Technology and Educational Context

An educational program is more than a list of course offerings, and a technology program is more than hardware and software. For insight into the impact that technology can have on student learning, teachers and administrators should look at technology in the larger context of sound instructional practices. Three themes emerge from the literature in this area:

Articulating goals for student learning. All the new technologies in the world will not have an impact on student achievement if learning objectives are not clearly focused. Technology can live up to its potential to improve student learning only when the goals for student learning are clearly articulated prior to the use of technology (Ringstaff and Kelley 2002; Schacter 1999).

Unfortunately, there are many examples of schools investing in technology hardware and software systems without having a clear vision of why and how they will use the technology. Sometimes schools add technology because a grant is available; other times, they invest in computers because schools in neighboring districts have done so. In the worst cases, the investment goes to waste as computers sit unused or underused. Compounding the problem, some teachers send students to computer labs to do work that has little connection to the core curriculum.

Schacter and Fagnano (1999) suggest that technology implementation efforts are more successful when they include the following practices:

- Engaging students in discussions and debate that include commenting on and reviewing their own and others’ work, and collaborating with others;
- Encouraging students’ reflection and thought, so that they can analyze multiple perspectives and think independently;
- Helping students develop or integrate their learning by having them design programs or software that foster critical thinking, judgment, and personal involvement;
- Using project-based learning activities that help students refine questions, make predictions, design plans, collect and analyze data, draw conclusions, and communicate findings;

- Teaching students to use computers as tools with which to design and carry out projects.

Applied effectively, technology not only increases students’ learning, understanding, and achievement, but also augments their motivation to learn, encourages collaborative learning, and develops critical thinking and problem-solving skills (Schacter and Fagnano 1999).

**Viewing technology as part of a broader reform effort.** Research also indicates that technology is most effective when seen as part of broader educational reform. With so much on educators’ plates today, beginning a technology initiative that is not clearly connected to other school improvement measures is not a good use of resources. Principals and teachers must identify from the start how the new technology fits in with what they’re already doing.

When the connection between student learning and technology integration efforts is explicitly articulated, teachers are more apt to see the connection with their curricula, and will be more likely to devote the time needed to learn to use the new technologies. For example, if all teachers are receiving training on research-based instructional strategies, the technology initiative that will make the most sense to them is one that emphasizes how technology will enhance those teaching strategies. By pairing the use of instructional strategies with appropriate technology applications, teachers learn to seamlessly integrate the two and are less likely to view them as competing priorities. A school must have a clear vision of what is possible through the use of technology and...
how technology will benefit students’ learning (Pitler and Enriquez-Olmos 2005).

**The value of administrative support and leadership.** Although teachers represent the front line for the use of technology to improve student learning, a substantive body of research strongly points to the importance of a school leadership component. According to Coley, Cradler, and Engel (1997), “research on the adoption of innovations in schools consistently points to the key role of administrators in successful implementation.” Byrom (1998) identifies the leadership and vision that these administrators bring to the table, as they relate to technology integration, as the single most important factor affecting the successful integration of technology.

Principals should be visible in their support of and use of technology. If a technology workshop is scheduled, the principal should not only attend, but be an active participant. As they visit classrooms to observe teaching and learning, principals should look for and comment on technology integration.

Recent research shows a correlation between principal leadership and student achievement. McREL has identified 21 leadership responsibilities with statistically significant relationships to student achievement that, when consistently implemented, can have a substantial impact on student achievement (Waters, Marzano, and McNulty 2003). These responsibilities include knowledge of curriculum and instruction, focus, input, monitoring and evaluation, and visibility. If we apply these findings to technology, it becomes clear that when school leaders involve teachers in the design and implementation of new technology initiatives and then monitor those initiatives, there is a strong likelihood that technology will lead to higher student achievement.

**Technology and Professional Development**

“If schools add technology without providing adequate professional development, the only thing that will increase is their electric bill.” That anonymous comment sums up the importance of professional development in technology for both teachers and principals. Although most teachers understand fundamental computer operations, they need to be taught much more if they are to see the impact technology can have on student learning. They need to see a reason to “bother” to learn how to effectively search the Internet. They need to learn how to use technology within proven teaching strategies.

Most of all, they need to be provided with ongoing technology professional development.

Teachers learn technology skills in a linear manner, moving over time from the entry level to adoption, adaptation, innovation, and transformation. Professional development geared to the middle will frustrate the teachers at the entry level and bore those at the top levels. This is no different than what we know about student learning (Pitler and Enriquez-Olmos 2005).

Providing teachers with an after-school workshop on using PowerPoint will have less lasting effect than working with them over time on how to use PowerPoint as a teaching tool. Teachers themselves feel acutely the limitations of short-term training (Ringstaff and Kelley 2002).

**Curriculum comes first.** Professional development must have an instructional focus that guides
Working with Laptops

During the past few years, the use of laptop computers has greatly increased, with many laptop programs being implemented at school, district, and even statewide levels. One program that has shown positive effects is Enhancing Missouri’s Instructional Networked Teaching Strategies (eMINTS). This program, initiated in Missouri and expanded nationwide in early 2004, is intended to support educators “as they integrate multimedia technology into inquiry-based, student-centered, interdisciplinary collaborative teaching practices that result in improved student performance…” (eMINTS 2004).

Participating teachers receive not only laptops but extensive professional development and ongoing support in integrating multimedia technology into teaching practice. Studies conducted during the 2000–2001 and 2001–2002 school years indicate that Missouri fourth-grade students in the eMINTS program earned higher Missouri Assessment Program scores in mathematics and social studies than students in comparison groups (Kleiman 2004).

Another large-scale laptop program is Maine’s Learning Technology Initiative (MLTI), whose goal is to provide each student and teacher in grades 7–12 with a laptop and wireless network access, with professional development and support available for teachers. A study of the program’s effectiveness found “credible evidence that MLTI as a total program may be effective in raising test scores … and is worthy of further study” (Muir, Knezek, and Christensen 2004).

Silvernail and Lane (2004) looked at Maine students who had used school-provided laptops in the seventh and eighth grades but no longer had them in ninth grade. They reported that these ninth-grade students “felt the quantity and quality of their school work had declined once they no longer had laptops.”

Improvements in instructional practice and the overall environment of schooling were found to be associated with Maine’s laptop initiative. A survey of Maine middle school teachers and students found over 70 percent agreed or strongly agreed that they were better able to create instructional materials that met the state’s standards. Similarly, over 70 percent of students surveyed agreed or strongly agreed that laptops had made school more interesting, helped them complete their work more quickly, and improved the quality of their work (Silvernail and Lane 2004).

Use peer coaching. Train-the-trainers models and/or peer coaching that is ongoing and job-embedded have been shown to be highly effective technology integration tools under certain conditions (Pitler and Enriquez-Olmos 2005; Dirksen and Tharp 2000). Greater rates of technology integration take place when teachers have ample time to acquire technology skills, when they have opportunities to share their technology-related work with their colleagues, and when their technology-based activities are adequately planned (Means 1997). These factors also result in larger numbers of teachers achieving higher levels of technology proficiency.

As with so many education initiatives, technology integration requires providing opportunities for teachers to discuss and work collaboratively with colleagues or partners to develop, modify, and improve their own instructional use of technology. Teachers feel a sense of empowerment when they are able to successfully use technology with their students and then show other teachers how to do the same (Pitler and Enriquez-Olmos 2005). A critical element in peer coaching is the time needed for teachers to collaboratively plan technology integration.

Don’t cut corners. It is important that technology professional development be extremely deliberate if it is to be successful in achieving its goals. Accordingly, the training should include:

- Classroom engagement issues related to technology;
- Collaborative teaching strategies;
- Research-based materials to help teachers integrate instructional software;
- Methods and tools to assess student products created by using technology, and
- Practice sessions in which teachers can “explore, reflect, collaborate with peers, work on authentic learn-
The new technologies allow students to have more control over their own learning, to think analytically and critically, and to work collaboratively. This “constructivist” approach is one effort at educational reform made easier by technology… (Russell and Sorge 1999).

Technology and Student Achievement

While any initiative aimed at promoting technology integration in schools is time-intensive, long-term, and frequently complex, there is much literature to suggest the value of engaging in such efforts and that the appropriate use of technology can improve student learning in a variety of areas.

The positive effects of computer-aided instruction on student achievement can occur across multiple subject areas. Researchers who reviewed 219 studies from 1990 to 1997 found that “students in technology-rich environments experienced positive effects on achievement in all major subject areas” (Schacter 1999). This finding is corroborated by several other studies, although the gains in student achievement were not uniform across subject areas (Mann et al. 1999; Ringstaff and Kelley 2002).

In terms of cognitive outcomes, the research literature describes two types of student learning relating to technology:

**Learning “from” computers.** The computers are essentially tutors, primarily serving the goal of increasing students’ basic skills and knowledge.

**Learning “with” computers.** The computers serve as a tool that can be applied to a variety of goals in the learning process, such as developing higher-order thinking, creativity, and research skills (Ringstaff and Kelley 2002).

Although there is evidence that computers can help students improve their performance on tests of basic skills, the application of educational technologies to instruction has progressed beyond that narrow purpose. Technology in schools today is dramatically different than the technology that was used in schools only several years ago. Today, students use complex multimedia products and advanced networking technologies to learn interactively and work collaboratively on projects; to gather, organize, and analyze information; to solve problems; and to communicate information (Ringstaff and Kelley 2002).
As principals consider new technology purchases or review existing technology plans, it is important to ensure that technology is always part of the overall school improvement plan; that professional development is provided for both teachers and principals; that teachers see the clear link between curriculum and technology; and that principals support and evaluate technology integration in the classroom. Finally, be clear what you expect as an outcome for technology and have a plan to evaluate your progress toward that goal. Looking at technology through these lenses will help ensure that you get the most from your technology investment.

References


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