

TECHNOLOGY AND PEDAGOGY

In support of *This We Believe* characteristics:

- Students and teachers engaged in active learning
- Multiple learning and teaching approaches that respond to diversity

Concept/Definition

Educational technology is a broad topic and can include school uses of desktop and laptop computers, VCRs, DVD players, projectors, and other AV equipment, handheld devices, cell phones, and calculators. This summary focuses on school uses of computers. School use of computers manifests itself in schools in at least four ways: computer as administrative tool, computer as teacher tool, computer as subject area, and computer as student learning tool. These first three are effective and practical uses of school computers, but this research summary focuses on integrating technology into the curriculum for student learning.

Summary of Current Research

There are really two ways to use technology for teaching and learning. Maddux, Johnson, and Willis (2001) referred to these as “Type I” and “Type II.” November (1990) referred to them as “automation” and “infomation.” Christensen (1997) referred to them as “sustaining” and “disruptive.”

The “Type I” or sustaining approach to educational computing uses computers to mimic the same behaviors and procedures that teachers use without the technology. This would include using technology to create worksheets and keep track of grades, create PowerPoint presentations instead of using the blackboard or overheads, post coursework and content online, practice skills or learn new information through educational software, or have online discussions.

Much of our early educational software, for example, was really direct textbook automation—we called it computer-assisted instruction. Later on came computer literacy, the computer-as-a-tool movement, and distance learning—which also repeated the basic practice of schools. Teachers still instruct in the same manner as before the technological innovation, delivering a content-based curriculum. (November, 1990, ¶3)

Automation, ease of access, ease of modification, and looking good—these are real advantages of Type I computing. There are lots of times that it is appropriate to simply automate conventional practices. Papert (2005) recognized that Type I uses can be an initial stepping-stone to new types

of integration. The problem, however, is that educational technologists do not generally feel that Type I tasks alone are a cost-effective use of technology.

Type I applications by themselves, no matter how well applied, cannot justify educational computing to media critics, other educators, school board members, legislators, or the public at large. Type I uses are insufficient because educational computing is too expensive to devote entirely to relatively trivial problems. (Maddux, Johnson, & Willis, 2001, p. 96)

In some places, Type I computing is equated with the educational use of technology, and it is not surprising, therefore, that, under those circumstances, technology integration has met with a great deal of criticism (e.g., Oppenheimer, 1997).

The real gains that come from new technologies are not from Type I applications, but from Type II applications (Maddux, Johnson, & Willis, 2001). Type II or disruptive applications represent innovation in teaching and learning. Within education, Type II applications make available new and better ways of teaching. Muir (2001) pointed out that Type II uses of educational technology involve empowering students to do work they could not do before (or do as easily). Innovation often involves looking beyond how teachers can use technology for their teaching, to how students can use technology for their learning. There is often a focus on the process of learning content, not just how to make content available to students.

Papert (2005) advocated allowing students to construct their own knowledge by creating products to teach others. Tapscott (1998) explained Papert’s view this way: “He explains that an instructionalist might make a game to teach the multiplication tables. A constructionist presents students with the challenge of inventing and creating the game” (p. 144). Becker (2000) found that teachers who were in the top quartile on a reliable and extensive measure of constructivist teaching philosophy were much more likely to have students make regular use of computers during class than teachers with a more traditional view of teaching.



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Teresa M., a teacher at Bellevue Elementary School near Seattle, gave her fourth-grade class this assignment. The students were to organize themselves into groups of four, each of which would act as an educational software company for the semester. By the end of the semester, each company would produce an "educational software package" containing software, a user's manual, a teacher's manual, advertising and whatever else the company decided to include. Each company could choose the educational content of its package. . . . Idit Harel [found] that when the students were asked to make educational software about a subject they found boring—in this case it was fractions—they developed an interest in the subject and increased their test scores. (Papert, 1996, pp. 21–22)

One approach, for example, shown to engage students in learning is the use of computers driving multimedia and hypermedia tools (Gooden, 1996; ISTE, 1990; Jensen, 1991; Muir, 1993, 1997; Ray, 1991). Lehrer (1993) found that multimedia tends to have long-term effects on understanding and retention. In a study of eighth graders using a hypertext/multimedia tool to design their own lessons about the American Civil War, the scores of students using the multimedia tool did not differ from the scores of the control group on a test given at the completion of the lesson. However, when tested one year later by an independent interviewer, the multimedia group displayed elaborate concepts and ideas that they had extended to other areas of history. In contrast, the control group of students remembered almost nothing about the historical content of the Civil War lesson.

Other examples of Type II computing include the following:

Fast ForWord, a CD-ROM training program focused on auditory processing and oral language, can enable children with dyslexia to learn to read, helping them learn to process and interpret the very rapid sequence of sounds within words and sentences by exaggerating and slowing them down. Various and vast were the improvements as a result of this

program (Temple, Deutsch, Poldrack, Miller, Tallal, Merzenich, & Gabrieli, 2003).

Seventh, eighth, and ninth grade physics students used software (ThinkerTools) that enabled them to be aware of where they were in the inquiry process and to reflect upon their own and other student's inquiries. These students were better able to apply principles of Newtonian mechanics to real-world situations than were eleventh and twelfth grade students who had not used the software (White, & Frederiksen, 1998).

Boster, Meyer, Roberto, and Inge (2002) studied instruction involving video clips offered by a company called UnitedSteaming. One group of eighth graders were shown clips related to state learning standards related to social studies and science and the control group covered similar content but without exposure to the video clips. The experimental group showed significant improvements in social studies over the control group.

Technology not only offers teachers new instructional opportunities, it also promotes that shift in teaching paradigms from whole-class instruction to small-group learning environments as well as a change from passive learning to more engaged learning (Pelgrum & Anderson, 1999; Roblyer & Edwards, 2000; Voogt & Odenthal, 1999). Means and Olson (1997) found that technology helps teachers in that it allows an increase in their technology and pedagogical skills and fosters greater contact and collaboration with external school reform and research organizations and more involvement in training and professional conferences. Another study (Barrett, 2002) showed that the technology extended ways of teaching and accommodated different learning styles. Yang's (2002) study revealed that the strategies that the teacher used with laptops in the classroom included (a) problem-based learning, (b) project-based learning, (c) collaborative learning, (d) hands-on activities, and (e) having students use laptops as cognitive tools.

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ANNOTATED REFERENCES

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Cuban (1986, 2000) has argued that computers are largely incompatible with the requirements of teaching, and that, for the most part, teachers will continue to reject their use as instruments of student work during class. Using data from a nationally representative survey of fourth through twelfth grade teachers, this paper demonstrates that, although Cuban correctly characterizes frequent use of computers in academic subject classes as a teaching practice of a small and distinct minority, certain conditions make a big difference in the likelihood of a teacher having her students use computers frequently during class time. In particular, academic subject area teachers who have at least five computers present in their classroom, who have at least average levels of technical expertise in their use, and who are in the top quartile on a reliable and extensive measure of constructivist teaching philosophy are very likely to have students make regular use of computers during class. In addition, other factors such as an orientation toward depth rather than breadth in their teaching (perhaps caused by limited pressures to cover large amounts of content) and block scheduling structures that provide for long class periods are also associated with greater



ANNOTATED REFERENCES (continued)

use of computers by students during class. Thus, despite their clear minority status as a primary resource in academic subject classroom teaching, computers are playing a major role in at least one major direction of current instructional reform efforts.

Richardson, W. (2006). *Blogs, wikis, podcasts, and other powerful web tools for classrooms*. Thousand Oaks, CA: Corwin Press.

This book brings teachers a bold vision and on-the-ground, Monday morning practicality. It will move educators to think differently about technology's potential for strengthening students' critical thinking, writing, reflection, and interactive learning. Richardson demystifies words like "blog," "wiki," and "aggregator," making classroom technology an easily accessible component of classroom research, writing, and learning.

This guide demonstrates how Web tools can generate exciting new learning formats and explains how to apply these tools in the classroom to engage all students in a new world of synchronous information feeds and interactive learning. With detailed, simple explanations, definitions and how-tos, critical information on Internet safety, and helpful links, this exciting book opens an immense toolbox, with specific teaching applications for

- Web logs, the most widely adopted tool of the read/write Web
 - Wikis, a collaborative Webspaces for sharing published content
 - Rich Site Summary (RSS), feeding specific content into the classroom
 - Aggregators, collecting content generated via the RSS feed
 - Social bookmarking, archiving specific Web addresses
 - Online photo galleries
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National Association of School Boards of Education Study Group on e-Learning (NASBE). (2001). *Any time, any place, any path, any pace: Taking the lead on e-learning policy*. Retrieved June 3, 2006, from http://www.nasbe.org/Educational_Issues/Reports/e_learning.pdf

The primary goal of this report of the NASBE Study Group on e-Learning is to provide a sufficient context so that education policy leaders can ask the right policy questions and take the lead on developing sound e-learning policies. The slogan adopted by the Florida Virtual School succinctly describes a compelling vision for a transformed education system, one in which "any time, any place, any path, any pace" learning is delivered through modern technologies that are available today. Having examined the emerging evidence and considered the doubts and cautions, the NASBE Study Group on e-Learning concludes that e-learning will improve American education in valuable ways and should be universally implemented as soon as possible. Technology is not a solution in isolation, but rather a key component that helps make it possible for schools to address core educational challenges.

RECOMMENDED RESOURCES

November, A. (2001). *Empowering students with technology*. Arlington Heights, IL: Skylight.

Powers, S. M., Rafferty, C. D., & Eib, B. J. (2001). The role of technology for learning in the reinvented middle school. In T. S. Dickinson (Ed.), *Reinventing the middle school*. (pp. 218–246). RoutledgeFalmer: New York.

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CITATION

Muir, M. (2007). *Research summary: Technology and pedagogy*. Retrieved [date] from <http://www.nmsa.org/Research/ResearchSummaries/TechnologyandPedagogy/tabid/1506/Default.aspx>

