Objective 1.7: Schools use advanced technology for all students and teachers to improve education.

National Need

National Concerns. Research has found that educational technology, when used effectively, can significantly improve teaching and learning. To support schools in incorporating technology into their curricula, the President has established the four pillars of the Educational Technology Literacy Challenge:

1. All teachers in the Nation will have the training and support they need to help students learn using computers and the Internet.
2. All teachers and students will have modern multimedia computers in their classrooms.
3. Every classroom will be connected to the Internet.
4. Effective software and online learning resources will be an integral part of every school's curricula.

The educational resources of the Internet are growing rapidly. However, many students and teachers, especially those in high-poverty or rural schools, have limited access to these resources.

Our Role. We have made great progress toward our goals to put modern computers in classrooms and connect them to the Internet. With increasing access to computers and advanced telecommunications, we must ensure that teachers also have the ongoing training and support they need to effectively use these investments for improved teaching and learning.

In response to this significant need, the Administration's educational technology fiscal year 2000 investments placed special emphasis on technology training for current and prospective educators. These funds will help ensure that all new teachers can use technology effectively in the classroom. In addition, the fiscal year 2001 budget requests increased funding for closing the digital divide--especially for increasing access to technology in communities with concentrations of disadvantaged students and their families--as well as for developing the next generation of learning tools to address critical educational needs.

The Department's educational technology initiatives include, among others, the Preparing Tomorrow's Teachers to Use Technology program, the Technology Literacy Challenge Fund, the Technology Innovation Challenge Grant and Star Schools programs, the Community Technology Centers, and Learning Anytime Anywhere program.

Our Performance

How We Measure. The Technology Literacy Challenge envisions a 21st century in which all students are technologically literate. The aforementioned "four pillars" are the concrete goals that help define the task, and they are at the heart of the challenge. These goals also provide the basis for performance indicators against which the Department measures the National progress in areas of educational technology supported by its programs.

Indicator 1.7.a. The ratio of students per modern multimedia computer will improve to 5:1 by 2001.

Assessment of Progress. Positive trend toward target. Targets for this indicator are continual progress toward the 2001 target of five students per multimedia computer. Data show that the target of continual progress is being met and suggest that the goal of five students per multimedia computer will be achieved by 2001.

To make technology a viable instructional tool requires that schools have enough computers to provide full, easy access for all students. Citing Glennan and Melmed (1996), *Getting America's Students Ready for the 21st Century* (U.S. Department of Education, 1996) notes that many studies suggest that full, easy access requires a ratio of about five students to each multimedia computer. As shown in Figure 1.7.a.1, in 1996-97, the ratio of students per instructional computer was 7:3:1; by 1998-99, the ratio had dropped to 5.7:1. In 1996-97, the ratio of students per multimedia computer was 21:2:1; by 1998-99, it had dropped to 9.8:1. As the cost of computing power continues to decline, schools are increasingly able to afford multimedia computers and the newer hand-held technology devices.

Figure 1.7.a.1

Number of Students per Instructional and Multimedia Computer
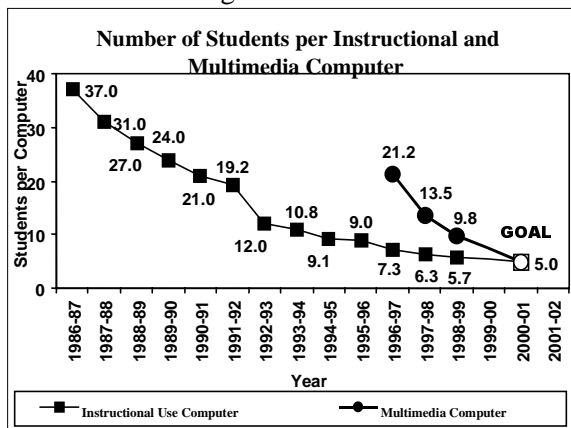
Source: Market Data Retrieval, *Technology in Education*, 1997, 1998, and 1999; Market Data Retrieval, 1997 as cited in Education Week, *Technology Counts*, 1997. *Frequency:* Annual. *Next Update*: Fall 2000 for the 1999-00 school year. **Validation procedure:** Data supplied by Market Data Retrieval. No formal verification or attestation procedure applied. **Limitations of data and planned improvements:** Market Data Retrieval data do not have consistently high response rates, and response rates vary substantially across sites. Accuracy of responses may vary considerably across districts and states. *Planned improvements:* None.

Indicator 1.7.b. The percentage of public school instructional rooms connected to the Internet will increase to 100 percent by 2000.

Assessment of Progress. Positive trend toward target. The target for this indicator is continual progress toward the 2000 target of 100 percent of instructional rooms connected to the Internet. Data show that the target of continual progress is being met.

Connections to the Internet make computers versatile and powerful learning tools by introducing students and teachers to new information, people, places, and ideas from around the world to which they might not otherwise be exposed. Figure 1.7.b.1 shows that in 1994 only 3 percent of instructional rooms were connected to the Internet. By 1999, 63 percent of classrooms were connected to the Internet. At this rate of progress, the goal of 100 percent by the year 2000 is likely to be met.
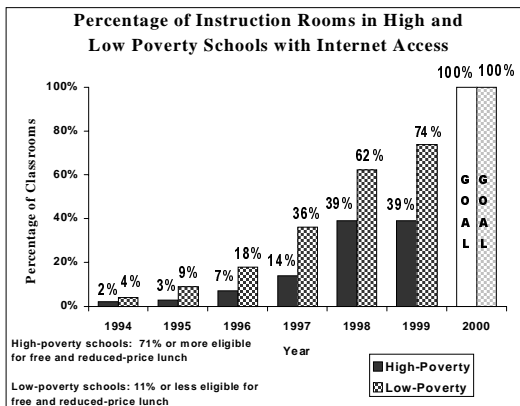
Figure 1.7.b.1

Percentage of Instructional Rooms with Internet Access
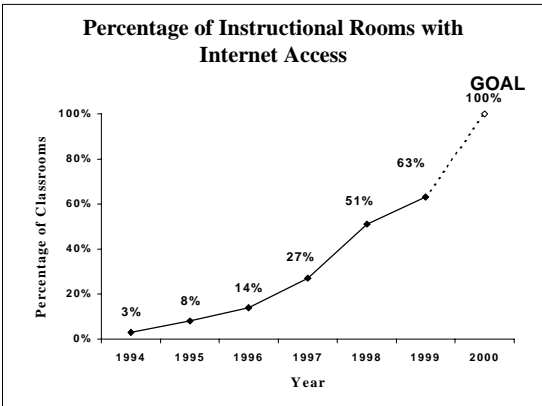
Source: National Center for Education Statistics (NCES), Internet Access in U.S. Public Schools and Classrooms: 1994-99, February 2000; Internet Access in U.S. Public Schools and Classrooms: 1994-1998, February 1999. *Frequency:* Annual. *Next Update:* February 2001 for fall 2000 data. **Validation procedure:** Data validated by NCES's review procedures and *NCES Statistical Standards.* **Limitations of data and planned improvements:** The measure looks at access to the Internet, but does not look at Internet use or the quality of that use. *Planned improvements:* None.

Indicator 1.7.c. Students in high-poverty schools will have access to educational technology that is comparable to the access of students in other schools.

Assessment of Progress. Positive trend toward target. Providing students with access to computers and using computers to support instruction requires significant investments in hardware, software, wiring, and professional development, yet school districts vary greatly in their capacity to fund these improvements. Internet access is a good measure of access to educational technology because it requires not only an Internet connection but also access to a computer. Research has documented differences in access between high-and low-poverty schools but also shows that access in all schools is increasing. In 1994, 2 percent of classrooms in high-poverty schools and 4 percent of classrooms in low-poverty schools had access to the Internet (see Figure 1.7.c.1). By 1999, the percentage of classrooms with Internet access had increased to 39 percent in high-poverty schools and 74 percent in low-poverty schools. The Federal role in reducing these disparities is significant. In 1997-98, Federal funds paid for 50 percent of computers purchased for high-poverty schools and 14 percent of computers purchased for low-poverty schools (USED, *Study of Educational Resources and Federal Funding,* 1999).

Figure 1.7.c.1

Percentage of Instruction Rooms in High and Low Poverty Schools with Internet Access

High-poverty schools: 71% or more eligible for free and reduced-price lunch

Low-poverty schools: 11% or less eligible for free and reduced-price lunch

Source: NCES, Internet Access in Public Schools and Classrooms, February 1998; Internet Access in U.S. Public Schools and Classrooms, February 2000. *Frequency:* Annual *Next Update:* February 2001 for fall 2000 data. **Validation procedure:** Data validated by NCES's review procedures and *NCES Statistical Standards.* **Limitations of data and planned improvements:** Poverty measures are based on free and reduced-price school lunch data, which may underestimate school poverty levels, particularly for older students and immigrant students. *Planned improvements:* None.

Indicator 1.7.d. Students with disabilities will have access to educational technology that is, at a minimum, comparable to the access of other students.

Assessment of Progress. Target not met. Internet access is good measure of access to educational technology because it requires not only an Internet connection but also access to a computer. With the exception of moderate use, the availability of access to and extent of use of the Internet by students with disabilities is significantly less than for all students, though the magnitude of the difference is only a few percentage points. Advances in technology and universal design are making significant contributions to overcoming barriers to access for the disabled.
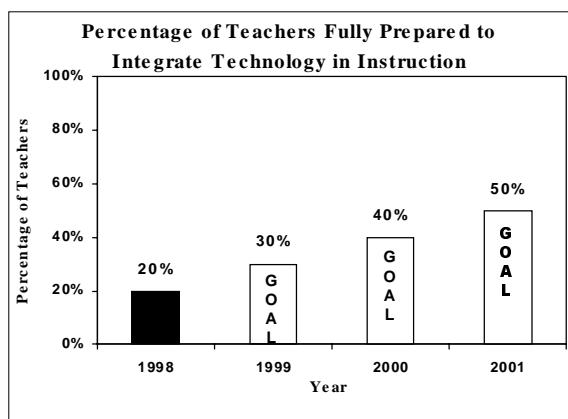
Figure 1.7.d.1

Availability and Use of the Internet by Students in Public Schools by Disability Status
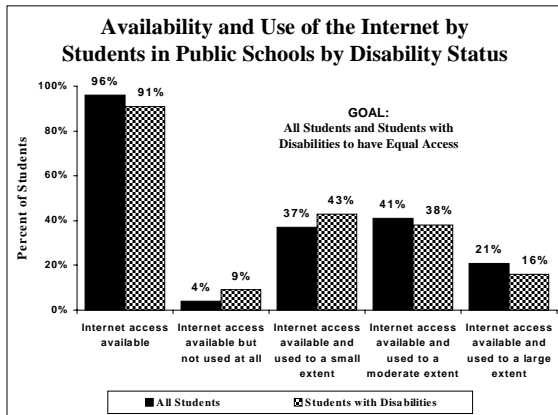
Source: NCES, Internet Access in U.S. Public Schools and Classrooms, February 2000, unpublished tabulations. *Frequency:* Annual. *Next Update:* February 2001 for fall 2000 data. **Validation procedure:** Data validated by NCES's review procedures and *NCES Statistical Standards.* **Limitations of data and planned improvements:** The measure looks at access to the Internet and extent of use but does not look at quality of use.

Indicator 1.7.e. By 2001, at least 50 percent of teachers will indicate that they feel very well prepared to integrate educational technology into instruction.

Assessment of Progress. No 1999 data, but progress toward target is likely.   Computers, effective software, online learning resources, and the Internet hold promise to improve learning; increase the amount of time students spend learning; and engage students in problem solving, research, and data analysis. Teachers' integration of the use of technology into the curricula is a major determinant of technology's contribution to student learning, once access to computers is provided. In 1998, 20 percent of teachers reported that they were fully prepared to integrate technology in their instruction. Federal resources for training of teachers to use technology (including the Technology Literacy Challenge Fund, the Technology Innovation Challenge Grants, and Preparing Tomorrow's Teachers to Use Technology programs) as well as state and local funds continue to support professional development in the use of educational technology for teachers and, correspondingly, progress toward the target for this indicator.

Figure 1.7.e.1

Percentage of Teachers Fully Prepared to Integrate Technology in Instruction

(bar chart: 1998: 20%, 1999: 30% GOAL, 2000: 40% GOAL, 2001: 50% GOAL; y-axis Percentage of Teachers 0%–100%; x-axis Year)

Source: NCES, *Teacher Quality: A Report on the Preparation and Qualifications of Public School Teachers*, January 1999. *Frequency:* Biennial *Next Update:* January 2001 with fall 2000 data. **Validation procedure:** Data validated by NCES's review procedures and *NCES Statistical Standards.* **Limitations of data and planned improvements:** The data are self-reported on feelings of preparedness rather than objective measures of teachers' actual classroom practice. The resources required, in terms of cost and burden, to regularly gather data other than self-report data on teacher preparedness for a Nationally representative sample are prohibitive. *Planned improvements:* None.

Indicator 1.7.f. Students will increasingly have access to educational technology in core academic subjects.

Assessment of Progress. No 1999 data, but positive trend toward target is likely. The benefits of computers in schools and classrooms can be multifaceted, ranging from increased student motivation to improved teacher skills and student achievement. Of key importance is the extent to which computers in classrooms serve as learning tools that improve student achievement and whether students acquire the technology literacy skills needed for the 21st century. According to the National Assessment of Educational Progress (NAEP), the use of computers in instruction has increased substantially in recent years. In 1978, 14 percent of 13-year-olds and 12 percent of 17-year-olds used computers when learning math. By 1996, these percentages increased to 54 percent and 42 percent respectively (see Figure 1.7.f.1). For writing instruction, 15 percent of students in grade 8 and 19 percent of those in grade 11 used computers in 1978; by 1996, 91 percent of grade 8 students and 96 percent of grade 11 students used computers (see Figure 1.7.f.2).
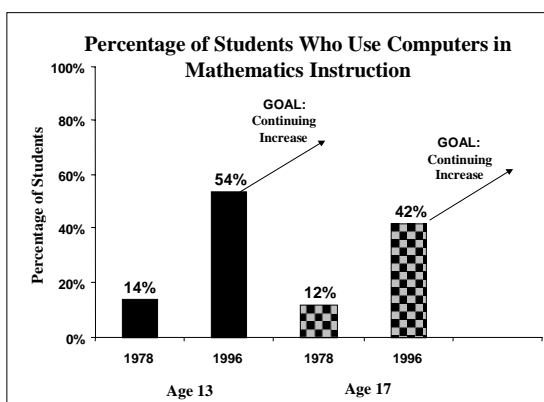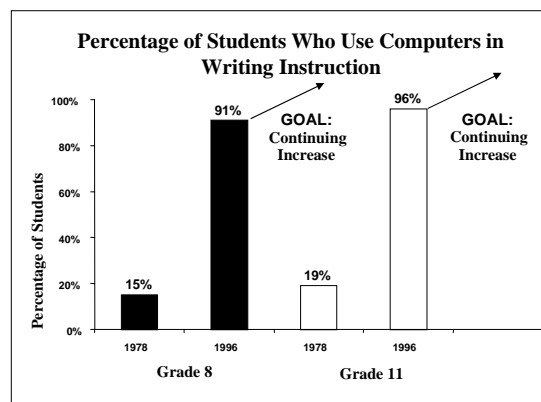
Figure 1.7.f.1

Percentage of Students Who Use Computers in Mathematics Instruction

(bar chart: Age 13 — 1978: 14%, 1996: 54% GOAL: Continuing Increase; Age 17 — 1978: 12%, 1996: 42% GOAL: Continuing Increase)

Figure 1.7.f.2

Percentage of Students Who Use Computers in Writing Instruction

(bar chart: Grade 8 — 1978: 15%, 1996: 91% GOAL: Continuing Increase; Grade 11 — 1978: 19%, 1996: 96% GOAL: Continuing Increase)

Source: National Assessment of Educational Progress (NAEP), 1978 and 1996. *Frequency:* Every 4 years per subject. *Next Update:* 2000 for 1999 data. **Validation procedure:** Data validated by NCES review procedures and *NCES Statistical Standards* **Limitations of data and planned improvements:** Questions yielding this data do not fully capture the extent to which computers are regularly used in classrooms to support instruction. For mathematics, NAEP asks students if they have ever studied math through computer instruction. For writing, NAEP asks students if they use a computer to write stories or papers. *Planned improvements:* None.

How We Plan to Achieve Our Objective

How ED's Activities Support the Achievement of this Objective. In addition to specific program initiatives, the Office of Educational Technology held a National conference in July 1999 on "Evaluating the Effectiveness of Technology," which will be followed up by a series of regional conferences starting in the summer of 2000. We are also funding work on the design of new evaluations and longitudinal studies that are National in scale, as well as the development of prototype assessment tools that incorporate the use of technology with a better understanding of the new skills that technology-using students need.

- **Technology challenge programs.** Financial support for leveraging state and local initiatives for effective use of educational technology.
  - Through the Technology Literacy Challenge Fund (TLCF), support grants to local districts to expand efforts to train teachers, purchase computers, connect classrooms to the Internet, and acquire, where necessary, high-quality educational software and online learning resources.
  - Encourage states and local districts to devote at least 30 percent of their TLCF allocations to provide training and support to enable teachers to use technology efficiently in their classrooms.
  - Provide evaluation tools and encourage states and districts to evaluate progress toward achieving the four National education technology goals and to evaluate the impact of education technology on student achievement.
  - Use the Technology Innovation Challenge Grants appropriation to continue and expand partnerships among educators, business and industry, and other community organizations to develop and demonstrate innovative applications of technology for effective use in the classroom. Build on the successes and lessons learned from this program and the Star Schools program in the Next Generation Technology Innovation program proposed to replace it.
- **Teacher preparation for 21st century classrooms.**
  - Use the Preparing Teachers to Use Technology program to make grants to teachers' colleges, other educational organizations, and consortia to help ensure that prospective teachers are prepared to integrate technology effectively into teaching when they enter the classroom.
  - Encourage states to adopt technology standards that are included in the teacher certification and recertification process. Encourage higher education institutions to partner with the private sector to integrate educational technology into preservice teacher preparation.
- **Technology connections, especially for high-poverty urban and rural schools and communities.**
  - Encourage schools to greatly expand their use of technology through the E-rate, or Universal Service Program, created under the Telecommunications Act of 1996.
  - Use funding for the Community Technology Centers initiative to address disparities in home access to educational technology by providing increased access to computers for students and adults in high-poverty urban and rural communities.
- **Research and development.**
  - Use the Interagency Education Research Initiative (IERI) to focus on the use of technology to promote improvements in teaching and learning targeted to early reading, English language literacy, and elementary mathematics and science.
  - Support the development of next generation learning technologies through the proposed Next Generation Technology Innovation Program, which would provide funding for expanding knowledge about and developing new applications of educational technology and telecommunications for improving teaching and learning.

How We Coordinate with Other Federal Agencies

The Department of Education (ED) recognizes that, in addition to its oversight of the many Department programs described above, assistance and support from other Federal agencies is also important.

Increase school and community access to educational technology. The Department is cooperating with numerous agencies on an ongoing basis and encouraging the effective use of technology. ED is cooperating in this area with the White House National Economic Council, the White House Office of Science and Technology Policy, the Department of Commerce, the Department of Labor, and the Department of Housing and Urban Development.

Improve data collection. The Department provides support for the Census Bureau's Current Population Survey (CPS) to make possible the inclusion of questions on computer and Internet access at home.

Encourage research. The Department, the National Science Foundation, and the National Institute of Child Health and Human Development jointly fund an interagency research initiative that focuses on the use of information and computer technologies in improving school readiness for reading and mathematics, initial teaching of reading and mathematics, and teacher preparation in reading, mathematics, and science. With the National Science Foundation, the Department cosponsored a study of educational technology and instructional practice.

Increase Internet access. The Department collaborates with the Schools and Libraries Division at the Federal Communications Commission for effective implementation of the Universal Service rate for educational access for schools and libraries (the E-rate).

Challenges to Achieving Our Objective

The digital divide between low- and high-poverty schools is closing slowly, but the digital divide between low- and high-income homes is larger than that between schools—and it persists. Lack of access to and use of computers in the home for children of low-income families exacerbates inequalities stemming from lower rates of access to computers in high-poverty schools.

Although the recent GAO report *Telecommunications Technology: Federal Funding for Schools and Libraries* found no duplication among Department programs, we believe that a continued focus on strengthening the focus on equity, professional development, and effective implementation among the various educational technology programs within the Department is needed. In particular, given the rising level of interest in online advanced placement courses and online postsecondary degree programs, stronger connections are needed between the K-12 and postsecondary education communities in the area of distance learning. The Office of Educational Technology meets on a regular basis with all relevant program offices to ensure that connections are made and continuity is maintained.