**Closing the Digital Divide

Internet Subsidies in Public Schools**
Research by Austan D. Goolsbee and Jonathan Guryan *As Internet use has dramatically increased over the past five years, policymakers have grown concerned about the so-called "digital divide," in which access and understanding of technology would be split across income and racial lines. New research analyzes the impact of an ambitious federal technology program aimed to bridge the digital divide in public schools.*

Policymakers and analysts have argued that public schools are a natural place to teach underserved populations about computers and increase access to new technology. As part of the Telecommunications Act of 1996, the government began actively subsidizing Internet and telecommunications access in U.S. classrooms and libraries through a tax on long-distance telephone services.

Starting in 1998 and continuing today, the E-Rate program provides $2.25 billion annually in subsidies to schools and libraries so they can invest in Internet and communications technology. This is especially significant when compared to the combined computer budget in all public schools, which totaled only $3.3 billion in 1999.

In their new study, "The Impact of Internet Subsidies in Public Schools," University of Chicago Graduate School of Business professors Austan D. Goolsbee and Jonathan Guryan provide the first step towards evaluating the effect of the E-Rate subsidy on Internet investment in California public schools.

"The effect of differing access to technology can magnify as people get older, so the subsidy may function as preventive medicine," says Guryan.

Goolsbee and Guryan approached their study with two goals in mind: 1) to understand the extent to which the $2.25 billion subsidy fulfilled its primary goal of increasing Internet usage in schools, particularly those serving disadvantaged students, versus merely subsidizing spending that was already taking place; and 2) addressing the considerable interest in and debate about whether spending on computers and information technology has any impact on student performance.

Employing new data on school technology usage in every California public school from 1996 to 2000, as well as application data from the E-Rate program, Goolsbee and Guryan find that the subsidy did succeed in significantly increasing schools' investment in Internet technology. By 2000, there were approximately 66 percent more classrooms in California with Internet connections than there would have been without the subsidy-the equivalent of accelerating Internet investment by about four years.

Despite the noticeable increase in classroom Internet connections, the authors find very little evidence that the program has any impact on student achievement, as measured by test scores in a variety of subjects.

**Analyzing the E-Rate**

The E-Rate program was designed to give all eligible schools and libraries affordable access to modern telecommunications and information services. The subsidy can be used for spending on all commercially available telecommunications services, Internet access, and internal communications, but not for buying computers for the school. The subsidy rate ranges from 20 to 90 percent depending on the school's share of students that qualify for the national school lunch program.

The federal government subsidizes or gives free school lunches to students whose family income is below a certain level, usually close to the poverty level. The number of school lunch eligible students determines funding for many federal and state education-related programs. The higher that number is, the higher the subsidy rate.

By 1997, the year before the first E-Rate funding was awarded, 55 percent of California's public schools had at least one classroom with Internet access, an increase of 9 percentage points from 1996. Even without subsidies, many school districts chose to make Internet investments. It is therefore difficult to distinguish between the effects of the E-Rate program alone versus the already strong upward trend in the fraction of schools with Internet access.

To address this concern, Goolsbee and Guryan used new data on the information technology owned in each year by every school in California. They merged this with administrative data on every E-Rate funding application these same schools filed, including the amount of funding, the subsidy rate, and the purpose of the funding. They also included demographic data for each school and district from the National Center for Education Statistics Common Core of Data and the 1990 U.S. Census.

California was chosen primarily because the state was already measuring technology usage at schools before the E-Rate program started.

"The fact that we were able to get detailed data on individual schools and what they had purchased before the E-Rate began is what allowed us to identify the impact of the program separately from just underlying trends in the economy," says Goolsbee.

From 1996 to 1997, the richest California schools had almost 50 percent more Internet classrooms per teacher than the poorest group. Over the next year, this gap increased. Once the E-Rate program began in 1998, however, the poorer groups began receiving large subsidies relative to the richest group, making Internet connections much more affordable. Their relative number of Internet connections accelerated and by 2000, some of the poorest school districts actually had more Internet connections than the richest school districts.

Goolsbee and Guryan find that most of the E-Rate funds went to schools with subsidy rates of 80 to 90 percent-schools with more than 50 percent of their students eligible for free or reduced price lunches from the federal government.

This reversal in the Internet access rates of rich and poor schools indicates a closing of the digital divide that occurred in the years following the introduction of the E-Rate program.

Rural schools are substantially less responsive to the subsidy than urban schools. The subsidies had the greatest impact on schools with heavily black and Hispanic student populations. Schools with a majority of white and Asian students did not show a significant increase in Internet connections. Elementary schools also respond to the subsidy to a greater degree than high schools.

"As a technology subsidy, the E-Rate program is a tremendous success," says Goolsbee. "Today, the majority of classrooms in schools are connected to the Internet."

**Gauging Student Performance**

Having established that the E-Rate program achieved its primary goal of getting classrooms connected to the Internet, particularly at disadvantaged schools, Goolsbee and Guryan extended their evaluation to the next logical level: Does this investment in technology have any impact on student performance?

Many of the most prominent supporters of the E-Rate program argued that the program should aspire to more than just wiring schools, and should help students develop basic skills.

Goolsbee and Guryan measured student achievement using the Stanford Achievement Test, which has been given every year to all elementary, middle, and high school students in California public schools beginning with the 1997-98 school year. They used three measures of school-level achievement: the average test score in the school, the fraction of students scoring above the 75th percentile score for the state, and the fraction of students scoring above the 25th percentile score for the state.

The authors looked at test scores for math, reading, and science. Their results showed no evidence that investments in Internet technology had any measurable effect on student achievement. However, they note that it may be too early to evaluate long-term investments in information technology, or that gains may have taken place in areas other than test scores.

The lack of impact on student performance is consistent with Department of Education evidence that only one-third of teachers reported they were prepared or well-prepared to use computers and the Internet in the classroom. If teachers are uncomfortable working with the technology or computers in general, it is easy to see why greater Internet access may not directly result in better prepared students.

"It certainly would have been great if you spent a modest amount of money on this program and saw a big educational bang for the buck," says Goolsbee. "But for researchers it's not surprising that the subsidy did not have this effect, because there is no magic bullet for improving student performance."

**Making the Internet Work in Classrooms**

Goolsbee and Guryan suggest the next step for studying effects of the E-Rate program would be to figure out why the high rates of Internet adoption have had a minimal impact on student performance.

"One possibility would be to run pilot programs, collect data, and see how schools are using the technology," says Guryan. "Are there schools that introduce the technology very effectively? What kind of schools are they? What are the skills that teachers need to be able to use the Internet?"

The authors highlight the importance of finding out what the technology actually achieves in the classroom, and whether teachers are even incorporating the Internet into the curriculum. Getting classrooms connected is only the first hurdle toward eliminating the digital divide.