Internet Access: The Last Mile

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Subject: Ubiquitous computing
Technology: Internet, projectors
Standards: NETS•T VI, NETS•A VI
(http://www.iste.org/standards/)
Imagine a business that with great ingenuity and expenditure of resources placed a telephone line in every worker’s office, but failed to provide phone receivers for them. A new CEO of the firm would immediately recognize the need to place a phone receiver in every office with a phone line to make those lines usable. This scenario is absurd because it would not be sensible to deliver phone lines to offices without phone receivers. In fact, it is inconceivable that the business market would create such a system. Yet this is precisely the current state of affairs in schools. For a number of years, Henry Jay Becker and his colleagues have conducted a series of studies monitoring use of computers in schools. In their 1999 report, Teacher and Teacher Directed Use of Computers & Software, they noted that, “Regular use of computers with students is highly dependent on access to computers … most teachers have relatively few computers compared to the number of students in their classroom.” (Editor’s note: For this and other resources, see Resources on p. 19.)

An average classroom today has only one to three computers—an insufficient number to allow a class of 25–30 students appreciable access to the Internet. In a 2003 survey by Norris et al., No Access, No Use, No Impact: Snapshot Surveys of Educational Technology in K–12, half of responding teachers reported using computers with their students less than 15 minutes per week. Less than one-fifth of the teachers reported using computers 45 minutes or more per week. The teachers attributed failure to use computers with their students to lack of access.

The Last Mile Problem
The term last mile was coined by the telecommunications industry to describe the unwieldy mile of copper cable that inefficiently completed connections for Alexander Graham Bell’s photophone, the precursor to fiber optics. Today, it is used to describe any innovation that involves exceptional expense or difficulty to complete the connection at the end point of a network that makes the innovation usable.

The last mile problem proved to be a challenge for extension of telephones, water and sewer lines, and rural electrification. For example, even though the electrical grid was begun at the end of the 19th century, it was well after World War II in the 20th century before the majority of rural homes in the United States were connected to the electrical system.

In the case of the Internet, even though links have been brought to the walls of the classroom, the last remaining gap between the network and the learner has yet to be bridged. Norris and colleagues note that the majority of schools do not provide a way for students to interact with the technology despite the investment made to bring Internet connections to schools.

The educational system has accomplished the equivalent of delivering telephone lines to every classroom while failing to provide phone receivers that allow learners to make use of this resource in school. The 2002 Pew Foundation report, Digital Disconnect, documents the Internet as having substantial positive effects on learning, but not in schools: “Internet-savvy students rely on the Internet to help them do their schoolwork—and for good reason. Students told us they complete their schoolwork more quickly; they are less likely to get stymied by material they don’t understand; their papers and projects are more likely to draw upon up-to-date sources and state-of-the-art knowledge; and they are better at juggling their school assignments and extracurricular activities when they use the Internet.” This report notes that schools have, in general, failed to recognize this transformation in learning.

Next Steps
Three steps are necessary to rectify this state of affairs:

1. Schools and national educational agencies and associations must recognize this state of affairs exists.
2. Technological strategies need to be devised to bridge the last mile and place technology in learners’ hands.
3. Leadership policies need to be developed that will ensure that access to technology will lead to gains in learning and achievement.

The leadership dimension is important. The Pew Foundation study found that even when access was potentially available in schools, educational benefits were undermined by a failure of leadership. Policies were often restrictive rather than facilitative. It was clear from the report that until school administrators provide leadership, nothing will happen, even when the technology is in place. “School administrators and not teachers set the tone for Internet use at school. The differences among the schools attended by students were striking.”

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They also used the display to analyze text and images and share their compositions and haikus with the whole class. Students in mathematics classes demonstrated and discussed interactive mathematics applets. They also presented collaboratively written chapter reviews highlighting important concepts, definitions, procedures, and applications. The teachers in these classes displayed samples of written work for small group and whole class analyses. They also accessed Web sites and streaming videos related to class topics.

Their classrooms are highly interactive during these activities, with students enthusiastically and actively generating, analyzing, and interpreting content and concepts. One teacher commented on the instructional effects of a projector, “I bought this laptop last year thinking it would be useful in the classroom. All I ended up doing with it was writing lesson plans. Without a projector, it’s a planning tool, not a teaching tool. With a projector, it is a teaching tool.”

Even when every student has a computer, a projector is still needed. Another teacher whose students all had wireless handheld computers commented that having a projector in her room was crucial. She explained, “Having 17 kids on 17 computers creates a need for crowd control—it’s hard to know where and when all 17 are focusing. The projector adds a focal point to the class.”

This classroom situation parallels the evolution of graphing calculators. Early adopters of graphing calculators immediately realized the need for a projection system, even though each student had a graphing calculator. The projection devices that manufacturers subsequently developed for these calculators are widely used in today’s math classrooms.

Classes can be equipped with projectors for a fraction of the cost of developing the infrastructure for bringing the Internet to classrooms. Adding a projector to every classroom with an Internet connection could make it possible to realize substantial benefits from the previously made investment.

A viable alternative in the longer term is to provide each student with a portable, wireless computer. If we were designing such a device for schools, we might envision a device larger than a personal digital assistant (PDA) but small enough to fit in a backpack—perhaps the size of a paperback book. In essence, this would constitute an electronic learning slate.

Many secondary students already have access to one-to-one computing in mathematics, because of the availability of graphing calculators. These are specialized handheld computers designed to facilitate mathematics teaching. They have increased student learning in classes of capable teachers who understand best practices. Graphing calculators offer what mathematicians call a proof of concept that one-to-one computing is possible. However, they are single-subject devices, primarily useful in only one content area. A multi-subject personal learning device with a wireless Internet connection and software to facilitate teaching in all of the content areas would address the current digital disconnect in schools.

It appears likely that for a cost of two to three times that of a graphing calculator, it may be possible to provide each student with a portable, wireless learning device in the near future. Students could move from less than a half-hour of access per week to complete access throughout the entire time they are at school.

A Tale of Two Technologies

The contrast between introduction of the graphing calculator and introduction of the Internet in schools is instructive. Both occurred during approximately the same time frame, over the span of approximately a...
During the past decade, American taxpayers have provided billions to ensure that the Internet reaches every school and almost every classroom. This is the largest single discretionary investment that has been made in schools. We have a responsibility to make effective use of this investment to yield a commensurate educational return. The Pew Foundation report concludes, “In the final analysis, schools would do well to heed the Latin writer Seneca’s words. ‘The fates guide those who go willingly; those who do not, they drag.’”

If we are successful in meeting this challenge and providing the necessary leadership, the last mile technology will become the first mile in educational advances for our students.

Resources

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Conclusion
During September 2004, readers of L&L can post recommendations and suggestions for these educational leaders at http://www.teacherlink.org/lastmile/. We would like to know how you have addressed this issue in your schools, and how you believe this challenge might be met.