Computers and Classrooms:

The Status of Technology in U.S. Schools

Summary and Highlights

The following is the Summary and Highlights section from the ETS Policy Information Center report, *Computers and Classrooms: The Status of Technology in U.S. Schools*. This material is copyrighted.

School Access to Technology

- There are major differences among schools in their access to different kinds of educational technology.
- Students attending poor and high-minority schools have less access to most types of technology than students attending other schools.
- Ninety-eight percent of all schools own computers. The current student-to-computer ratio of 10 to 1 represents an all-time low ratio. The ratio ranges from about 6 to 1 in Florida, Wyoming, Alaska, and North Dakota to 16 to 1 in Louisiana.
- While 85 percent of U.S. schools have multimedia computers, the average ratio of students to computers is 24 to 1, nearly five times the ratio recommended by the U.S. Department of Education. The ratio ranges from about 9 to 1 in Florida to about 63 to 1 in Louisiana. Students attending poor and high-minority schools have less access than students attending other schools.
- About three-quarters of the nation's schools have access to cable TV. This percentage ranges from 91 percent of Connecticut's schools to 36 percent of Vermont's schools. Students attending poor and high-minority schools have less access to cable TV than students attending other schools.
- Sixty-four percent of U.S. schools have access to the Internet, up from 35 percent in 1994 and 50 percent in 1995. In Delaware, Hawaii, New Mexico, and South Carolina, all schools are connected. Students attending poor and high-minority schools are less likely to have Internet access than other students. Only 14 percent of U.S. classrooms have access to the Internet.
- Little more than half of our schools have CD-ROM drives, ranging from 91 percent of the schools in North Carolina to only 29 percent of the schools in Vermont. Students attending poor and high-minority schools have less access to CD-ROM than students attending other schools.

- Thirty-eight percent of our schools are using local area networks (LANs) for student instruction. This ranges from 57 percent of the schools in Colorado, Utah, and North Carolina, to 16 percent of the schools in Vermont. Students attending poor and high-minority schools have less access to LANs than students attending other schools.
- About one-third of U.S. schools have videodisc technology, ranging from 95 percent of Florida's schools to 10 percent of Mississippi's schools. Students attending poor and high-minority schools are more likely than students attending other schools to have access to videodisc technology.
- Just under one-fifth of our schools have access to satellite technology, ranging from 50 percent of the schools in Missouri to only 1 percent of Hawaii's schools. While students attending high-minority schools have less access to this technology than students attending other schools, students attending poor schools have more access than students attending rich schools.

Use of Computers

- Among eleventh graders, writing stories and papers was the most frequently rated computer use at home and school. Among fourth and eighth graders, playing games (presumably at home) was the prevalent computer use. At all three grade levels, using the computer to learn things and for writing were highly rated uses. About half the students said they used a computer at home.
- Nine percent of fourth graders, 10 percent of eighth graders, and 19 percent of twelfth graders said they used a computer for school work almost daily. Sixty percent of fourth graders, 51 percent of eighth graders, and 37 percent of twelfth graders said that they never used a computer for school work.
- Black and Hispanic fourth graders were more likely than White and Asian students to report using computers almost daily.
- Fourth graders receiving Title 1 services and those attending the lowest scoring third of schools reported more frequent use of computers than other students.
- White, Black, and Hispanic twelfth graders were more likely than Asian students to report almost daily use of computers.
- Twelfth graders receiving Title 1 services and those attending rural/small town schools were more likely to report daily computer use than other students.
- About 40 percent of fourth-grade teachers used computers to teach reading, U.S. history/social studies, and geography.

- About one-third of eighth-grade teachers used computers to teach U.S. history/social studies and geography, and 17 percent reported using the computer to teach reading.
- With a few exceptions, the use of technology to teach reading, U. S. history/social studies, and geography was found to be equitable. Among the exceptions:
  - White fourth graders were more likely than Black fourth graders to have teachers who used computers to teach geography.
  - White eighth graders were more likely than their Black and Hispanic classmates to have teachers who used computers to teach history.
  - Students whose teachers indicated that the ability level of their class was low were less likely than other students to be taught geography using a computer.
- About half of the nation's 13- and 17-year-olds had access to a computer to learn mathematics.
- For college-bound seniors from the Class of 1996, word processing exposure was the most frequent type of coursework or experience, followed by computer literacy, use in English courses, use in solving mathematics problems, data processing, computer programming, and use in solving natural science and social science problems. Only 9 percent of students reported no computer coursework or experience. Findings by gender and racial/ethnic group follow:
  - Females were more likely than males to have word processing experience.
  - Students from minority groups were less likely to have courses or experience in word processing and computer literacy, and less likely to use computers in English courses and to solve problems in mathematics and natural science.
  - Minority group students were more likely to have courses in data processing and computer programming.
  - Females were less likely than males to have coursework or experience in computer literacy and computer programming, and less likely to use computers to solve math and natural science problems.
  - Since 1987, the percentage of college-bound seniors reporting no computer coursework or experience dropped from 26 percent to 9 percent.
  - Drops were registered in computer programming and in using the computer to solve math problems.
  - Increases were registered in all other areas, particularly in word processing and in using computers in English courses.

The Effectiveness of Educational Technology

- Research generally agrees that drill-and-practice forms of computer-assisted instruction are effective in producing achievement gains in students.
- More pedagogically complex uses of educational technology generally show more inconclusive results, yet many offer promising and inviting educational vignettes.
- Many ongoing educational technology projects are in the process of documenting and recording measures of student motivation, academic outcomes, and other outcomes such as increased skills in problem-solving and collaboration.
- Evaluations of educational technology are really evaluations of instruction enabled by technology, and the outcomes are highly dependent on the implementation of the instructional design.
- Evaluations of educational technology applications must confront a number of methodological problems, including the need for measures other than standardized achievement tests, differences among students in opportunity to learn, and differences in starting points and program implementation.
- Effects of educational technology on teachers should be emphasized because teachers remain in the classroom to influence many generations of students.

Connecting Teachers and Technology

- Research shows that helping teachers learn how to integrate technology into the curriculum is a critical factor for the successful implementation of technology applications in schools.
- Most teachers have not had the education or training to use technology effectively in their teaching.
- Only 15 percent of U.S. teachers reported having at least nine hours of training in education technology in 1994.
- In 18 states, teacher education students do not need courses in educational technology to obtain a teaching license.
- Only 16 percent of teachers currently use telecommunications for professional development.
- Research on the adoption of innovations in schools consistently points to the key role of administrators in successful implementation.
- Effective staff development for teachers should take advantage of telecommunications technologies that allow teachers to interact with each other, take online courses, and easily access the latest research in their discipline.

Effective Courseware

- Effective courseware needs to reflect the research on how students learn, be matched to national, state, or district educational standards, and be integrated into the teaching and learning activities of the classroom.
- Research-based criteria for the development of effective curriculum should also be applied to the development and selection of educational courseware.
- The California Instructional Technology Clearinghouse has rated only 6 to 8 percent of evaluated courseware as "exemplary," and from 33 to 47 percent as "desirable." Less than half of the courseware submitted to the Clearinghouse had sufficient quality to merit review.
- Promising directions in courseware development might include a national clearinghouse; partnerships among developers, teacher groups, and private and public agencies; and a determination of courseware needs that would meet current and emerging curriculum directions.

The Costs of Educational Technology

- Research shows that the cost of the technology currently in our schools is about $3 billion, or $70 per pupil. This cost represents just over 1 percent of total education spending.
- Estimates indicate that it will cost about $15 billion to make all of our schools "technology rich." This is about $300 per student, 5 percent of total education spending, and about five times what we now spend on technology.
- Different deployment scenarios are estimated to cost from $11 billion for a lab with 25 networked PCs in every school, to $47 billion for a networked PC for every five students.
- The primary upfront factor affecting costs is the purchase and installation of computers and other hardware.
- Secondary, very high-cost, factors relate to the hiring or reassignment of technology staff and the training of staff and teachers.
- Telecommunications costs (e.g., Internet access, telephone bills) are a small portion of total technology costs, estimated at from 4 to 11 percent.
- Connecting schools with cable substantially increases their technological capacity over that of telephone wire, but technical problems have to be solved.
- Wireless solutions are appropriate and cost-effective under certain circumstances, such as in old buildings requiring asbestos removal or in rural areas. Savings from 20 to 40 percent of the cost of Internet connectivity have been observed.

- Urban/rural disparities in telephone costs exist which adversely affect rural schools. Significantly higher percentages of non-metropolitan than metropolitan schools are located in high-cost service areas.
- A variety of technology cost reductions to schools have been achieved through the configuration of networks, discounted group rates, donated services, and special programs.