for that use, and the school and classroom contexts within which they do or do not use these technologies. This report also includes an examination of the relationships between teachers' use of technology and these contextual factors. As a preface to discussing these empirical results, the introductory chapter highlights literature on technology and instruction.

Technology and Instruction

The U.S. Department of Education, in its *Getting America's students ready for the 21st Century: Meeting the technology literacy challenge,* described computers as "the new basic" of American education, and the Internet as "the blackboard of the future" (U.S. Department of Education, 1996, p. 3). Over the past 20 years, education technology has been a major focus of reform and policy at the federal level, as well as at state and local levels. Such initiatives have been guided by the goals of increasing the availability of computers in classrooms and schools, assisting schools with Internet access, and providing resources and guidance for teacher training and the integration of technology into the curriculum. The availability of computers and the Internet has increased significantly in the nation's schools and classrooms (Williams, 2000). This increase has been coupled with initiatives aimed toward understanding how best to use technology to improve teaching and learning and training educators to use technology effectively.

Existing research on education technology includes a small number of national studies that describe teachers' use of technology, as well as their training to use these tools. Specifically, this research suggests that most current and past uses of education technology have typically supported traditional notions of teaching and learning. For example, in the early 1980s, students most often used computers for drill and practice (Becker, 1983). Typically, drill-and-practice software consists of sequences of worksheet-style questions that automatically adjust their difficulty to match individual students' responses. Also, in the early 1980s, teachers typically used computers to teach students programming skills (Becker, 1983). They rarely used computers for content-related instruction (Becker, 1985); students were more likely to learn about how to use computers at school than they were to use computers to learn about mathematics or social studies (Becker, 1983).

By the early 1990s, the practice of using computers for programming had declined considerably and an emphasis on using computers as a tool for learning content had emerged (Becker, 1994; Sutton, 1991). However, the primary use of computers remained drill and practice in elementary schools in the early 1990s. In high schools, it was classes on computer education, and middle schools provided a combination of drill and practice and computer education (Becker, 1994). Finally, as the decade of the 1990s progressed, school computer use had shifted to some degree to reflect a greater emphasis on problem solving and in-depth learning and less emphasis on drill and practice and basic skills. Fulton (1997) found that 25 percent of the 1996

[1] All data presented in this report are for public school students, with the exception of CPS data.

high school graduates who participated in the Scholastic Assessment Test (SAT) program reported having used computers for solving math problems, processing data, or computer programming. Approximately 10 percent had used computers to solve problems in natural science. Using a nationally representative sample of teachers, the Teaching, Learning, and Computing Study found that CD-ROM reference and surfing the Internet were more likely to be assigned as classroom activities than games and traditional drill-and-practice applications (Becker, 1999). However, many of these newer uses have been limited to a small proportion of teachers and students.

Teachers are in fact using computers or the Internet generally more frequently to complete a number of instruction-related tasks than to augment instruction itself (Becker, 1999). For example, they may use these technologies to help prepare for classroom instruction (e.g., to access research on best practices, download information to present in class) or to complete administrative tasks (e.g., to record and calculate grades). The Teaching, Learning, and Computing Study also indicated that two-thirds of all teachers used the Internet in their effort to find information for use in their lessons, and about one-third reported doing so on at least a weekly basis (Becker, 1999). In addition, teachers may also use technology to communicate with parents or students about students' performance, assignments, or special events. They may also use technology to communicate with other members of their profession to share ideas or strategies for presenting content or helping students who are struggling with the content. Sixteen percent of teachers in the Teaching, Learning, and Computing Study communicated by e-mail with teachers from other schools as often as five times during the school year, and 18 percent of teachers said they posted information on the Internet, including suggestions, opinions, or student work (Becker, 1999).

Teacher Training and Preparation

As the brief history of technology use for learning suggests, the way educators teach and students learn has not changed dramatically over the past two decades. The research on teacher change and instructional reform in general indicates that such changes in teacher practice are often slow, minimal, or even nonexistent (Ball, 1990; Cohen, 1990; Peterson, 1990). A number of factors contribute to the success or failure of instructional reforms. One important factor the literature has identified is that teachers do not always have opportunities to learn about and practice instructional reforms. In the area of technology, teachers may have learned about how to use computers and adapt their teaching from a variety of sources—teacher preparation programs (for prospective teachers), professional development activities (for practicing teachers), and informal learning opportunities such as assistance from classmates, colleagues, or students.

Professional development research suggests that teachers' opportunities to learn about education technology during traditional professional development activities are often lacking. Often described as an important vehicle for school reform (Sprinthall, Reiman, & Theis-Sprinthall,

1996), professional development activities in general have been widely criticized for being relatively ineffective. Specifically, they have been described as short term, devoid of continuity due to inadequate follow-up and the lack of ongoing feedback from experts, isolated from the participants' classroom and school contexts, and characterized by too few opportunities to learn by doing and reflecting with colleagues (Fullan with Stiegelbauer, 1991). In fact, while a majority of teachers participate in such activities, a small percentage of teachers report feeling very well prepared to integrate technology into instruction (Lewis et al., 1999).

Teacher preparation programs have received similar criticisms. Traditional programs for prospective teachers have been described as fragmented, superficial, and unconnected to real classroom experiences (National Commission on Teaching and America's Future [NCTAF], 1996). With respect to education technology, some observers have claimed that prospective teachers are not getting the training they need to successfully integrate technology into classroom instruction (President's Committee of Advisors on Science and Technology, 1997). For example, some researchers have reported that most students training to become teachers do not routinely use technology while in the field and do not work under supervising teachers who can advise them on using technology in the classroom (Moursund & Bielefeldt, 1999). Additionally, about half of the technology training that prospective teachers get in the classroom is delivered as part of other classes (i.e., methods and curriculum classes), and the other half is provided in the form of stand-alone technology classes (Moursund & Bielefeldt, 1999). Furthermore, most teacher-preparation programs provided by schools, colleges, and departments of education do not have written, funded, regularly updated technology plans (Moursund & Bielefeldt, 1999).

Informal learning opportunities, in addition to these formal learning opportunities, may also provide teachers with assistance using technology. Peer collaboration, in particular, has been heralded by many teachers, researchers, and policymakers as essential for teachers' continuous learning (Coley, 1997). Teachers may benefit when they learn about technology from one another and provide one another with motivation to continue working with this resource. Research supports this proposition; teachers who use computers benefit from interacting with a network of other teachers at their school who also use computers (Software and Information Industry Association [SIIA], 2000).

Technology Use in Schools and Classrooms

In recent years, policymakers have recognized that teachers and administrators need resources and organizational capacity to implement instructional reforms (CEO Forum on Education and Technology, 2000; Coley, 1997; Means, 1995; SIIA, 2000; Trotter, 1999; U.S. Department of Education, 1996; U.S. Congress, Office of Technology Assessment, 1995a). For example, teachers' ability and willingness to use computers and the Internet may depend, to some extent, on the schools and classrooms in which they work. Specifically, certain characteristics of classrooms and schools, such as equipment, time, technical assistance, and leadership, may act as either barriers to or facilitators of technology use.

Equipment

On a most basic level, teachers may be more likely to integrate computers and the Internet into classroom instruction if they have access to adequate equipment and connections. Research indicates that the number of computers in America's classrooms and schools has grown substantially in recent years. In 1983, there was one computer for every 125 students (Glennan & Melmed, 1996). By 1998, there was one computer for every 6 students (Rowand, 1999). As the number of computers in schools has grown, so has the availability of the Internet in schools and classrooms. Between 1994 and 1998, Internet availability among public schools increased from 35 to 95 percent (Williams, 2000). In 1997, 27 percent of instructional rooms had Internet connections, whereas 63 percent were connected in 1999 (Williams, 2000). By 1999, there was one instructional computer with an Internet connection for every 9 students (Williams, 2000).

However, availability is not the same as use. Computers may be available, but are they being used? Research suggests that the answer is yes, to some degree. As availability has grown, so has the number of students and teachers using computers and the frequency with which they use them (Levin et al., 1998). For example, the percent of eleventh-grade students who had never used computers in school dropped substantially between 1984 and 1996 (from 55 to 16 percent) and the frequency with which students used computers increased between 1984 and 1996 (Snyder and Wirt, 1998). By 1996, 72 percent of fourth-graders, 47 percent of eighth-graders, and 50 percent of eleventh-graders reported using a computer in school at least once a week (Snyder and Wirt, 1998).

Although the presence of computers and the Internet has grown sharply in recent years, much of the technology equipment currently in schools and classrooms is from an earlier generation of technology—computers with less processing power, less storage capability, and limited capacity for being linked together electronically (Anderson & Ronnkvist, 1999). Using data from 1998, Anderson and Ronnkvist (1999) have concluded that although computing capacity for instruction has improved substantially over the past several years, there are a number of "major deficiencies" (p. 16). For example, they found that most of the computers in schools do not have the capability to run a large variety of multimedia software and are also limited in how they can access graphical information on the Internet.

Time

The nation's schools have been increasingly challenged by policy initiatives "to do better, and to do differently" (McLaughlin & Oberman, 1996, p. iv), pushing teachers to change the way they teach. At the same time, teachers face many other challenges, including rapidly increasing technological changes and a greater diversity in the classroom. With regard to technology, there is often little time in teachers' schedules to become familiar with hardware and software or to learn to integrate the new technology into their lesson plans (President's Committee of Advisors on Science and Technology, 1997). Lack of time to become acquainted with technology and learn to use it has been identified as the greatest obstacle to the effective use of education technology (Becker, 1990b; President's Committee of Advisors on Science and Technology, 1997).

Technical Assistance

Another important resource for the development of teacher expertise in the use of education technology is technical assistance. A full-time computer coordinator, for example, may assist teachers with using computer software and hardware or adapting their teaching practice to include computer or Internet use. However, according to one study, less than 5 percent of all schools have such a staff member. Furthermore, where they are present, computer coordinators typically spend a significant amount of time teaching students, and much less time assisting teachers (Becker, 1998).

Leadership

Principal leadership has been described as one of the most important factors affecting the effective use of technology in classrooms (Byrom, 1998). Principals who exhibit leadership are instrumental in modeling the use of technology in classrooms. They understand how it can support best practices in instruction and assessment and provide teachers with guidance for its use. Principals may also participate actively in professional development activities related to education technology and provide teachers with opportunities to learn how to use these resources. In our nation's schools, however, teachers often receive little administrative and pedagogical guidance (President's Committee of Advisors on Science and Technology, 1997). For some teachers, lack of principal leadership may prove to be a barrier to their effective use of technology.

General Framework

The previous discussion described three general topics of high importance in current studies of education technology. First, the growing interest in how technology is being used in schools and classrooms and the limited research on this topic illustrate the importance of examining whether and how teachers use education technology. Second, because teachers may be more likely to use education technology and to use it more effectively if they have opportunities to learn about its use, it is valuable to understand how prepared teachers feel to use technology and their learning experiences. Finally, it is important to understand the extent to which teachers' school and classroom environments (e.g., the availability of and access to technology, supports for and barriers to technology use) are related to their technology use. These general topics suggest that a useful model for studying education technology would begin with examining whether and how teachers use it and then explore the teacher preparation and training, and the school and classroom contexts, that characterize where technology is used and where it is not used.

Study Methodology

Three sources of data are presented in this report—the Fast Response Survey System [FRSS], the Current Population Survey [CPS], and the National Assessment of Educational Progress

(NAEP). These data sources share a number of differences that preclude comparisons among them. For example, the CPS findings that are presented include both public and private school teachers. The FRSS and NAEP findings presented in this report include only public school teachers. Additionally, for the NAEP, students were sampled and their teachers surveyed. Thus, unlike the FRSS teacher survey, the NAEP data are not nationally representative of teachers.

All comparative statements in this report have been tested for statistical significance using chi-square tests or *t*-tests adjusted for multiple comparisons using the Bonferroni adjustment and are significant at the 0.05 level. Appendix B provides a detailed discussion of the sample and survey methodology. The primary teacher characteristic used as an analysis variable in this report is total years of teaching experience (3 or fewer years, 4 to 9 years, 10 to 19 years, 20 or more years). In addition to work experience, this variable may also, though not necessarily, represent for many teachers their age or cohort (e.g., teachers with fewer years of experience may be young and newly-trained). The school characteristics used as analysis variables in this report are school instructional level, school enrollment size, locale (city, urban fringe, town, rural), percent minority enrollment, and percent of students in school eligible for free or reduced-price school lunch (which indicates the concentration of poverty in the school). These variables are defined in appendix B.

It is important to note that many of the school characteristics used for independent analyses may also be related to each other. For example, enrollment size and instructional level of schools are related, with secondary schools typically being larger than elementary schools. Similarly, poverty concentration and minority enrollment are related, with schools with a high minority enrollment also more likely to have a high concentration of poverty. Other relationships between analysis variables may exist. Because of the relatively small sample size used in the FRSS, it is difficult to separate the independent effects of these variables. Their existence, however, should be considered in the interpretation of the data presented in this report.

Organization of This Report

The remaining chapters of the report are organized around the following themes: (1) technology and instruction, (2) availability, (3) frequency of use, (4) teacher training and preparation, and (5) barriers to technology use. Each chapter presents results from the NCES Fast Response Survey System 1999 teacher survey of education technology. In addition, findings from other surveys will be referenced throughout this report to provide context for the FRSS data. Computer and Internet usage supplements to the CPS, a monthly survey of the U.S. population conducted by the Census Bureau, will provide a backdrop for American students' and teachers' computer and Internet usage. NCES's NAEP will assist in providing a more detailed portrait of implementation of technology in U.S. schools. Conclusions are provided in the final chapter of the report. Technical information, including a detailed study methodology (appendix B) and tables of standard errors for all data presented in this report (appendix A), are included as technical appendices to the report. The questionnaire is included in appendix C.

Chapter 2

Technology and Instruction

Highlights

- In 1999, among teachers with computer availability in their schools, many used computers or the Internet to conduct a number of preparatory and administrative tasks (e.g., creating instructional materials, gathering information for planning lessons) and communicative (e.g., communication with colleagues) tasks. However, teachers generally used these technologies less frequently for such tasks as accessing research, best practices examples, and model lesson plans, as well as communicating with parents and students.

- Approximately half of public school teachers who had computers available in their schools used computers or the Internet for classroom instruction. Teachers assigned students to use these technologies for word processing or creating spreadsheets most frequently, followed by Internet research, practicing drills, and solving problems and analyzing data.

- Elementary teachers were more likely than secondary teachers to use the computer or Internet to communicate with parents at home, use the computer or Internet for classroom instruction, assign projects inside the classroom, or assign students to use computers to practice drills or to solve problems and analyze data. On the other hand, secondary teachers were more likely than elementary teachers to use computers or the Internet for administrative record keeping at home and school, as well as communicating with students at school, assigning projects outside of class, and assigning students to conduct research using the Internet.

- Teachers in low minority and low poverty schools were generally more likely than teachers in high minority and high poverty schools, respectively, to use computers or the Internet for a wide range of activities, including gathering information at school, creating instructional materials at school, communicating with colleagues at school, and instructing students.

- Teachers with the fewest years of experience were more likely than teachers with the most years of experience to use computers or the Internet to gather information for planning lessons and creating instructional materials at home. They were also generally more likely than more experienced teachers to use these technologies to access research and best practices examples at school and model lesson plans at school and at home.

CHAPTER 2

Technology and Instruction

This report investigates teachers' use of technology for instructional purposes. This chapter begins with background information on teacher and student use of technology from the 1992 and 1998 administrations of the National Assessment of Educational Progress (NAEP). Following this are results of the 1999 Fast Response Survey System (FRSS) survey on teacher use of technology. Specifically, three types of technology use are discussed: (1) preparation and administration, (2) classroom instruction, and (3) communication. Included is information that relates technology use to school and teacher characteristics.

Technology Use in Schools and Classrooms: Findings from NAEP

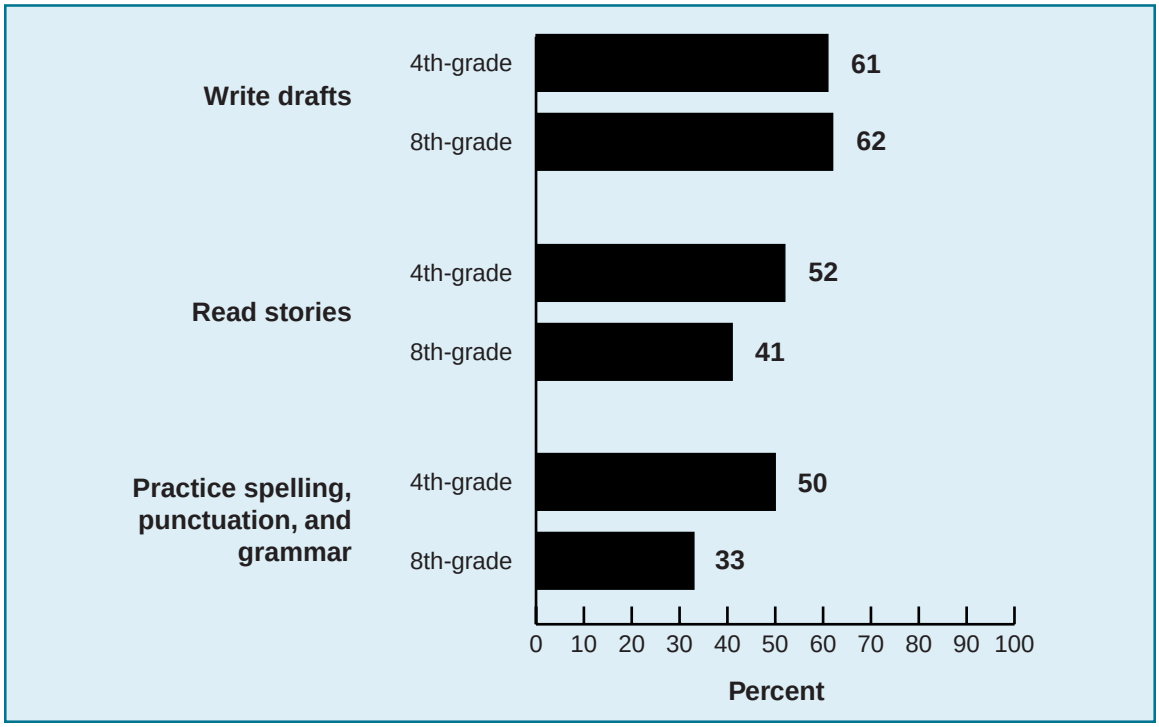
NAEP asked both teachers and students about computer use over the past four administrations of the surveys. The data presented in this chapter come from surveys of public school teachers of grades 4 and 8, and surveys of students in grade 12. The surveys were administered in 1992, 1996, and 1998. The NAEP findings presented in this chapter are based on all public school teachers and come from the 1992 and 1998 surveys.[1]

Computer Use for Reading and Writing Instruction

In 1998, teachers of grades 4 and 8 were asked the extent to which they assigned students to use computers for a number of instructional purposes, including: to practice spelling, punctuation, and grammar, to write drafts, to read stories, and to use software for reading instruction. Teachers of fourth- and eighth-grade students reported that their students used computers for writing drafts most frequently (teachers re

[1] NAEP findings are provided for contextual purposes only. Due to differences in survey items and sample, NAEP findings are not comparable to FRSS findings.

FIGURE 2.1.—PERCENT OF 4TH- AND 8TH- GRADE PUBLIC SCHOOL STUDENTS WHO HAVE TEACHERS REPORTING STUDENT USE OF COMPUTERS FOR VARIOUS CLASS ACTIVITIES: 1998



SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1998 Reading Assessments.

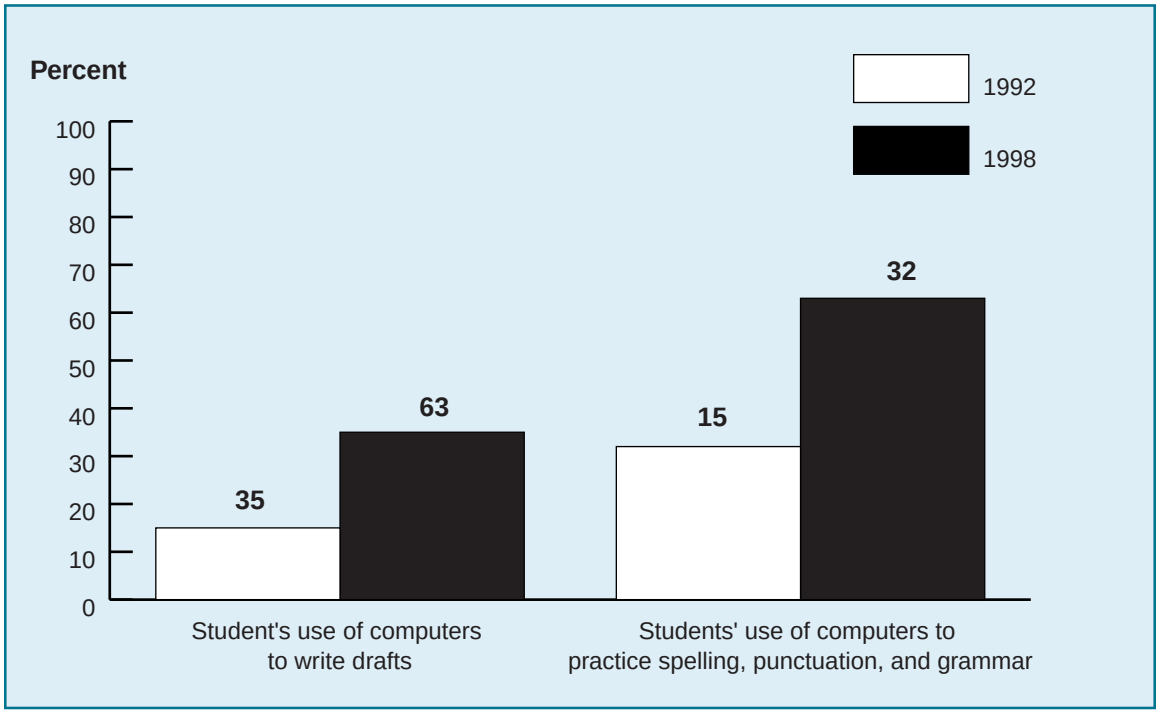
ported 61 percent of fourth-grade students and 62 percent of eighth-grade students did this to any extent—figure 2.1).[2] This was followed by reading stories and practicing spelling, punctuation, and grammar. Teachers' assignment of activities using the computer varied by instructional level. Teachers of fourth-graders were more likely than teachers of eighth-grade students to report that their students used computers to read stories and practice spelling, punctuation, and grammar.

Between 1992 and 1998, there was an increase in the proportion of teachers reporting that eighth-grade students used computers to write drafts (35 percent in 1992 compared with 63 percent in 1998) and practice spelling, punctuation, and grammar for writing instruction (15 percent in 1992 compared with 32 percent in 1998—figure 2.2).

Teachers of twelfth-grade students were not surveyed in recent NAEP administrations, though twelfth-grade students were surveyed and asked about their technology use for writing instruction. Seventy-seven percent of twelfth-graders indicated that they used computers to write drafts/final versions of papers, 45 percent used computers to practice spelling, punctuation, and grammar, and 27 percent used computers to write in a log or journal (table A-2.5).

[2] All comparative statements in this report have been tested for statistical significance using chi-square tests or *t*-tests adjusted for multiple comparisons using the Bonferroni adjustment and are significant at the 0.05 level.

FIGURE 2.2.—PERCENT OF 8TH- GRADE PUBLIC SCHOOL STUDENTS WHO HAVE TEACHERS REPORTING STUDENT USE OF COMPUTERS TO WRITE DRAFTS AND PRACTICE SPELLING, PUNCTUATION, AND GRAMMAR: 1992 AND 1998



SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1992 and 1998 Writing Assessments.

Technology Use in Schools and Classrooms: Findings from FRSS[3]

Preparatory and Administrative Tasks

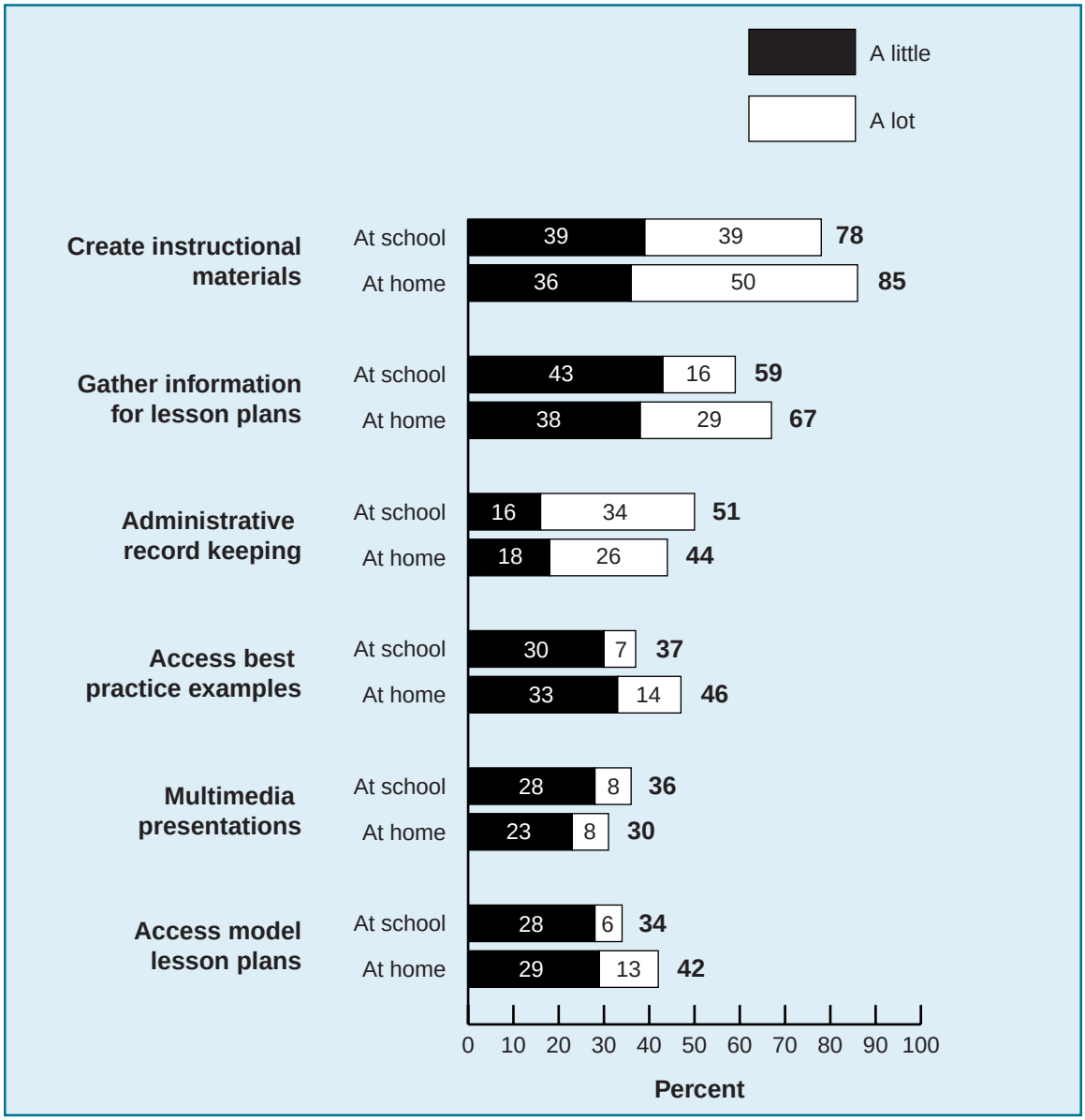
In 1999, the 99 percent of public school teachers who reported computer availability in school indicated that they used computers or the Internet at school to accomplish a number of preparatory and administrative tasks. Overall, 78 percent of public school teachers used computers or the Internet at school to create instructional materials, and 59 percent of teachers reported using computers or the Internet at school to gather information for planning lessons (figure 2.3).[3] Public school teachers also used computers or the Internet at school for administrative record keeping (51 percent), accessing research and best practices for teaching (37 percent), preparing multimedia presentations for class (36 percent), and accessing model lesson plans (34 percent).

In addition to using computers or the Internet at school for preparatory and administrative tasks, the 82 percent of teachers with computers available at home also used these technologies at home for such purposes.[4] For example, among these teachers with computers at home, public

[3] All of the FRSS findings presented in this chapter are based on teachers who reported having computers available in their schools (99 percent) or, for questions about technology use at home, teachers who reported having computers available at home (82 percent).

[4] The same teachers may be using computers for preparatory and administrative purposes both at home and at school.

FIGURE 2.3.—PERCENT OF 4TH- AND 8TH-GRADE PUBLIC SCHOOL STUDENTS WHO HAVE TEACHERS USING COMPUTERS FOR VARIOUS CLASS ACTIVITIES: 1996



SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 Science Assessments.

school teachers used computers or the Internet at home to create instructional materials (85 percent), to gather information (67 percent), as well as for administrative record keeping (44 percent), accessing research and best practices for teaching (46 percent), preparing multimedia presentations for class (30 percent), and accessing model lesson plans (42 percent).

Differences by school and teacher characteristics. Teachers' use of technology for preparatory and administrative purposes varied by a number of school and teacher characteristics. For example, among teachers with computers available in their schools, secondary teachers were more likely than elementary teachers to use computers or the Internet at school for administrative record

keeping (62 percent compared with 45 percent), and they were also more likely to do this at home than elementary teachers (50 percent compared with 41 percent—table 2.1). Moreover, teachers in schools with the fewest students enrolled were more likely than teachers in schools with the highest enrollments to use these technologies at school to gather information for planning lessons (67 percent compared with 56 percent). On the other hand, teachers in schools enrolling more students were generally more likely to use computers or the Internet at school for administrative record keeping (58 percent of teachers in schools with more than 1,000 students enrolled compared with 49 percent in schools with 300 to 999 students) and at home for this task (53 percent of teachers in schools enrolling 1,000 or more students compared with 35 percent of teachers in schools with less than 300 students and 42 percent in schools with 300 to 999 students).

In addition to instructional level and enrollment size, there were a number of differences by school minority enrollment in the percent of teachers reporting that they used computers or the Internet for preparatory and administrative tasks. For example, teachers in schools with lower minority enrollments were more likely than teachers in schools with the highest minority enrollments to gather information for lesson plans using these technologies at school (61 percent of teachers in schools with less than 6 percent, 67 percent of teachers in schools with 6 to 20 percent, and 60 percent of teachers in schools with 21 to 49 percent minority enrollments compared with 46 percent of teachers in schools with 50 percent or more minority enrollments).

Teachers in schools with fewer minority students were also generally more likely than those in schools with the highest minority enrollments to use computers or the Internet at school for administrative record keeping (55 percent of teachers in schools with 6 to 20 percent and 21 to 49 percent minority enrollments compared with 40 percent of teachers in schools with 50 or more minority enrollments) and creating instructional materials (81 percent of teachers in schools with 6 to 20 percent minority enrollments and 82 percent of teachers in schools with 21 to 49 percent minority enrollments compared with 71 percent of teachers in schools with 50 percent or more minority enrollments). Finally, teachers in schools with the lowest minority enrollments (less than 6 percent) were more likely than those with the highest minority enrollments (50 percent or more) to use computers or the Internet at school for preparing multimedia presentations (40 percent compared with 29 percent).

As is the case with teacher reports from schools with varying minority enrollments, teacher reports of whether they used computers or the Internet for various preparatory and administrative tasks varied by poverty concentration of the school, as measured by the proportion of students eligible for free or reduced-price lunch. For example, teachers in schools with the lowest poverty concentrations were more likely to use computers or the Internet at school to create instructional materials than teachers in schools with the highest poverty concentrations (85 percent compared with 73 percent). In addition, teachers in schools with lower poverty concentrations were generally more likely than teachers in schools with the highest poverty concentrations to use these technologies at school to gather information for planning lessons

TABLE 2.1.—PERCENT OF PUBLIC SCHOOL TEACHERS WHO HAVE COMPUTERS AT SCHOOL OR AT HOME REPORTING USING COMPUTERS OR THE INTERNET A LITTLE OR A LOT AT SCHOOL AND AT HOME FOR VARIOUS ACTIVITIES, BY SCHOOL AND TEACHER CHARACTERISTICS: 1999

School and teacher characteristics	Activities					
	Create instructional material		Gather information for lesson plans		Administrative record keeping	
	At school	At home	At school	At home	At school	At home
All public school teachers	**78**	**85**	**59**	**67**	**51**	**44**
Instructional level						
Elementary	79	86	57	66	45	41
Secondary	77	84	62	69	62	50
Enrollment size						
Less than 300	79	81	67	63	49	35
300 to 999	79	87	58	67	49	42
1,000 or more	75	84	56	69	58	53
Locale						
City	76	85	53	66	46	49
Urban fringe	79	87	60	70	49	41
Town	79	86	60	69	60	45
Rural	82	82	64	60	55	41
Percent minority enrollment in school						
Less than 6 percent	79	86	61	68	51	42
6 to 20 percent	81	86	67	68	55	46
21 to 49 percent	82	87	60	65	55	45
50 percent or more	71	83	46	67	40	44
Percent of students in school eligible for free or reduced-price school lunch						
Less than 11 percent	85	86	65	72	57	48
11 to 30 percent	80	87	63	68	54	45
31 to 49 percent	79	87	60	62	49	40
50 to 70 percent	77	84	55	64	54	46
71 percent or more	73	83	49	63	43	41
Teaching experience						
3 or fewer years	79	91	60	76	52	46
4 to 9 years	82	87	61	70	53	51
10 to 19 years	79	86	58	66	54	42
20 or more years	76	82	58	63	47	41

See note at end of table.

TABLE 2.1.—PERCENT OF PUBLIC SCHOOL TEACHERS WHO HAVE COMPUTERS AT SCHOOL OR AT HOME REPORTING USING COMPUTERS OR THE INTERNET A LITTLE OR A LOT AT SCHOOL AND AT HOME FOR VARIOUS ACTIVITIES, BY SCHOOL AND TEACHER CHARACTERISTICS: 1999—CONTINUED

School and teacher characteristics	Activities					
	Access research and best practice examples		Multimedia presentations		Access model lesson plans	
	At school	At home	At school	At home	At school	At home
All public school teachers	**37**	**46**	**36**	**30**	**34**	**42**
Instructional level						
Elementary	34	46	36	29	34	43
Secondary	42	49	35	33	35	40
Enrollment size						
Less than 300	44	47	38	29	38	40
300 to 999	36	46	36	28	34	43
1,000 or more	36	48	33	36	31	40
Locale						
City	35	47	36	31	36	43
Urban fringe	38	49	38	31	31	43
Town	38	46	32	31	35	42
Rural	39	41	35	25	36	39
Percent minority enrollment in school						
Less than 6 percent	39	50	40	32	35	43
6 to 20 percent	41	42	38	30	37	39
21 to 49 percent	33	45	35	32	31	40
50 percent or more	35	49	29	27	33	48
Percent of students in school eligible for free or reduced-price school lunch						
Less than 11 percent	44	49	41	33	30	40
11 to 30 percent	40	49	40	32	36	43
31 to 49 percent	33	41	32	27	38	38
50 to 70 percent	33	44	36	31	31	40
71 percent or more	35	43	32	26	35	47
Teaching experience						
3 or fewer years	39	55	34	31	42	59
4 to 9 years	43	52	39	32	40	47
10 to 19 years	37	42	37	33	30	38
20 or more years	33	43	34	26	31	37

NOTE: Teachers who reported that computers were not available to them anywhere in the school were excluded from the "At school" analyses presented in this table. Teachers who reported not having a computer available at home were excluded from the "At home" analyses presented in this table.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

(65 percent of teachers in schools with less than 11 percent and 63 percent of teachers in schools with 11 to 30 percent of students eligible for free or reduced-price school lunch compared with 49 percent of teachers in schools with 71 percent or more students eligible for free or reduced-price school lunch).

Finally, teachers with varying years of teaching experience differed with respect to whether they used computers or the Internet to conduct a number of preparatory and administrative tasks. For example, teachers with the fewest years of teaching experience were more likely than teachers with the most experience to use these technologies at home to gather information for planning lessons (76 percent compared with 63 percent) and to create instructional materials (91 percent compared with 82 percent). Teachers with 4 to 9 years of experience were more likely to use computers or the Internet at school to access research and best practices examples than those with 20 or more years of experience (43 percent compared with 33 percent). Finally, teachers with less than 10 years of teaching experience were generally more likely to use these technologies at school to access model lesson plans than those with 10 to 19 years of experience (42 percent of teachers with 3 or fewer years and 40 percent of teachers with 4 to 9 years of teaching experience compared with 30 percent of teachers with 10 to 19 years of teaching experience) and at home to conduct this task (59 percent of teachers with 3 or fewer years and 47 percent of teachers with 4 to 9 years of experience compared with 37 percent of teachers with 20 or more years of teaching experience).

Communication

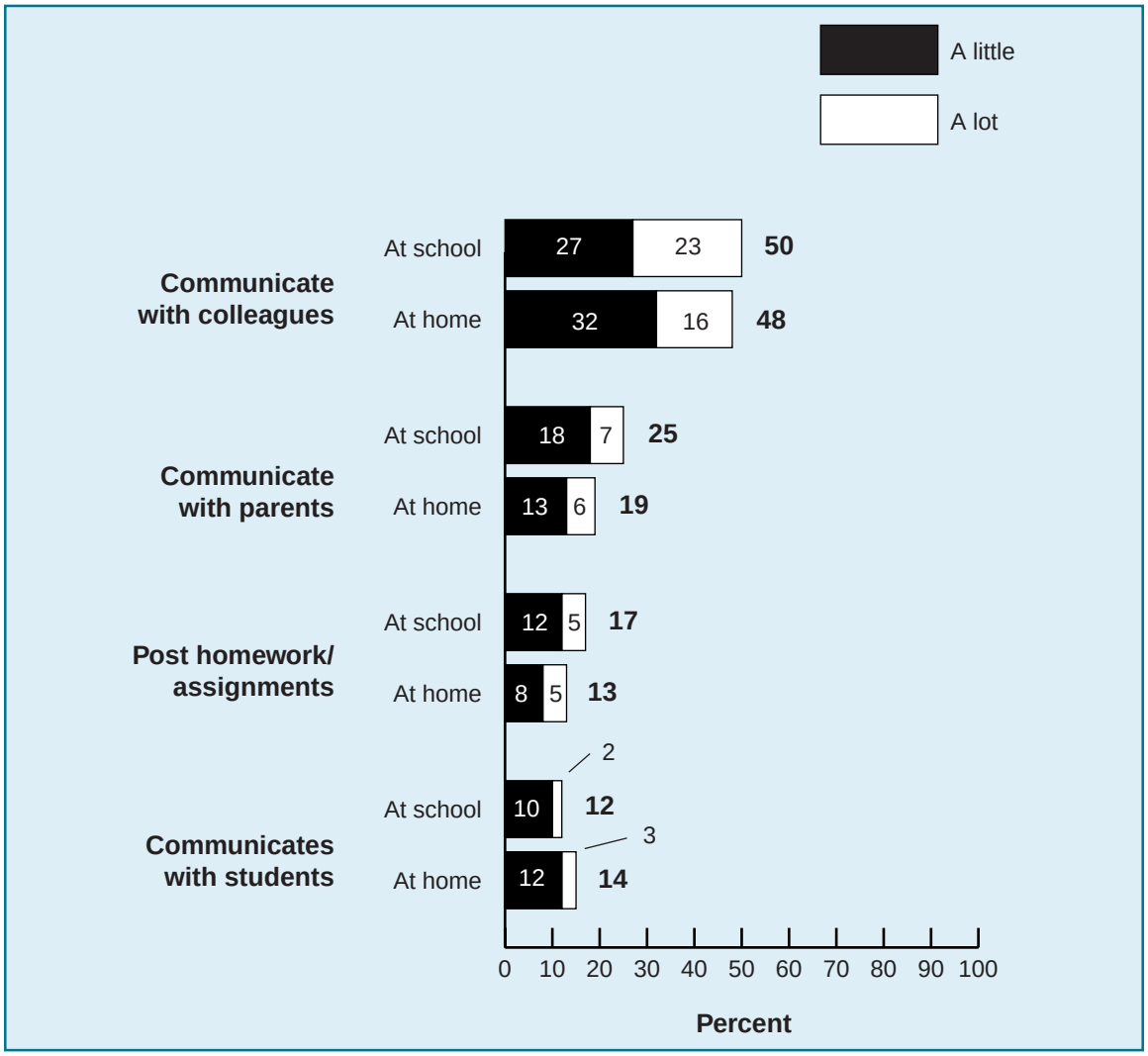
The 1999 FRSS survey on public school teachers' use of technology also asked teachers how often they used computers or the Internet either at school or at home to communicate with colleagues, parents, or students or to post homework or assignments. Public school teachers with computers available in their schools used computers or the Internet to communicate with colleagues most frequently (50 percent at school, 48 percent at home), compared to communication with parents (25 percent at school, 19 percent at home), posting homework or assignments (17 percent at school, 13 percent at home), and communication with students (12 percent at school and 14 percent at home—figure 2.4).

Differences by school and teacher characteristics. Teachers' use of technology for communicative purposes varied by a number of school and teacher characteristics. For example, elementary teachers were more likely than secondary teachers to use computers or the Internet at home to communicate with parents (20 percent compared with 15 percent, respectively—table 2.2). On the other hand, secondary teachers were more likely than elementary teachers to use these technologies at school to communicate with students (14 percent compared with 10 percent). Furthermore, teachers in schools with medium-sized enrollments were more likely than teachers in schools with small enrollments to report that they used computers or the Internet at home to communicate with colleagues (50 percent of teachers in schools with 300 to 999 students compared with 38 percent of teachers in schools with less than 300 students). Teachers in schools with large enrollments were also more likely to use these technologies at school to post homework or assignments (23 percent in schools with 1,000 or more students compared

with 16 percent in schools with 300 to 999 and 11 percent in schools with less than 300 students) and at home to conduct this task (19 percent of teachers in schools with 1,000 or more students compared with 11 percent in schools with 300 to 999 and 7 percent in schools with less than 300 students).

Teachers' use of computers or the Internet for communicative purposes also varied by minority enrollment of the school. Teachers in schools with lower minority enrollments were generally more likely than teachers in the highest minority schools to use these technologies at school to communicate with colleagues (53 percent of teachers in schools with less than 6 percent minority enrollments and 62 percent of teachers in schools with 6 to 20 percent minority enroll-

FIGURE 2.4.—PERCENT OF PUBLIC SCHOOL TEACHERS WHO HAVE COMPUTERS AT SCHOOL OR AT HOME REPORTING USING COMPUTERS OR THE INTERNET A LITTLE OR A LOT AT SCHOOL AND AT HOME, FOR VARIOUS TASKS: 1999



NOTE: Teachers who reported that computers were not available to them anywhere in the school were excluded from the "At school" analyses presented in this figure. Teachers who reported not having a computer available at home were excluded from the "At home" analyses presented in this figure. Detail may not sum to totals due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

TABLE 2.2.—PERCENT OF PUBLIC SCHOOL TEACHERS WHO HAVE COMPUTERS AT SCHOOL OR AT HOME REPORTING USING COMPUTERS OR THE INTERNET A LITTLE OR A LOT AT SCHOOL AND AT HOME, FOR VARIOUS ACTIVITIES, BY SCHOOL AND TEACHER CHARACTERISTICS: 1999

School and teacher characteristics	Activities			
	Communicate with colleagues		Communicate with parents	
	At school	At home	At school	At home
All public school teachers	**50**	**48**	**25**	**19**
Instructional level				
Elementary	51	49	25	20
Secondary	50	48	24	15
Enrollment size				
Less than 300	52	38	23	21
300 to 999	52	50	25	19
1,000 or more	46	49	24	18
Locale				
City	48	48	23	19
Urban fringe	50	51	25	19
Town	54	50	27	17
Rural	53	43	24	20
Percent minority enrollment in school				
Less than 6 percent	53	50	28	20
6 to 20 percent	62	48	30	17
21 to 49 percent	46	51	25	21
50 percent or more	41	44	14	16
Percent of students in school eligible for free or reduced-price school lunch				
Less than 11 percent	59	52	28	16
11 to 30 percent	55	53	29	21
31 to 49 percent	54	45	29	18
50 to 70 percent	41	44	20	22
71 percent or more	38	40	18	15
Teaching experience				
3 or fewer years	51	51	22	20
4 to 9 years	52	46	25	18
10 to 19 years	52	50	25	18
20 or more years	48	48	25	19

See note at end of table.

TABLE 2.2.—PERCENT OF PUBLIC SCHOOL TEACHERS WHO HAVE COMPUTERS AT SCHOOL OR AT HOME REPORTING USING COMPUTERS OR THE INTERNET A LITTLE OR A LOT AT SCHOOL AND AT HOME, FOR VARIOUS ACTIVITIES, BY SCHOOL AND TEACHER CHARACTERISTICS: 1999—CONTINUED

School and teacher characteristics	Activities			
	Post homework/ assignments		Communicate with students	
	At school	At home	At school	At home
All public school teachers	**17**	**13**	**12**	**14**
Instructional level				
Elementary	16	12	10	13
Secondary	20	13	14	17
Enrollment size				
Less than 300	11	7	8	12
300 to 999	16	11	12	14
1,000 or more	23	19	13	17
Locale				
City	18	14	11	13
Urban fringe	17	12	10	16
Town	17	13	15	14
Rural	17	11	13	13
Percent minority enrollment in school				
Less than 6 percent	16	11	12	15
6 to 20 percent	14	9	14	15
21 to 49 percent	20	11	11	15
50 percent or more	18	19	8	12
Percent of students in school eligible for free or reduced-price school lunch				
Less than 11 percent	14	11	10	12
11 to 30 percent	16	12	14	17
31 to 49 percent	21	13	14	14
50 to 70 percent	17	12	9	15
71 percent or more	19	16	9	10
Teaching experience				
3 or fewer years	19	16	12	13
4 to 9 years	18	12	12	17
10 to 19 years	18	11	11	15
20 or more years	16	13	11	13

NOTE: Teachers who reported that computers were not available to them anywhere in the school were excluded from the "At school" analyses presented in this table. Teachers who reported not having a computer available at home were excluded from the "At home" analyses presented in this table.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

ments compared with 41 percent of teachers in schools with 50 percent or more minority enrollments). Similarly, teachers in schools with lower minority enrollments were also more likely to use computers or the Internet at school to communicate with parents than teachers in schools with the highest minority enrollments (25 percent to 30 percent of teachers in schools with less than 50 percent minority enrollments compared with 14 percent of teachers in schools with 50 percent or more minority enrollments). On the other hand, teachers in schools with high minority enrollments (50 percent or more) were more likely than teachers in schools with minority enrollments of 6 to 20 percent to use these technologies at home to post homework or assignments (19 percent compared with 9 percent, respectively).

Like minority enrollment, poverty concentration of the school is related to teachers' use of technology for communicative purposes. For example, teachers in schools with lower poverty concentrations were generally more likely than teachers in the highest poverty schools to use computers or the Internet to communicate with colleagues. Fifty-nine percent of teachers in schools with less than 11 percent, 55 percent of teacher in schools with 11 to 30 percent, and 54 percent of teachers in schools with 31 to 49 percent of students eligible for free or reduced-price school lunch used these technologies at school for this purpose, compared with 38 percent of teachers in schools with 71 percent or more students eligible for free or reduced-price school lunch. Similarly, 53 percent of teachers in schools with poverty concentrations of 11 to 30 percent eligible for free or reduced-price school lunch used these technologies at home to communicate with colleagues, compared with 40 percent of teachers in schools with 71 percent or more students eligible for free or reduced-price school lunch.

Classroom Instruction

In addition to preparation for instruction, administrative tasks, and communication, teachers may also use computers or the Internet for a number of instructional activities in their classrooms. The 1999 FRSS survey on public school teachers' use of technology asked teachers how often they used computers or the Internet during class time and assigned students to use these technologies for projects and various other activities, including: word processing/spreadsheets, Internet research, practice drills, solving problems/analyzing data, CD-ROM research, multimedia projects, graphical presentations, demonstration/simulation, and correspondence with experts.

General classroom instructional use. Fifty-three percent of public school teachers indicated that they used computers or the Internet for instruction during class time (table 2.3). Elementary teachers were more likely to do this than secondary teachers (56 percent compared with 44 percent), and teachers in schools with smaller enrollments were more likely to do this than teachers in schools with the largest enrollments (56 percent of teachers in schools enrolling less than 300 and 300 to 999 students compared with 40 percent of teachers in schools with 1,000 or more students). Teachers in schools with lower minority enrollments were generally more likely to use computers or the Internet for instruction during class time than teachers in schools with high minority enrollments (56 percent of teachers in schools with less than 6 percent minority enrollment compared with 45 percent of teachers in schools with 50 percent or more

TABLE 2.3.—PERCENT OF PUBLIC SCHOOL TEACHERS WHO HAVE COMPUTERS AT SCHOOL REPORTING USE OF COMPUTERS OR THE INTERNET FOR INSTRUCTION DURING CLASS TIME, BY SCHOOL AND TEACHER CHARACTERISTICS: 1999

School and teacher characteristics	Percent
All public school teachers	**53**
Instructional level	
Elementary	56
Secondary	44
Enrollment size	
Less than 300	56
300 to 999	56
1,000 or more	40
Locale	
City	48
Urban fringe	53
Town	56
Rural	56
Percent minority enrollment in school	
Less than 6 percent	56
6 to 20 percent	56
21 to 49 percent	52
50 percent or more	45
Percent of students in school eligible for free or reduced-price school lunch	
Less than 11 percent	63
11 to 30 percent	52
31 to 49 percent	54
50 to 70 percent	47
71 percent or more	50
Teaching experience	
3 or fewer years	50
4 to 9 years	54
10 to 19 years	50
20 or more years	54

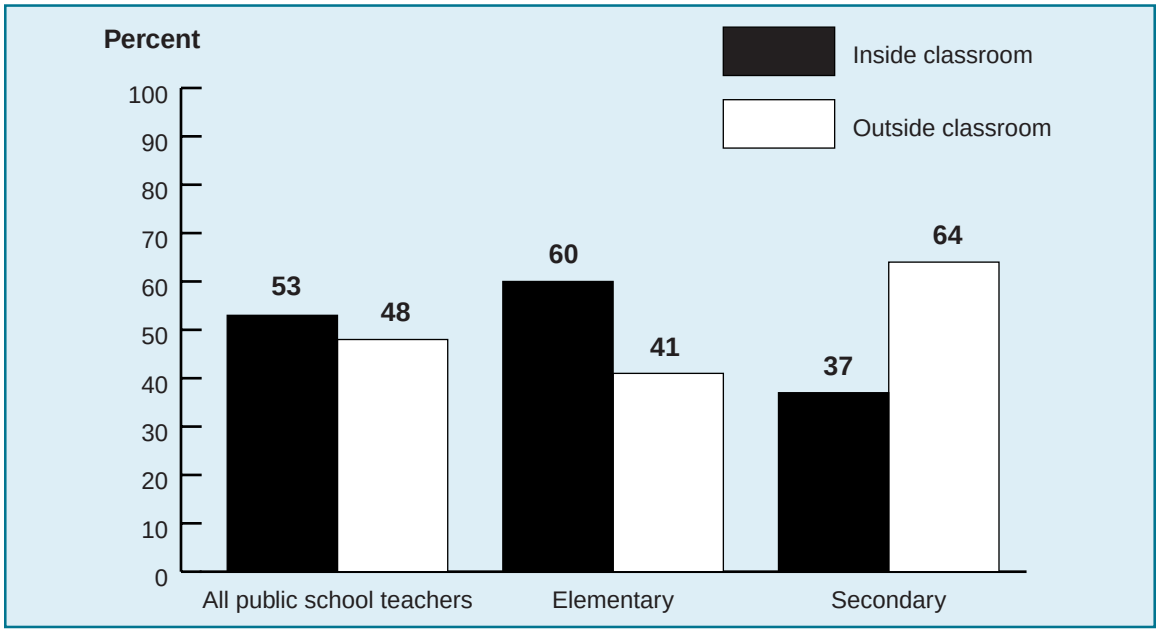
NOTE: Teachers who reported that computers were not available to them anywhere in the school were excluded from the analyses presented in this table. These estimates have been revised from previously published estimates.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

minority students). Similarly, teachers in the lowest poverty schools (based on percent of students eligible for free or reduced-price school lunch) were more likely than teachers in schools with 50 to 70 percent eligible students to use computers or the Internet in this way (63 percent compared with 47 percent).

Project assignment. Overall 53 percent of public school teachers assigned projects using the computer or Internet *inside* of the classroom, and 48 percent of public school teachers assigned projects using the computer or Internet *outside* of the classroom (figure 2.5). The percent of

FIGURE 2.5.—PERCENT OF PUBLIC SCHOOL TEACHERS WHO HAVE COMPUTERS AT SCHOOL REPORTING ASSIGNING PROJECTS USING COMPUTERS, INSIDE AND OUTSIDE THE CLASSROOM, BY INSTRUCTIONAL LEVEL: 1999



NOTE: Teachers who reported that computers were not available to them anywhere in the school were excluded from the analyses presented in this figure.

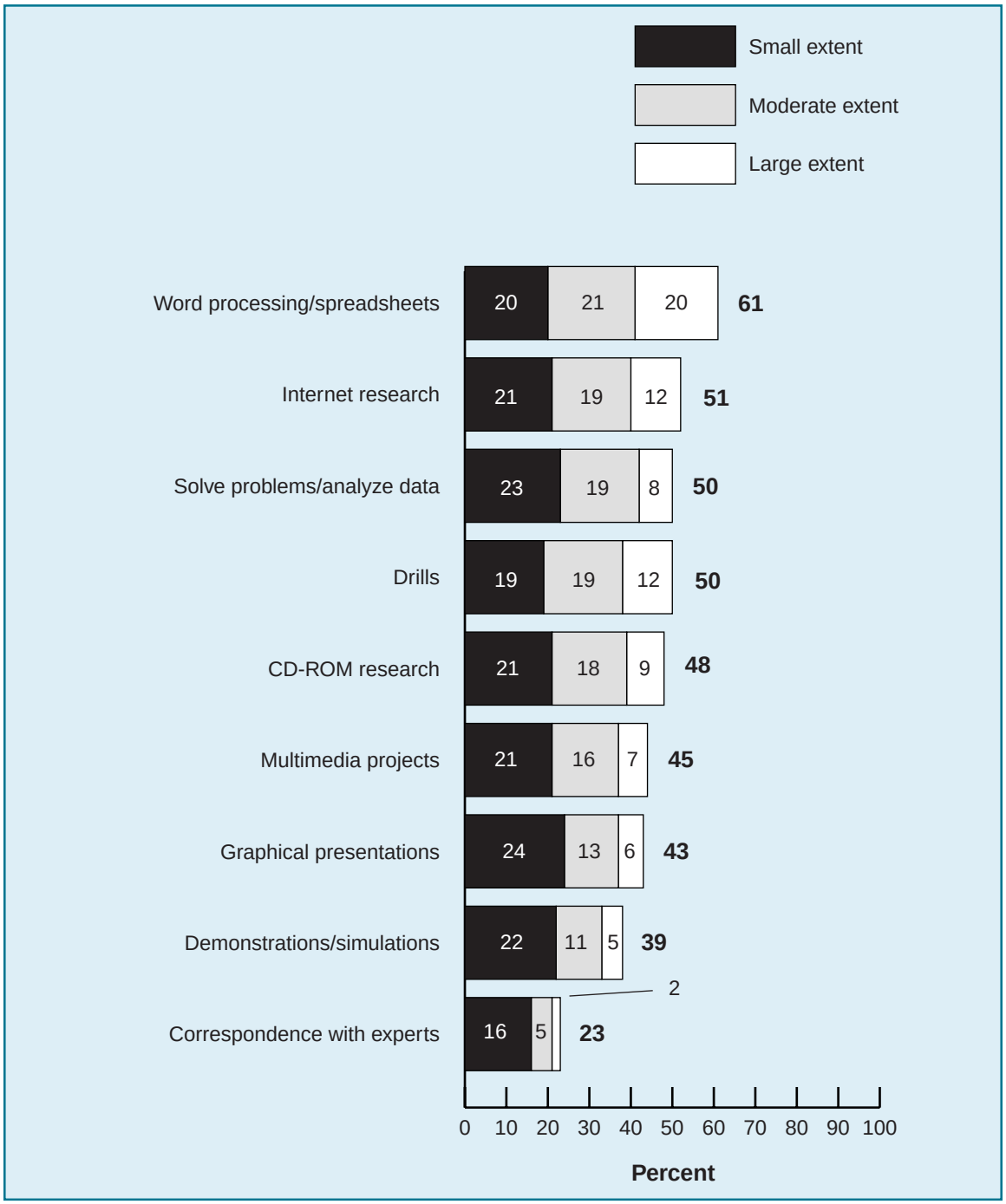
SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

teachers assigning projects using the computer inside and outside of the classroom varied by the instructional level of the school. Elementary teachers were more likely than secondary teachers to assign projects using the computer *inside* the classroom (60 percent compared with 37 percent), and less likely than secondary teachers to assign projects using the computer *outside* of the classroom (41 percent compared with 64 percent).

Instructional activities. Public school teachers assigned students to use computers or the Internet for word processing/spreadsheets most frequently (61 percent did this to some extent), followed by Internet research (51 percent), practice drills (50 percent), solving problems and analyzing data (50 percent), CD-ROM research (48 percent), multimedia projects (45 percent), graphical presentations (43 percent), demonstration and simulation (39 percent), and correspondence with experts (23 percent—figure 2.6).

Differences by school and teacher characteristics. Teachers' use of technology for instructional activities varied by a number of school and teacher characteristics. For example, elementary teachers were more likely than secondary teachers to assign students to use computers or the Internet to practice drills (60 percent compared with 28 percent—table 2.4). In addition, elementary teachers were more likely than secondary teachers to assign students to use these technologies to solve problems and analyze data (54 percent compared with 41 percent). On the other hand, secondary teachers were more likely than elementary teachers to assign students to use these technologies to conduct research using the Internet (64 percent compared

FIGURE 2.6.—PERCENT OF PUBLIC SCHOOL TEACHERS WHO HAVE COMPUTERS AT SCHOOL ASSIGNING STUDENTS DIFFERENT TYPES OF WORK USING COMPUTERS OR THE INTERNET TO A SMALL, MODERATE, OR LARGE EXTENT: 1999



NOTE: Teachers who reported that computers were not available to them anywhere in the school were excluded from the analyses presented in this figure. Detail may not sum to totals due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

TABLE 2.4.—PERCENT OF PUBLIC SCHOOL TEACHERS WHO HAVE COMPUTERS AT SCHOOL ASSIGNING STUDENTS TO DO VARIOUS ACTIVITIES WITH COMPUTERS OR THE INTERNET TO ANY EXTENT, BY SCHOOL AND TEACHER CHARACTERISTICS: 1999

School and teacher characteristics	Activities				
	Word processing/ spreadsheets	Internet research	Drills	Solve problems/ analyze data	CD-ROM research
All public school teachers	**61**	**51**	**50**	**50**	**48**
Instructional level					
Elementary	60	44	60	54	48
Secondary	62	64	28	41	47
Enrollment size					
Less than 300	57	48	53	51	50
300 to 999	63	50	57	53	50
1,000 or more	56	54	28	39	43
Locale					
City	57	49	49	47	43
Urban fringe	63	50	49	51	50
Town	59	50	49	51	46
Rural	64	55	54	49	54
Percent minority enrollment in school					
Less than 6 percent	66	57	55	55	55
6 to 20 percent	61	52	51	50	50
21 to 49 percent	61	51	47	48	48
50 percent or more	53	41	47	45	38
Percent of students in school eligible for free or reduced-price school lunch					
Less than 11 percent	70	61	49	47	54
11 to 30 percent	65	56	54	55	53
31 to 49 percent	60	54	45	50	49
50 to 70 percent	54	45	51	49	46
71 percent or more	53	35	51	43	37
Teaching experience					
3 or fewer years	64	54	48	49	47
4 to 9 years	65	54	52	52	52
10 to 19 years	56	47	50	49	45
20 or more years	60	50	50	49	49

See note at end of table.

TABLE 2.4.—PERCENT OF PUBLIC SCHOOL TEACHERS WHO HAVE COMPUTERS AT SCHOOL ASSIGNING STUDENTS TO DO VARIOUS ACTIVITIES WITH COMPUTERS OR THE INTERNET TO ANY EXTENT, BY SCHOOL AND TEACHER CHARACTERISTICS: 1999—CONTINUED

School and teacher characteristics	Activities			
	Multimedia projects	Graphical presentations	Demonstrations/ simulations	Correspondence with experts
All public school teachers	**45**	**43**	**39**	**23**
Instructional level				
Elementary	43	42	38	23
Secondary	48	47	40	23
Enrollment size				
Less than 300	39	43	37	22
300 to 999	46	44	39	23
1,000 or more	46	44	39	25
Locale				
City	44	44	39	25
Urban fringe	46	44	41	23
Town	42	38	36	23
Rural	46	43	38	24
Percent minority enrollment in school				
Less than 6 percent	49	45	40	26
6 to 20 percent	48	45	41	26
21 to 49 percent	46	46	40	24
50 percent or more	36	36	34	18
Percent of students in school eligible for free or reduced-price school lunch				
Less than 11 percent	55	52	44	28
11 to 30 percent	46	45	41	25
31 to 49 percent	47	43	41	27
50 to 70 percent	44	41	35	22
71 percent or more	33	37	36	14
Teaching experience				
3 or fewer years	44	41	39	17
4 to 9 years	50	47	41	25
10 to 19 years	44	44	40	27
20 or more years	43	42	37	22

NOTE: Teachers who reported that computers were not available to them anywhere in the school were excluded from the analyses presented in this table.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Public School Teachers Use of Computers and the Internet," FRSS 70, 1999.

with 44 percent).

Teachers in schools with different enrollment sizes varied with respect to whether they assigned students to use computers or the Internet for various instructional activities. Teachers in schools with smaller enrollments were nearly twice as likely as teachers in schools with large enrollments to assign students to use these technologies to practice drills (53 percent of teachers in schools with less than 300 students and 57 percent with 300 to 999 students compared with 28 percent of teachers in schools with 1,000 or more students). Teachers in schools with smaller enrollments were also more likely than teachers in schools with the largest enrollments to assign students to use computers or the Internet to solve problems and analyze data (51 percent of teachers in schools with less than 300 students and 53 percent with 300 to 999 students compared with 39 percent of teachers in schools with 1,000 or more students).

There were also differences in whether teachers assigned students to use technology for various instructional activities according to minority enrollment. For example, teachers in schools enrolling the smallest proportion of minority students were more likely to assign students to use these technologies for word processing and creating spreadsheets than teachers in the highest minority enrollment schools (66 percent in schools with less than 6 percent minority enrollments compared with 53 percent of teachers in schools with 50 percent or more minority enrollments).

Teachers in lower minority enrollment schools were also generally more likely than teachers in the highest minority enrollment schools to assign students to use these technologies for multimedia presentations (49 percent of teachers in schools with less than 6 percent minority enrollments and 48 percent in schools with 6 to 20 percent minority enrollments compared with 36 percent of teachers in schools with 50 percent or more minority enrollments) and CD-ROM research (55 percent of teachers in schools with less than 6 percent minority enrollments and 50 percent in schools with 6 to 20 percent minority enrollments compared with 38 percent of teachers in schools with 50 percent or more minority enrollments). Finally, teachers in schools with smaller proportions of minority enrollments were more likely to use computers or the Internet for Internet research (57 percent of teachers in schools with less than 6 percent minority enrollments and 52 percent in schools with 6 to 20 percent minority enrollments compared with 41 percent of teachers in schools with 50 percent or more minority enrollments).

Similar to the differences in minority enrollment, school poverty concentration is related to a number of activities for which teachers assign students to use computers or the Internet. Teachers in schools with the lowest poverty concentrations were more likely than teachers in schools with the highest poverty concentrations to assign students to use these technologies for graphical presentations, multimedia presentations, word processing and spreadsheets, research using CD-ROM and the Internet, and corresponding with experts. For example, 52 percent of teachers in schools with less than 11 percent of students eligible for free or reduced-price school lunch assigned students to use these technologies for graphical presentations compared with 37 percent of teachers in schools with 71 percent or more students eligible for free or reduced-price school lunch.