Technology and Academic Achievement

by Les Foltos

Over the last fifteen years American schools have dramatically increased spending on classroom technology to more than $5 billion annually because there has been a widely held belief by governmental, business and educational leaders that "wiring schools, buying hardware and software, and distributing the equipment throughout will lead to abundant classroom use by teachers and students and improved teaching and learning" (Cuban, Kirkpatrick, & Craig, Winter 2001). In recent years a growing number of critics of technology in the classroom have raised questions about what kind of return schools have gotten for this investment. Larry Cuban has been quick to note that his surveys suggest that fewer than 20% of teachers use technology several times a week, and up to half of all teachers didn't use technology at all (Cuban, et al., Winter 2001; Cuban, August 1999). Even if teachers used the technology, Cuban concluded, few employed these tools in ways that would improve teaching and learning. "... [M]ore often than not," he noted, "their use sustained rather than altered existing patterns of teaching practice" (Cuban, et al., Winter 2001).

America's return on this massive investment in classroom technology seems even more questionable when parents, policymakers, and educators look for evidence of the impact on student achievement. Supporters of educational technology continue to believe that technology will make a difference in academic achievement, but tend to rely on anecdotal evidence about student motivation and their development of critical thinking skills to support this belief. They have been forced to depend on faith and their observations in a large measure because, "[T]here still is very little scientifically-based research to gauge the effectiveness of technology," according to John Bailey, the Director of Educational Technology for the U.S. Department of Education (Murray, October 22, 2002).

Given the lack of evidence that technology increases academic achievement, it is not surprising that some observers are asking whether the resources and time devoted to technology might produce more significant increases in academic achievement if focused on other education needs.

New Evidence

Recently, a growing number of researchers have published studies that provide substantial evidence that technology can play a positive role in academic achievement. Several organizations like Edutopia, the North Central Regional Educational Lab (NCREL) and the Center for Applied Research in Educational Technology (CARET) are documenting research studies that link technology to increases in academic achievement. Two studies are reflective of the growing body of research on technology's role in academic achievement.

Harold Wenglinsky's study, "Does it Compute: The Relationship between Educational Technology and Student Achievement in Mathematics," concluded that for 4th and 8th graders technology has "positive benefits" on achievement as measured in NAEP's mathematics test. But it is critical to note Wenglinsky's caveat to this conclusion. He argues that not all uses of technology were beneficial. Wenglinsky found using computers to teach low order thinking skills, "...[W]as negatively related to academic achievement...." Put another way, this type of computer use was worse than doing nothing. By contrast, teachers who had students use computers to solve simulations saw their students' math scores increase significantly. As he explored the reasons for the differing ways teachers used technology, Wenglinsky found that professional development was the difference between those teachers who used skill and drill software and those who used software that could create simulations. Teachers who had training and skills used technology in ways that focused students on simulations and applications that encouraged students to develop problem solving skills. Those teachers who hadn't had training used skill and drill software (Wenglinsky, 1998).

More recently, educators in Missouri issued their findings on a study of the impact the statewide eMints program had on academic achievement. This program is designed as a comprehensive approach to assist teachers to integrate technology. Participating teachers receive classroom equipment and over two hundred hours of professional development over a two-year period. In addition to traditional workshops, eMints training includes peer coaching for individual teachers. The training is designed to help teachers integrate technology so that they can use inquiry-based teaching and emphasize critical-thinking and problem solving skills. As one of the program leaders noted, "We find that when you put the two, (inquiry-based learning and true technology integration) together there's a synergy created that really boosts students' learning" (Brannigan, 2002). The power of pairing technology with inquiry learning was directly reflected in the test scores of more than 6,000 third and fourth grade students who recently took the Missouri Assessment Program (MAP) test. "Results show that a higher percent of students in eMINTS classrooms scored in the 'Proficient' or 'Advanced' categories...when compared with other students who took the MAP tests..." (Brannigan, 2002; Evaluation Team Policy Brief, 2002).

Technology and Learning: Two Pieces of the Puzzle

These two studies highlight the importance of rethinking our current beliefs about technology. Educators can no longer accept the belief that technology is a silver bullet. Secretary of Education, Rod Paige, recently told educators they need to look beyond their focus on wiring schools and providing classroom access to computers. "The (real) issue," Paige insisted, "is how we use this access-how we get results." Paige encouraged educators to ask how technology can "add value to student performance?" (Brannigan, Jan 31, 2002).

The two research studies highlighted above offer clear direction for educators who are trying to answer the questions raised by Secretary Paige. Both studies

argue that improvements in student learning occur when technology is paired with instructional strategies like project-based instruction, which actively involves students in intellectually complex work that demands higher-order thinking and problem solving skills. Henry Becker's research adds further weight to the argument that technology is a particularly strong tool for supporting active, inquiry-based learning. Becker argues that the kind of active learning necessary to master principles and concepts and explain student work is easier to implement in a technology-rich environment where "...[S]tudents have a rich array of information to work with (rather than only pre-selected, quality filtered textbook content), when communications structures enable students to pose relevant questions to appropriate individuals... and when technology-based tools such as databases, analytic software, and composition software help them to extract understanding from information" (Becker, 2000).

Each of these studies also highlights the importance of Michael Fullan's observation that "The more powerful that technology becomes, the more indispensable good teachers are" (Fullan, 1998). If we expect teachers to use technology in ways that enrich and enhance student achievement, we must provide them with the professional development they need to develop the confidence and skills to apply technology, and an understanding of how technology supports standards-based education. Preparing teachers to use technology effectively may also mean following the example of Missouri's eMints program and ensuring that professional development focuses on instructional strategies like project-based learning, and cooperative or collaborative strategies, in addition to technology skills.

This need to prepare teachers to use technology effectively means schools and districts have to adopt new models of professional development. Too often, the limited staff development available focused on the computer, not technology's role in learning and teaching. As a result, the President's Commission on Web-Based Learning found that the training teachers received was "usually too little, too basic, and too generic to help them develop real facility in teaching with technology" (Web-Based Commission, 2001). Ninety-six percent reported that the most common training they received was on basic computer skills (Web-Based Commission, 2001). Another survey of public school teachers found that while most (78%) received some technology-related professional development in the 1998-99 school year, the training was basic and brief, lasting only one to five hours for 39 % of teachers, and just six to ten hours for another 19% of those trained (Web-Based Commission, 2001), The results of this failure to prepare teachers to use these new teaching tools were predictable. In 1999 a survey commission by the U.S. Department of Education reported that two-thirds of teachers surveyed were not comfortable using technology (Web-Based Commission, 2001).

There is a consensus about the characteristics of a new, more effective model of professional development. One of the most salient of characteristics is that "...[T]eachers need opportunities to work with colleagues, both in their school

building and beyond. They need chances to learn from one another's successes and failures and to share ideas and knowledge" (The National Center for Research on Teacher Learning, 1995). Professional development also needs to be ongoing, and if we are to overcome the barrier of time, teachers' daily schedules must include "embedded opportunities for professional learning and collaborating with colleagues..." (The National Council of Staff Development, 2001). Others argue professional development must be immediately linked to the work teachers are doing in their class each day, and must model effective classroom instruction (NCREL, 2000). To meet these needs, many leaders who are pressing for new staff development models encourage schools to adopt peer coaching or study groups to provide needed on-the-job collaboration on issues that are immediately relevant to classroom needs.

Conclusion

During the Clinton Administration a presidential committee on educational technology noted there was too little research being conducted on the impact of technology in the classroom and called upon researchers to accept the challenge. Some researchers, perhaps too few, have accepted this responsibility. They are finding that it is difficult to isolate technology as a variable in good instruction, but they are finding that in the right circumstances, technology plays a positive role in enhancing academic achievement. Educators are increasingly focusing on this research, but must also be mindful of the circumstances in which research studies show technology has been a powerful learning tool. With this understanding of the context for success, educational leaders can shape programs that prepare teachers to use these powerful new learning tools effectively.

Resources:

Edutopia: Research on Project Based Learning
This site summarizes the findings of eight studies on technology's role in academic achievement when paired with project based learning.

Caret (Center for Applied Research in Educational Technology)
Caret contains links to a growing number of studies done on the relationship between technology and academic achievement.

enGauge: Research and Best Practice.
enGauge identifies recent research that demonstrates this linkage between technology and instructional strategies that increase academic achievement, and defines what the research looks like in practice.

References

Becker, H., Ravitz, J., and Wong, Y. (September 1999). *Report to Participants* Teaching, Learning and Computing: 1998. http://www.crito.uci.edu/tlc/findings/special_report/report_to_participants_rev2.pdf

Brannigan, Cara. (January 31, 2002)."Paige: Focus on Learning Outcomes, Not Hardware." *eSchool News*.

Brannigan, Cara. (June 5, 2002). "Study: Missouri's ed-tech program is raising student achievement." *eSchool News*.

Cuban, Larry, Kirkpatrick, Heather, and Craig Peck. (Winter 2001). "High Access and Low Use of Technologies in High School Classrooms: Explaining an Apparent Paradox." *American Education Research Journal*.

Cuban, Larry. (August 22, 1999)." Don't Blame Teachers for Low Computer Use in Classrooms." Los Angeles Times.

Cradler, J., McNabb, M., Freeman, M., and Burchett, R. (May, 2002). "How Does Technology Influence Student Learning?" *Learning and Leading with Technology*.

Evaluation Team Policy Brief. (2001). *Analysis of the 2001 MAP Results for eMINTS Students*. http://emints.more.net/evaluation/reports/map2001-emints.pdf.

Fullan, Michael. (1998). "The Three Stories of Educational Reform: Inside; Inside/Out; Outside/In". *Kappan Professional Journal*. Archived at http://www.pdkintl.org/kappan/kful0004.htm

Murray, Corry. October 22, 2002. "Webcast Probes Meaning of "Scientifically-Based Research." *eSchool News*.

National Center for Research on Teaching and Learning. (1995). "Learning to Walk the Reform Talk: A Framework for Professional Development for Teachers".

North Central Regional Education Laboratory. (2000). "Critical Issue: Providing Professional Development for Effective Technology Use." Archived at http://www.ncrel.org/sdrs/areas/issues/methods/technlgy/te1000.htm

National Staff Development Council. (2001). *NSDC Standards for Staff Development*. Archived at http://www.nsdc.org/library/standards2001.html.

Web-Based Education Commission to the President and Congress of the United States. (December, 2001). *The Power of the Internet for Learning: Moving from Promise to Practice*.

Wenglinsky, H. (1998) *Does it Compute? The Relationship Between Educational Technology and Student Achievement in Mathematics*. Princeton, N.J.: ETS Policy Information Center.